MORAY EAST
OFFSHORE WINDFARM

# Marine Licence Application

## Rock Volume Change for Backfilling Activity

## Environmental Report

**November 2020**

Moray Offshore Windfarm (East) Limited

| Produced by Royal HaskoningDHV on behalf of Moray Offshore Windfarm (East) Limited | |
|---|---|
| **Produced by** | Paul Salmon, Beth Travis |
| **Reviewed by** | Alexia Chapman |
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## Review / Approval

| **Moray East** | |
|---|---|
| Enrique Alvarez Cordobes<br>Head of Construction | Marcel Sunier<br>Project Director |

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| **AC** | Alternating Current |
| **AIS** | Automatic Identification System |
| **CIEEM** | Chartered Institute of Ecology and Environmental Management |
| **CMS** | Construction Method Statement |
| **DPFPV** | Dynamic Positioned Fall Pipe Vessel |
| **EDA** | Eastern Development Area |
| **ES** | Environmental Statement |
| **HLV** | Heavy Lift Vessel |
| **ICES** | International Council for the Exploration of the Sea |
| **IEEM** | Institute of Ecology and Environmental Management |
| **JCP** | Joint Cetacean Protocol |
| **JUV** | Jack-up Vessel |
| **MU** | Management Unit (for marine mammals) |
| **MS-LOT** | Marine Scotland Licensing Operations Team |
| **NRA** | Navigational Risk Assessment |
| **OfTI** | Offshore Transmission Infrastructure |
| **OSP** | Offshore Substation Platform |
| **OWF** | Offshore Wind Farm |
| **PMF** | Priority Marine Feature |
| **pSPA** | Proposed Special Protection Area |
| **RAM** | Restricted Ability to Manoeuver |
| **SAC** | Special Area of Conservation |
| **SCOS** | Special Committee on Seals |
| **SLVIA** | Seascape, Landscape and Visual Impact Assessment |
| **SMRU** | Sea Mammal Research Unit |
| **SPA** | Special Protection Area |
| **SSC** | Suspended Sediment Concentration |
| **TI** | Transmission Infrastructure |
| **UKBAP** | UK Biodiversity Action Plan |
| **WCS** | Worst-Case Scenario |
| **WTG** | Wind Turbine Generator |

## Definitions

The following definitions have been used throughout this document with respect to the company, the consented wind farms and how these definitions have changed since submission of the Moray East Environmental Statement (ES) in 2012 and the Moray East Modified Transmission Infrastructure (TI) ES in 2014 and the Moray East Offshore Substation Platform Environmental Report in 2017.

- **Moray Offshore Windfarm (East) Limited (formerly known as Moray Offshore Renewables Limited)** – the legal entity submitting this Environmental Report;
- **Moray East Offshore Wind Farm** - the wind farm being developed in the Moray East site (also referred as the Wind Farm);
- **The Moray East site -** the area in which the Moray East Offshore Wind Farm is located. Section 36 Consents and associated Marine Licences to develop and operate up to three generating stations on the Moray East site were granted in March 2014. At that time the Moray East site was known as the Eastern Development Area (EDA) and was made up of three sites known as the Telford, Stevenson and MacColl offshore wind farm sites. The Section 36 Consents and Marine Licences were subsequently varied in March 2018; with the Marine Licences additionally varied in July 2019 and April 2020.
- **Telford, Stevenson and MacColl wind farms** – these names refer to the three consented offshore wind farm sites located within the Moray East site;
- **Transmission Infrastructure (TI)** - includes both offshore and onshore electricity transmission infrastructure for the consented Telford, Stevenson and MacColl wind farms. Includes connection to the national electricity transmission system near New Deer in Aberdeenshire encompassing Alternating Current (AC) Offshore Substation Platforms (OSPs), AC OSP interconnector cables, AC export cables offshore to landfall point at Inverboyndie continuing onshore to the AC collector station (onshore substation) and the additional regional Transmission Operator substation near New Deer. A Marine Licence for the offshore TI was granted in September 2014 (Modified Offshore Transmission Infrastructures (OfTI) Marine Licence) and varied in 2019. A further Marine Licence for two additional distributed OSPs was granted in September 2017 and subsequently varied in July 2019. The onshore TI was awarded Planning Permission in Principle in September 2014 by Aberdeenshire Council and a Planning Permission in Principle under Section 42 in June 2015. In June 2018 Aberdeenshire Council granted Approval of Matters Specified in Conditions for both the Cable Route and the Substation;
- **Offshore Transmission Infrastructure (OfTI)** – the offshore elements of the transmission infrastructure, comprising AC OSPs, OSP inter-connector cables and AC export cables offshore to landfall (for the avoidance of doubts some elements of the OfTI will be installed in the Moray East site);
- **Moray East Environmental Statement 2012** – The ES for the Telford, Stevenson and MacColl wind farms and Associated Transmission Infrastructure, submitted August 2012;
- **Moray East Modified Transmission Infrastructure Environmental Statement 2014** – the ES for the TI works in respect to the Telford, Stevenson and MacColl wind farms, submitted June 2014;
- **Moray East OSP Environmental Report 2017** – the environmental report comprising of the "Statement Regarding Implications for the Modified TI ES 2014 and HRA". The report was produced in support of the application submitted in May 2017 for the Moray East OSP Marine Licence;
- **The Development** – the Moray East Offshore Wind Farm and OfTI;

- **OfTI Corridor** – the export cable route corridor, i.e. the OfTI area as assessed in the Moray East Modified TI ES 2014 excluding the Moray East site;
- **Design Envelope** – the range of design parameters used to inform the assessment of impacts;
- **Development area** - the Moray East site and OfTI Corridor together; and
- **the Applications** – (1) the Application letters and ES submitted to the Scottish Ministers on behalf of Telford Offshore Windfarm Limited, Stevenson Offshore Windfarm Limited and MacColl Offshore Windfarm Limited, on 2 August 2012 and the Additional Ornithology Information submitted to the Scottish Ministers by Moray Offshore Renewables Limited on the 17 June 2013; (2) the Section 36 Consents Variation Application Report for Telford, Stevenson and MacColl Offshore Wind Farms dated December 2017 and (3) the Marine Licence Applications and associated documents submitted for the OfTI and OSP Licences in June 2014 and May 2017 respectively;

**Moray East Offshore Wind Farm Consents** – are comprised of the following:

- **Section 36 Consents:**
  - Section 36 consent for the Telford Offshore Wind Farm (as varied) – consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Telford Offshore Wind Farm assigned to Moray East on 19 June 2018.
  - Section 36 consent for the Stevenson Offshore Wind Farm (as varied) – consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Stevenson Offshore Wind Farm assigned to Moray East on 19 June 2018.
  - Section 36 consent for the MacColl Offshore Wind Farm (as varied) – consent under Section 36 of the Electricity Act 1989 for the construction and operation of the MacColl Offshore Wind Farm assigned to Moray East on 19 June 2018.
- **Marine Licences**
  - Marine Licence for the Telford Offshore Wind Farm (as varied) – Licence Number: 04629/20/0 – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on 19 July 2018.
  - Marine Licence for the Stevenson Offshore Wind Farm (as varied) – Licence Number: 04627/20/0 – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on 19 July 2018.
  - Marine Licence for the MacColl Offshore Wind Farm (as varied) Licence Number: MS-00008972 (formerly 04628/20/0) – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on 19 July 2018.
  - Marine Licence for Moray Offshore Windfarm (East) Limited – Licence Number: 07086/20/1 – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009 (as amended), Part 4 Marine Licensing to deposit, backfill of seabed depressions within the Scottish marine area and the UK marine licensing area.

- **OfTI Licences** – are comprised of the following:

  - Marine Licence for the Offshore Transmission infrastructure (as varied) – Licence Number 05340/19/0 – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area (referred to as the "OfTI Marine Licence").
  - Marine Licence for two additional distributed OSPs (as varied) – Licence Number 06347/19/0 – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction, operation and maintenance works and the deposit of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area (referred to as the "OSP Marine Licence").

## Executive Summary

During the construction phase of the Development, Jack-Up Vessels (JUVs) are required at multiple stages: for pile installation at each Wind Turbine Generator (WTG) and offshore substation platforms (OSP) locations (work complete), and again during jacket and WTG installation. JUVs are also used as accommodation vessels.

The depressions in the seabed caused by the JUVs have the potential to impact the structural integrity of the WTG and OSP foundation piles, creating the risk of inter-array cables and the trencher to slide into the depressions, and may limit the ability of subsequent jacking-up by the jacket and WTG installation vessels around WTG locations. Therefore, backfilling of some of these seabed depressions caused by the JUV spud cans is a necessary part of the construction process which cannot be avoided when a JUV is used.

In October 2019, a Marine Licence for the backfill of depressions caused by the pilling vessel Apollo was granted. Since the Marine Licence was granted, it was subsequently varied in April 2020 and July 2020 to take account of the need to also use JUVs during the installation of the substructures and topsides and WTGs instead of the Heavy Lift Vessel (HLV) Orion, which was originally anticipated to be used; this vessel is no longer available due to an incident. This results in further depressions being created and, therefore, more rock required to backfill the increase in depressions. Therefore, a new Marine Licence is required to increase the deposition of rock on to the seabed compared to the existing Moray East Backfill Marine Licence from 106,600 $m^3$ to 189,106 $m^3$, an increase of 82,506 $m^3$. Additionally, rock bags, which will be used in close proximity to the WTG and OSP foundations, will be added to the description of seabed deposits. No other parameters of the existing Moray East Backfill Marine Licence will be changed.

This Environmental Report is submitted in support of a new Marine Licence application being submitted by Moray East to Marine Scotland Licensing Operations Team (MS-LOT). An assessment of the potential impacts of the increase of rock requirement for backfilling activities has been carried out in relation to key receptors including: physical environment, benthic ecology, fish and shellfish ecology, marine mammals, birds; commercial fisheries, and shipping and navigation. The impact assessment concluded that there will be no significant impacts due to the proposed backfilling activities. A summary of the assessment is presented in the table below.

| Receptor | Potential Impact | Original worst case impact assessment | Worst-case assessment with increased rock volume |
|---|---|---|---|
| Physical Processes | Increased suspended sediment concentrations and deposition on the seabed | Negligible | Negligible |
| Benthic Ecology | Direct Habitat Change | Minor | Minor |
| | Increase in Sediment Deposition affecting Benthic Communities | Negligible | Negligible |
| | Effects from Sediment Contamination | Negligible | Negligible |
| Fish and Shellfish | Underwater Noise | No impact | No impact |
| | Increase in SSC and subsequent deposition | Negligible | Negligible |
| | Habitat Change | Minor | Minor |
| | Release of Contaminants | Negligible | No Impact |
| Ornithology | Noise disturbance | No impact | Negligible |
| | Changes to Prey Availability | Negligible | Negligible |
| Marine Mammals | Noise Disturbance | No impact | Negligible |
| | Increased suspended sediment concentrations and contamination | Negligible | Negligible |
| | Changes to prey availability | Negligible | Negligible |
| | Vessel Collision | Minor | Minor |
| Commercial Fisheries | Construction Impacts | Negligible | Negligible |
| | Loss of fishing grounds | Negligible | Negligible |
| Marine Infrastructure, Shipping and Navigation | Construction Impacts | Negligible | No Impacts |
| | Operation and Maintenance Impacts | | Negligible |
| Cumulative Impacts | Notable those associated with Beatrice OWF | No Impact | No Impacts |

# 1 Introduction

## 1.1 Background

Section 36 Consents were granted in March 2014 and were subsequently varied in March 2018 for the construction and operation of three offshore wind farms (Telford, Stevenson and MacColl) within the Moray East site. Marine Licences for the three offshore wind farms were granted in September 2014 and were subsequently varied in July 2019 and April 2020 (together the Section 36 Consents and Marine Licences for the Wind Farm are referred as the Moray East Offshore Wind Farm Consents). The MacColl Marine licence was further varied in October 2020. Moray East was granted a Marine Licence for two Offshore Substation Platforms (OSPs) in September 2014 and was subsequently varied in July 2019 (Modified OfTI Marine Licence) and in 2017 a Marine Licence was granted for two additional distributed OSPs and subsequently varied in July 2019 (OSP Marine Licence) (together these licences are referred to as the OfTI Marine Licences). Figure 1-1 shows the location of the offshore wind farm and export cable routes.

Moray East is a joint venture partnership between OceanWinds, Diamond Generating Europe and China Three Gorges and has been established to develop, finance, construct, operate, maintain and decommission the Moray East Offshore Wind Farm (hereafter referred to as the 'Development').

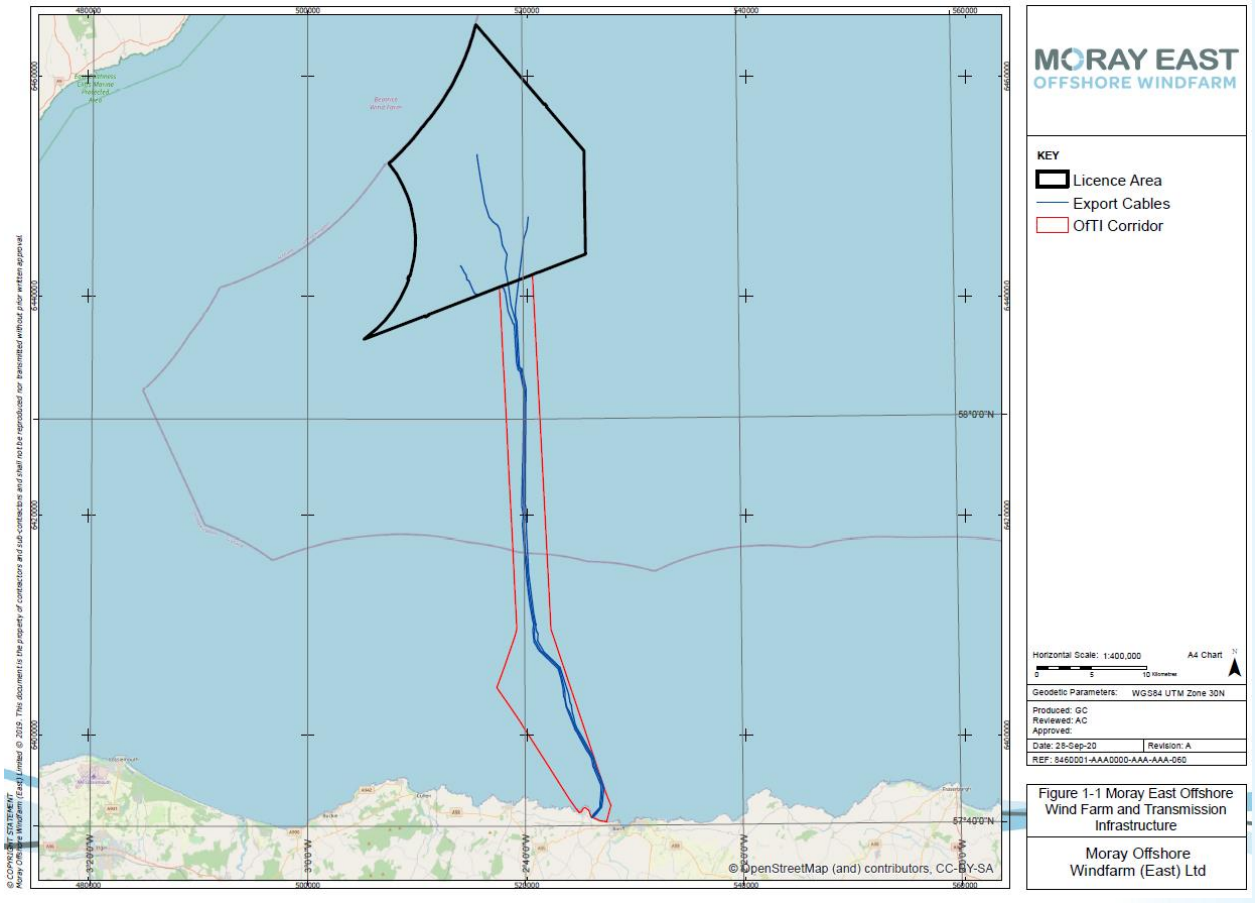


**Figure 1-1: Location of the offshore wind farm and export cable route**

During the construction phase of the Development, Jack-Up Vessels (JUVs) will be required at multiple stages: for pile installation at each Wind Turbine Generator (WTG) and offshore substation platforms (OSP) location, and again during jacket and WTG installation. At the time of preparing this report, pile

installation was completed in March 2020, OSP installation completed in September 2020, jacket installation is ongoing and WTG installation will occur in 2021.

The depressions in the seabed caused by the JUV have the potential to impact the structural integrity of the WTG and OSP foundation piles, creating the risk of inter-array cables and the trencher to slide into the depressions, and may limit the ability of subsequent jacking-up by the jacket and WTG installation vessel around WTG locations. Therefore, backfilling of these seabed depressions caused by the spud cans is a necessary part of the construction process which cannot be avoided when a JUV is used.

## 1.2 Objectives of this Document

This document is the supporting Environmental Report for the application of a Marine Licence to increase the deposits consented under the existing Moray East Backfill Marine Licence (07086/20/1).

A new Marine Licence is required due to an increase in the deposition of rock on to the seabed compared to the existing Moray East Backfill Marine Licence from 106,600 $m^3$ to 189,106 $m^3$, an increase of 82,506 $m^3$. Additionally, rock bags, which will be used in close proximity to the WTG and OSP structures, will be added to the description of seabed deposits (Table 1-1). No other parameters of the existing Moray East Backfill Marine Licence will be changed.

**Table 1-1: Original and new application request for rock deposits**

| Marine Licence Deposits Description | Amount | Description |
|---|---|---|
| Original deposits | 106,600 $m^3$ | Crushed, un-weathered and chemically stable rock, size range 5 mm to 200 mm |
| New application deposits | 189,106 $m^3$ | Crushed, un-weathered and chemically stable rock and rock bags, size range 5 mm to 200 mm |

These changes are required due to the need to use JUVs during the installation of the substructures and topsides and WTGs instead of the Heavy Lift Vessel (HLV) Orion which was originally anticipated to be used. This vessel is no longer available due to an incident and the Construction Method Statement (CMS) has now been updated to the use of JUVs for pile installation at each WTG and OSP location, and again during jacket and WTG installation.

The rock volume increase (above that set out in the existing Marine Licence) is required due to the additional (multiple) use of JUVs where rock placement is required following each discrete JUV operation. The rock bag requirement stems from (i) the need to avoid using rocks in close proximity to some of the structures to ensure their integrity and (ii) the configuration of the rock fall pipe from the Dynamic Positioned Fall Pipe Vessel (DPFPV) which would not be able to place rock accurately in close proximity to structures without damaging them. Section 2 sets this out in more detail.

This Environmental Report is submitted in support of a new Marine Licence application being submitted by Moray East to Marine Scotland Licensing Operations Team (MS-LOT). A description of the backfilling activities is provided in Section 2, a description of the baseline environment is provided in Section 3 and an assessment of impacts is presented in Section 4.

# 2 Engineering Background

## 2.1 Requirement for Additional Rock Volume and Rock Type

The CMS and Vessel Management Plan (Document reference: 8460001-PCA0010-MWE-REP-004 and 8460001-PCA0010-ANA-REP-002) had stated that the HLV Orion was expected to complete the WTG and OSP substructures topsides installation. Due to a recent incident with the HLV Orion, alternative vessels were required for the jackets and topside installations. After consulting the market, no suitable HLVs were identified as being available for the proposed works in the required timeframe and JUVs are being used as an alternative. Greater use of JUVs will result in both a greater number of depressions caused by the JUV spud cans and multiple uses of many of the spud can locations on the seabed. Each operation requiring use of the JUV will potentially require rock infilling of the spud can depressions back to mean seabed level and, therefore, a larger volume of rock is required compared to the existing Moray East Backfill Marine Licence.

The infill of the depressions has been carried out after piling and before jacket installation and will be carried out after jacket but before WTG installation. An ROV is used to determine if infill is required. For sections too close to the pile, rock bags will be used.

The proposed increase in rock volume is still expected to use inert rock from a quarry with a size range of 5 – 200 mm rock, as described in the existing backfill Marine Licence environmental report (8460001-PPL0050-RHD-REP-002). The rock used will be crushed fresh, un-weathered and will be chemically stable.

## 2.2 Method Statement

The methods of installation of the backfill rock deposit has been described in detail within the CMS and the original Backfill Marine Licence Environmental Report. A summary of these methods is provided below.

Over the entire construction period of the Moray East Offshore Wind Farm (OWF) a total of three different JUVs are anticipated to be used: the 'Apollo' used during the piling campaign, the 'Scylla' which is currently installing substructures and topsides, and the 'Bold Tern' which will install the WTGs.

Depending on the seabed conditions, the JUV legs will penetrate the seabed to varying degrees. During recovery of JUV legs, the resulting depression will naturally backfill to a certain degree, with the volume of backfill being dependent on the sediment type, current velocities at the bed and seabed conditions. The following list provides the spudcan diameter, maximum depth of leg penetration, and likely depression depth caused by each vessel following natural backfill:

- 'Apollo' – 10.8 m diameter, the deepest leg penetration was 13 m with a depression of 5.4 m
- 'Scylla' - hexagonal spudcans 14.5 m diameter, maximum expected leg penetration of approximately 15 m with a maximum expected depression of approximately 6 m
- 'Bold Tern' – 13.25 m diameter with maximum expected leg penetration of approximately 13.2 m with a maximum expected depression of approximately 6 m

Although each JUV can have a maximum leg penetration, as outlined above, in reality leg penetration on the Moray East site has been considerably less. For example, average leg penetration of the Scylla has been 3 m with a maximum leg penetration of 6.3 m over 37 jacking attempts[1]

The depressions will be filled with rock with a typical installation tolerance of +/- 50 cm of the bed level. The backfilling will be undertaken using a DPFPV which is a purpose-built vessel for the accurate placement of rock / gravel material in a controlled manner by using a fall pipe system. The fall pipe extends from the vessel and is remotely controlled at the bottom end of the fall pipe for precise manoeuvrability and positioning of the fall pipe. The average duration for backfilling of each seabed depression will be six hours.

For the sections of the depressions that are close to the foundations, rock bags will be used instead of loose rock deposited using the DPFPV system (see Section 1.2 for a description). The rock bags are a stone-filled net designed to encase the rock preventing it from breaking down or migrating from its intended location (see Figure 2-1 as an example of the type of rock bag to be used).

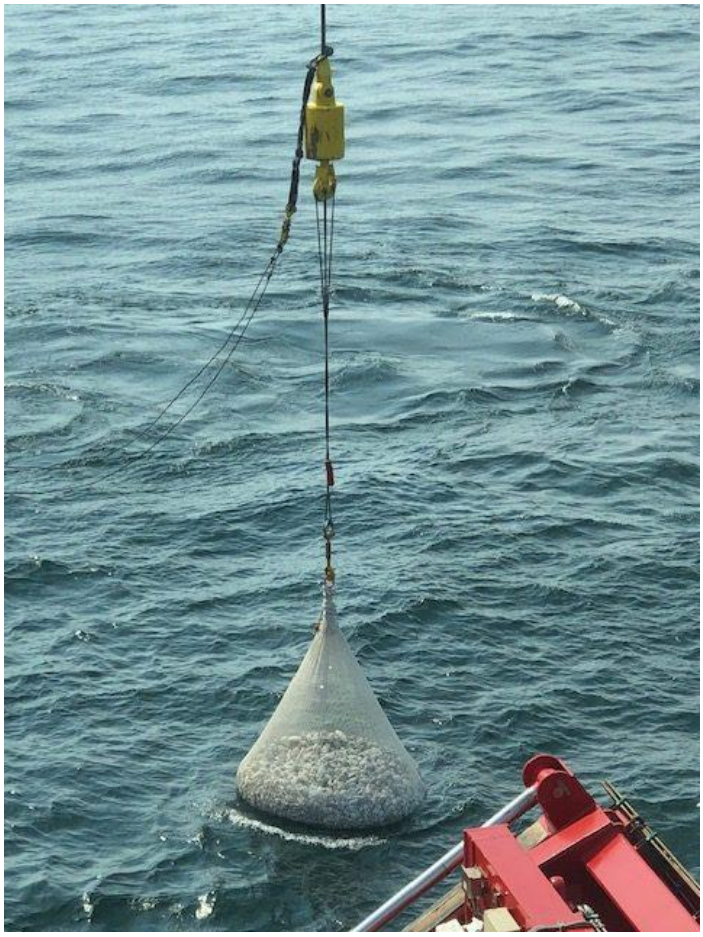

**Figure 2-1: An example of the size and shape of rock bag to be used at Moray East.**

Table 2-1 below provides an approximate indication of the distribution of total rock quantity across the three offshore wind farms and OSPs. The locations for the backfill operations are shown on Figure 2-2.

[1] Jacket and topside installation using the Scylla commenced in July 2020 and, at the time of writing this report, is currently ongoing.

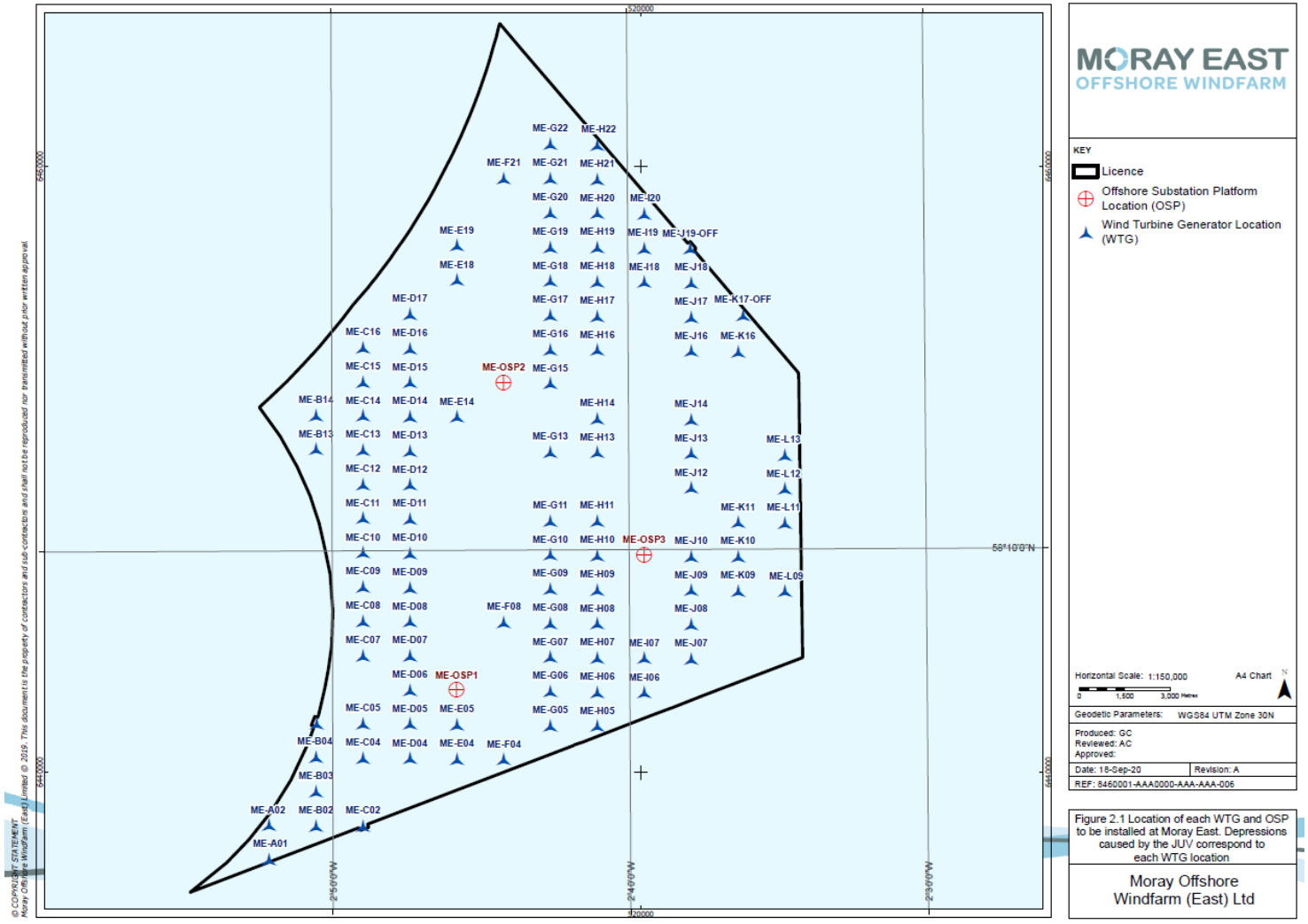


**Figure 2-2: Location of each WTG to be installed at Moray East. Depressions caused by the JUV correspond to each WTG and OSP location.**



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**Table 2-1: Distribution of rock volume across the three offshore wind farm sites and OSPs.**

| Task (noting vessel name) | Rock volume ($m^3$) | | | | |
|---|---|---|---|---|---|
| | Telford | Stevenson | MacColl | OSP1 & 2 | OfTO & OSP 3 |
| Bold Tern pile stability - backfilling depressions caused by the Bold Tern that impact pile stability. This is to improve the strength of the soil to provide the pile support. | 2,239 | 4,479 | 26,871 | - | - |
| Overlap Scylla vs Bold Tern - backfilling depressions caused by the Scylla that would cause the Bold Tern stability issues and risk it sliding. | 45,848 | 36,678 | 70,300 | - | - |
| Overlap Apollo vs Bold Tern - backfilling depressions caused by the Apollo that would cause the Bold Tern stability issues and risk it sliding. | 351 | - | 2,340 | - | - |

All JUVs will aim to prevent spudcan footprints from overlapping to reduce the rock volume required for backfilling. Should a JUV revisit a location, it will endeavor to use the same jack-up location as previously to reduce the creation of additional depressions.

It is highly likely that depression backfill will not be required at every location. Table 2-1 provides the reason for backfilling at each WTG location; however, these conditions will not be present at each location, i.e. not every depression caused by the Bold Tern will require backfilling to preserve pile stability. An ROV will be deployed after each construction campaign to determine whether the depression requires backfilling.

The original Backfill Marine Licence Environmental Report calculated the Worst-Case Scenario (WCS) for the footprint of each depression caused by the Apollo, used during piling, and a total footprint calculation. Table 2-2 sets out the footprint of each depression the Apollo will leave along with the total footprint affected by this vessel. Additionally, Table 2-2 also shows the equivalent information for the Scylla and Bold Tern, which constitute the additional seabed footprint now affected by these JUVs that may require backfilling.

**Table 2-2: Footprint of depressions caused by JUVs that may require backfilling**

| Vessel | No. of locations | Footprint of each depression | Total footprint |
|---|---|---|---|
| Apollo | 103 | 92.16 $m^2$ | 37,969.92 $m^2$ |
| Scylla | 103 | 165 $m^2$ | 67,980 $m^2$ |
| Bold Tern | 100 | 138 $m^2$ | 55,200 $m^2$ |

Figure 2-3 shows an extract of the Seabed Management Plan for the three JUVs at an example WTG location. Depending on the JUV, proximity to the WTG/OSP centre will vary as follows:

- Apollo spudcans to WTG/OSP centre ranges from 16 m (closest spudcan edge) to 50 m (further spudcan edge);
- Scylla spudcans to WTG/OSP centre ranges from 24 m (closest spudcan edge) to 120 m (further spudcan edge); and
- Bold Tern spudcans to WTG centre ranges from 25 m (closest spudcan edge) to 115 m (further spudcan edge).

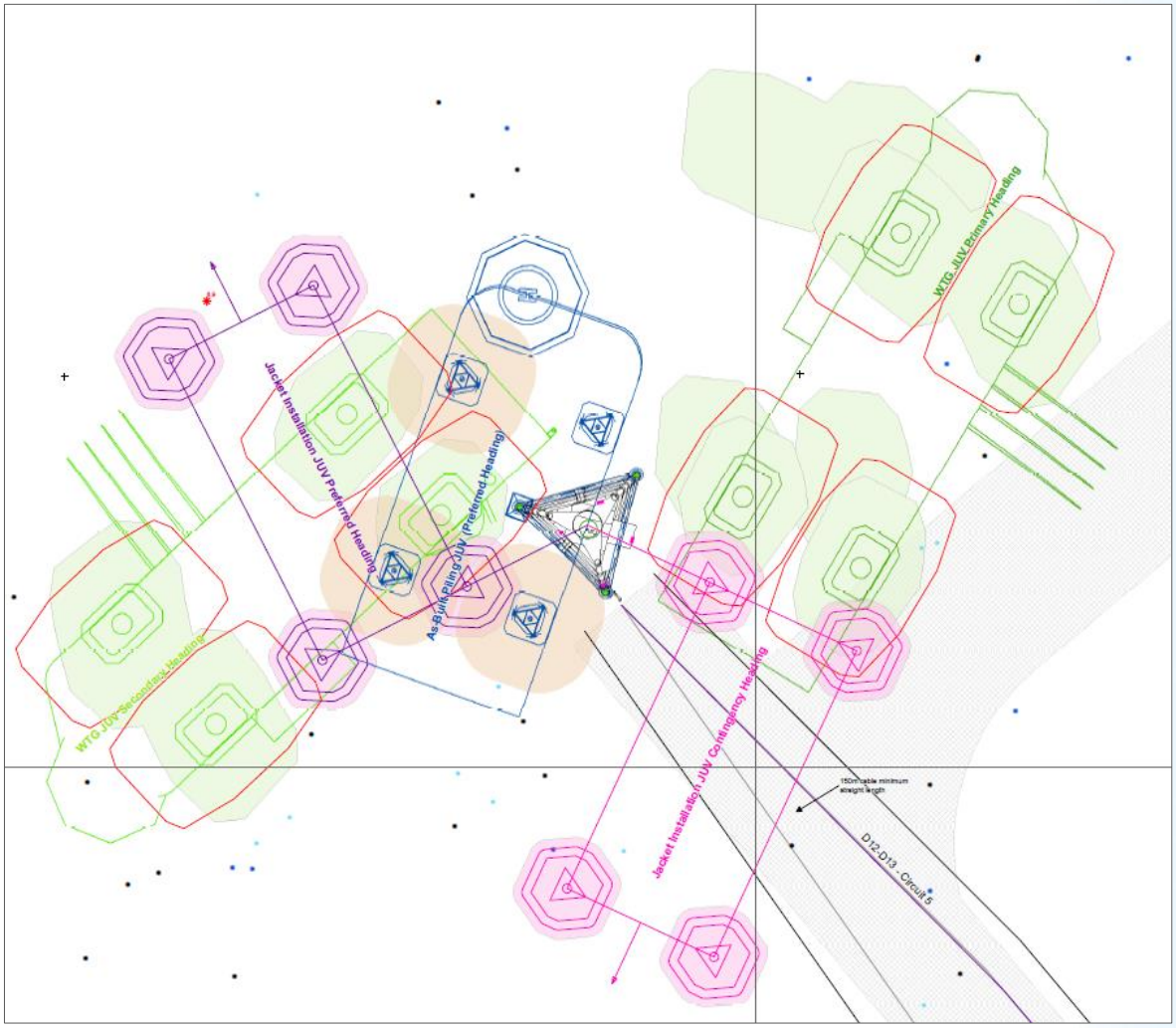


**Figure 2-3: Extract from the Seabed Management Plan showing the potential jack-up locations of the three JUVs during construction: Apollo (piling), Scylla (substructures and topside installation), and Bold Tern (WTG installation)**

The backfilling activity will occur between August 2019 and June 2022. The average duration for backfilling of each seabed depression will be 6 hours.

# 3 Existing Environment

A detailed description of the baseline conditions can be found within the Moray East Environmental Statement (ES) (Moray East, 2012) and the original Backfill Marine Licence Environmental Report (2019). The following sections provide an overview of the key receptors that may be potentially affected by the increase in rock deposits and is, therefore, not considered a full baseline of the existing environment. Notably no marine archaeology, or Seascape, Landscape and Visual Impact Assessment (SLVIA) baseline is presented due to the lack of potential significant impacts on such receptors.

## 3.1 Physical Environment

The Moray East site encompasses part of the summit and the eastern flank of Smith Bank, a morphological high point in the Outer Moray Firth measuring approximately 35 km long from south-west to north east, and 20 km wide (295 $km^2$).

Dominant seabed sediments include moderately to well sorted, fine to medium grained sand and muddy sand, with some shell and are described as relatively homogeneous. The available evidence suggests that (bedload) material is travelling into the Firth from the north, passing along the Caithness coast and towards the Inner Moray Firth (Moray East, 2012). Tidal currents are largely incapable of mobilising anything larger than fine sand-sized material within the Moray East site and as a result, there is only limited net bedload transport of sediment due to tidal currents alone. However, during storm events, it is likely that the commonly present medium-sized sand is regularly mobilised across the Moray East site.

During site characterisation surveys for Moray East ES 2012 levels of sediment contaminants were below guideline levels at all sampling locations within the Development area (Moray East, 2012).

### *3.1.1 Suspended Sediment Concentrations*

During calm conditions, Suspended Sediment Concentrations (SSC) are typically very low (approximately less than 5 mg/l). However, during storm events, near bed energy can increase due to the influence of wave stirring of the seabed. This can cause a short-term increase in SSC, theoretically 1,000s to 10,000s of mg/l very close to the seabed, 100s or 1,000s mg/l in the lower water column and 10s of mg/l in the upper water column. Coarser sediments may be transported a short distance in the direction of flow or down-slope under gravity before being re-deposited. Finer material that persists in suspension is transported in the direction of net tidal residual flow.

## 3.2 Biological Environment

### *3.2.1 Benthic Ecology*

The benthic survey conducted for the Moray East ES (2012) showed that the dominant seabed sediment habitat type within the Moray East site was slightly gravelly sand with patches of shelly gravelly sand, sandy gravel and gravel. The benthic communities associated with these seabed habitat types were found to be rich and diverse and were characterised by polychaete worms (e.g. *S. bombyx*, *Notomastus spp*., *Lumbrineris gracilis* and *Chone sp.*), the burrowing urchin (*Echinocyamus pusillus)* and the bivalve *Cochlodesma praetenue*. Statistical analysis showed that benthic communities were most influenced by depth and sediment types.

The most common biotopes identified within and around the Moray East site include:

- • SS.SSa.CFiSa EpusOborApri (Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand);
- • SS.SCS.CCS. MedLumVen (Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel); and
- • SS.SSa.OSa. OfusAfil (Owenia fusiformis and Amphiura filiformis in offshore circalittoral sand or muddy sand) or SS.SSa.IMuSa. FfabMag (Fabulina fabula and Magelona mirabilis with venerid bivalves and amphipods in infralittoral compacted fine muddy sand).

No rare or protected species with respect to the EC Habitats Directive 92/43/EEC and/or the Wildlife and Countryside Act 1981 (as amended) were found within the boundary of the Moray East site. Individual juvenile Icelandic cyprine or Ocean quahog *Arctica islandica* was recorded, which is on the OSPAR List of Threatened and/or Declining Species and Habitats (Region II – Greater North Sea) and the list of Scottish Priority Marine Features (PMF). Other PMF recorded include: the coarse sand biotope, MoeVen (recorded at one reference station outside the boundary of the Moray East site) and sandeels (as sandeel complex *Ammodytes marinus, A. tobianus*), as included within the Scottish PMF list. "Subtidal sands and gravels" habitat was also recorded which is a UK Biodiversity Action Plan (UK BAP) priority habitat as a result of its importance for the conservation of biodiversity. Although the UK BAP has now been succeeded by the post 2010 Biodiversity Framework, "Offshore subtidal sands and gravels" are included in the Scottish PMF list.

### *3.2.2 Fish and Shellfish*

#### 3.2.2.1 Commercial Species

The Moray Firth supports a number of commercially targeted fish and shellfish species. The principal shellfish and cephalopod species landed are *Nephrops* (*Nephrops norvegicus*), scallops (*Pecten aximus*) and squid (*Loligo* spp.). With respect to fish, haddock (*Melanogrammus aeglefinus*), herring (*Clupea harengus*), whiting (*Merlangius merlangus*), monkfish/ anglerfish (*Lophius* spp.), mackerel (*Scomber scombrus*) and cod constitute the majority of landings.

#### 3.2.2.2 Spawning and nursery grounds

There are spawning and nursery grounds for a number of species within and in the immediate vicinity of the Moray East site, including cod, herring, lemon sole (*Microstomus kitt*), Nephrops, plaice (*Pleuronectes platessa*), sandeel (*Ammodytidae* spp.), and sprat (*Sprattus sprattus*). There are also nursey grounds for the following species: anglerfish, blue whiting (*Micromesistius poutassou*), haddock, hake (*Merluccius merluccius*), ling (*Molva molva*), mackerel, saithe (*Pollachius virens*), spotted ray (*Raja montagui*), spurdog (*Squalus acanthias*) and thornback ray (*Raja clavate*). The Moray East site does not overlap with the spawning grounds of either the Orkney / Shetland or the Buchan herring stocks (the two stocks known to have spawning grounds in the vicinity of the Moray Firth) but it is located within high intensity nursery grounds as defined by Ellis et al. (2010).

#### 3.2.2.3 Species of Conservation Importance

A number of species of conservation importance are found in the Moray Firth and may therefore transit through the Development area. These include diadromous migratory species, (those using the marine and freshwater environments during their life cycle) elasmobranchs (sharks and rays) and commercial fish species.

Diadromous migratory species potentially present include European eel (*Anguilla Anguilla)*, allis and twaite shad (*Alosa alosa, Alosa fallax)*, sea and river lamprey (*Lampetra fluviatilis, Petromyzon marinus)*, smelt (*Osmerus osperlangus)*, salmon (*Salmo salar)* and sea trout (*Salmo trutta)*.

A number of other fish species which are commercially exploited with conservation status may be present in the Development of the including anglerfish, mackerel, cod, herring and sandeel. Atlantic salmon and sea lamprey are of conservation interest in a number of Special Area of Conservation (SAC) rivers in the Moray Firth area.

### *3.2.3 Birds*

The Moray Firth's coastal and offshore waters are internationally important for populations of seabird, seaduck, wader and wildfowl. Because of this, a number of areas bordering the Moray Firth have been designated as Special Protection Areas (SPAs) under EU Directive 79/409/EEC (the Birds Directive). In addition to resident birds, the area is used for breeding, over-wintering or as a temporary feeding ground during the spring and autumn migrations of species breeding in Scandinavia and the Arctic.

The Moray East ES (2012) described the ornithological environmental baseline, which identified the key ornithological species recorded during boat-based surveys undertaken between April 2010 and March 2012, vantage point surveys undertaken from four coastal locations between 2010 and 2011, and aerial surveys and seabird tracking undertaken in summer 2011. In total, ten species were put forward for consideration of impact assessment for the three Telford, Stevenson and MacColl wind farms (now the Moray East site).

#### 3.2.3.1 Key Species Commonly Sighted Species in the Moray Firth

Five species (fulmar, kittiwake, guillemot, razorbill and puffin) were recorded frequently during boat–based surveys and are designated features of more than one of the three local SPAs (East Caithness Cliffs SPA, North Caithness Cliffs SPA, and Troup, Pennan and Lion's Heads SPA).

Boat based surveys conducted from 2010 to 2012 informed the ornithology baseline for the Moray East ES 2012 and formed the base for population density and abundance estimates for the five species mentioned above. The estimates show guillemot has the highest density and abundance estimate and fulmar has the lowest.

#### 3.2.3.2 Sites Designated for Ornithological Receptors

A number of sites designated for ornithological receptors were considered in the Moray East ES (2012) and again in the Backfill Marine Licence Application Environmental Report (2019). A summary of SPAs relevant to the backfilling activities are provided in Section 3.3 below. Sites include East Caithness Cliffs SPA, North Caithness Cliffs SPA, Troup, Pennan and Lion's Heads SPA and Moray Firth proposed SPA (pSPA).

### *3.2.4 Marine Mammals*

The Moray Firth is an important area for marine mammals, with at least 14 species of cetacean and two species of seal being recorded in and around the Moray Firth. The bottlenose dolphin (*Tursiops truncates)* and harbour seal (*Phoca vitulina)* populations are both considered to be nationally and internationally important and are primary features of the Moray Firth SAC and Dornoch Firth and Morrich More SAC (Moray East, 2012), respectively. Bottlenose dolphin, harbour porpoise (*Phocoena phocoena)*, harbour seal and grey seal (*Halichoerus grypus)* are all listed under Annex II of the Habitats Directive as requiring protection through the designation of SACs (Moray East, 2012). Large cetacean species, including minke whale (*Balaenoptera acutorostrata)*, humpback whale (*Megaptera novaeangliae)* and less frequently

killer whale (*Orcinus orca)* and long-finned pilot whales (*Globicephala melas)* have been recorded within the Moray Firth during the summer months as they migrate.

#### 3.2.4.1 Harbour (Common) Seal

A number of haul-out sites for harbour seals are located within the Moray Firth, primarily in the Beauly, Cromarty and Dornoch Firths (Thompson et al., 1996; Special Committee on Seals (SCOS), 2010). Harbour seals occur throughout the year in these areas, with peak numbers at haul-out sites between June and August when they are used as breeding sites (Thompson & Miller, 1990; Thompson et al., 1996). Counts between 2011 and 2016 recorded 940 seals within the Moray Firth haul out sites, the majority of which were recorded within the Inner Firth at Culbin, Loch Fleet and Findhorn (SCOS, 2017).

The harbour seal density across the Moray East site is low at only 0.014 individuals per $km^2$, as calculated from the Russell et al. (2017) seals at sea density maps.

#### 3.2.4.2 Grey Seal

Grey seals within the Moray Firth are predominantly observed during the summer period, although smaller numbers are present throughout the year. In August 2016, surveys carried out by Sea Mammal Research Unit (SMRU) recorded a Management Unit (MU) population of 1,252 grey seals within the Moray Firth, approximately 350 of which were at Outer Dornoch Firth (SCOS, 2017).

The closest breeding site to the Development is Orkney, approximately 42 km to the north of the Development with the closest haul out site being Helmsdale, which is also located approximately 42 km from the Development. The grey seal density across the site is 0.23 individuals per $km^2$, as calculated from the Russell *et al.* (2017) seals at sea density maps.

#### 3.2.4.3 Harbour Porpoise

Harbour porpoise are distributed throughout the Moray Firth (Hastie et al., 2003b; Thompson et al., 2010; Robinson et al., 2007) increasing during the summer months along the coast due to lactating females and their calves moving inshore, who are then followed by males (Robinson et al., 2007).

The Joint Cetacean Protocol (JCP) Phase III report (Paxton et al., 2016) demonstrated that the Outer Moray Firth has high persistent densities of harbour porpoise during the summer period, with an estimated abundance of 9,000, which represents 1.3 % of the North Sea MU population (Paxton et al., 2016). Using the data in the report a worst-case density estimate of 1.7 individuals per $km^2$ is predicted. Relative density estimates from boat-based surveys at the Moray East site (2010-2012) were 0.16 animals per $km^2$; slightly lower than those predicted for the Moray Firth by SCANS II. Data from the second SCANS (Small Cetaceans in the European Atlantic and North Sea) survey (Hammond et al., 2013) estimated harbour porpoise densities of 0.274 individuals per $km^2$ in the vicinity of the Development area and preliminary results from the more recent aerial SCANS III surveys showed a slightly lower density estimate of 0.152 individuals per $km^2$ within the relevant survey block for the Moray Firth.

#### 3.2.4.4 Bottlenose Dolphin

A resident population of bottlenose dolphins can be found within the Inner Moray Firth, for which the Moray Firth SAC has been designated. Although the majority of the population (71 to 111 individuals) appear to regularly utilise the Moray Firth SAC it is clear that a relatively high number of individuals also frequently utilise areas outside the SAC (Thompson et al., 2006; 2009).

The distribution of bottlenose dolphin sightings within the Moray Firth appear to be coastal, with the majority occurring in the Inner Firth and along the southern coast, generally in waters of less than 25 m deep (Hastie et al., 2003a; Robinson et al., 2007). Some individuals of the resident population exhibit movement patterns between the Moray Firth and other areas, for example, bottlenose dolphins from the Moray Firth SAC are regularly sighted in the Tay Estuary (Thompson et al., 2011). A study conducted by Thompson et al., (2015) predominantly recorded bottlenose dolphin along the coastal areas particularly at the entrance to the inner Moray Firth, with very few recorded in the outer Moray Firth or offshore areas.

Within the Moray East marine mammal baseline surveys, there were relatively few sightings of bottlenose dolphin made within the Moray East site compared to the coastal areas nearby. The estimated density across the Moray East site is 0.0005 individuals per $km^2$, much lower than the estimated densities from the JCP Phase III report and from SCANS-III.

Within the JCP Phase III report, the bottlenose dolphin density for the "Moray Firth offshore development area" was estimated to be between 250 individuals in the summer and 110 in the autumn (Paxton et al., 2016). This gives an estimated density of 0.3 individuals per $km^2$. The SCANS-III density estimate for bottlenose dolphin in Block S is 0.004 individuals per $km^2$.

#### 3.2.4.5 Minke Whale

Minke whale are present within Moray Firth and appear to move south into the North Sea and into the waters around Western Scotland at the beginning of May and remaining present until October, with occasional sightings outside of this period (Evans, 2008; DECC, 2016). Minke whale are the most abundant whale species within the Moray Firth, with sightings being reported throughout the area (Reid et al., 2003; Robinson et al., 2007; Thompson et al., 2010). Data indicates that minke whales visit the Moray Firth in late summer to forage with the majority of sightings between May and September (Bailey & Thompson, 2009).

#### 3.2.4.6 White Beaked Dolphin

White-beaked dolphins (*Lagenorhynchus albirostris*) are present all year round in Scotland and the east coast of England, however sightings increase in the summer months as animals move towards the shore (Evans, 1992; Northridge *et al.,* 1995; Reid *et al.,* 2003). Sightings within the Moray Firth are low compared to other areas of the northern North Sea.

During surveys carried out in 2011 for the Beatrice OWF, most sightings were in offshore areas, with only occasional sightings within the inner Moray Firth (BOWL, 2012).

The Phase III JCP report suggests that numbers within the "Moray Firth offshore development area" are highest during the spring, with an estimated abundance of 180 individuals, with the lowest numbers in winter (40 individuals) giving a density estimate of 0.02 individuals per $km^2$ (Paxton *et al.,* 2016).

#### 3.2.4.7 Other Cetacean Species

Common dolphin and Risso's dolphins (*Grampeus griseus)* have also been recorded in the Moray Firth with occasional sightings of killer whale, long-finned pilot whale, fin whale (*Balaenoptera physalus),* humpback whale and sperm whale (*Physeter macrocephalus)* also being reported in the outer Moray Firth (DECC, 2016).

### *3.2.5 Commercial Fisheries*

International Council for the Exploration of the Sea (ICES) rectangle 45E7, within which the Moray East site is located, recorded landings values (average 2001 to 2010) that are of moderate importance on a national and regional scale.

The principal species targeted are: king scallops (55.4 %); Nephrops (14.1 %); whitefish, including haddock, monks and cod (19.7 %); and squid (7.6 %), mainly using boat dredges to target scallops, otter trawls to target Nephrops, seine nets and otter trawls to target whitefish, and demersal trawls to target squid (Moray East, 2012). More recent data shows the landings have largely remained the same from the Moray East ES 2012 baseline (ICES, 2017).

Landings values for all species from rectangle 45E7 are broadly highest between May and September, although there are also moderate landings recorded in April and October. The majority of landings from rectangle 45E7 are into ports in the Moray Firth area. Fraserburgh is the principal port, with 44.8 % of landings (values) from 45E7 (Moray East, 2012).

### *3.2.6 Marine Infrastructure, Shipping and Navigation*

The Moray East site is located within the vicinity of the Jacky Oil Field and the Beatrice Oil Field. The closest platform is located at the Jacky Field, approximately 3.7 nm west of the Stevenson site.

Vessel based surveys conducted in April to July 2010 and November 2010 to January 2011 showed in total, there was an average of 14 vessels per day passing within 10 nm of the Moray East site during the winter and 18 vessels per day recorded during the summer. It is noted that the increased traffic recorded in the summer survey can be partly attributed to fishing and recreational vessels passing through the area in more favourable weather and sea conditions.

A Navigational Risk Assessment (NRA) was submitted in 2010 which presented survey data collected via Automatic Identification System (AIS) and Radar over a 90 day period between 1 May and 31 July 2010. Further AIS data was recorded between 4 and 31 March 2018 which has been compared to the 2010 AIS data in order to determine the validity of the data. The analysis showed an average of approximately 11 unique vessels per day (mainly cargo and fishing vessels) were recorded in both survey periods. Overall, the difference in the volume of traffic recorded within the study area during the 2010 and 2018 surveys was insignificant.

## 3.3 Designated Conservation Sites

There are a number of nature conservation designations within the Moray Firth and in the vicinity of the Moray East site. Designated sites have been included in the assessment where there is spatial overlap and/or there are mobile features which may occur within the Moray East site. A summary of the designated sites that have the potential to be impacted by the backfilling activities is provided in Table 3-1.

**Table 3-1 Designated conservation sites with the potential to interact with backfilling activities**

| Site name | Screened in qualifying features |
|---|---|
| Moray Firth SAC | Bottlenose dolphin |
| Dornoch Firth and Morrich More SAC | Harbour Seal |
| Berridale and Longwell waters SAC | Atlantic Salmon |
| River Spey SAC | Atlantic Salmon and Sea Lamprey |
| River Thurso SAC | Atlantic Salmon |
| East Caithness Cliff SPA | Annex I species: peregrine<br>Migratory species during breeding season: guillemot, herring gull, kittiwake, razorbill and shag<br>Birds present during breeding season: puffin, great black-backed gull, cormorant, fulmar, razorbill, guillemot, kittiwake, herring gull and shag. |
| North Caithness Cliff SPA | Annex I species: peregrine<br>Migratory species during breeding season: guillemot<br>Species present during breeding season: puffin, razorbill, kittiwake, fulmar and guillemot |
| Troup, Pennan and Lion's Head SPA | Migratory species during breeding season: guillemot<br>Species present during the breeding season: razorbill, kittiwake, herring gull, fulmar and guillemot. |
| Moray Firth pSPA | The European Shag is proposed as a breeding and non-breeding species. The following non-breeding species have also been proposed: Common eider; Common goldeneye; Common scoter; Great northern diver; Greater scaup; Long-tailed duck; Red-breasted merganser; Red-throated diver; Slavonian grebe and Velvet scoter. |

# 4 Assessment of Effects

## 4.1 Approach

The impact assessment method follows the method used for the Moray East Backfilling Environmental Report used for the original Marine Licence application. Full details are available in the Backfilling Environmental Report (Moray East, 2019).

The impact assessment process followed the Institute of Ecology and Environmental Management (IEEM)[2] (2010) Guidelines for Ecological Impact Assessment in Britain and Ireland – Marine and Coastal. These guidelines were also used for the Moray East 2012 ES; however, the impact significance has been adapted for this Environmental Report from the impact significance used in Moray East 2012 ES. The impact significance criteria used are provided in Table 4-1.

**Table 4-1 Impact Significance Definitions**

| Impact Significance* | Definition |
|---|---|
| Major | Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in an exceedance of statutory objectives and / or breaches of legislation. |
| Moderate | Intermediate change in receptor condition, which are likely to be important considerations at a local level. |
| Minor | Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process. |
| Negligible | No discernible change in receptor condition. |
| No impact | No change in receptor condition; therefore, no impact. |

*A 'significant' impact is any impact significance greater than a minor impact.

The Moray East ES and original Backfilling Environmental Report (Moray East, 2019) both assessed the impacts of rock placement to infill depressions caused by the spudcans. This section draws upon this information and assesses whether an increase in the required volume of rock and increased frequency and locations for the operations, would change the significance of impacts associated this activity, and whether the previous impact assessment remains valid.

The impact of increased rock volume in backfilling activities will not change the effect on SLVIA, or marine archaeology and these environmental aspects have not been assessed further within this report.

## 4.2 Physical Environment

The original Backfill Marine Licence Environmental Report (Moray East, 2019), assessed the potential impact of increased sediment suspension and deposition of a volume of rock for backfill of 106,600m$^3$, and this has now increased to 189,106 m$^3$. Using the information provided in Section 2.2 (Method Statement) regarding the additional locations and frequency of backfilling operations, the assessment has been updated.

[2] Now the Chartered Institute of Ecology and Environmental Management (CIEEM).

#### *4.2.1 Potential further increases in suspended sediment concentrations*

There is potential for an increase in SSC following placement of the backfill material into the seabed depressions left by the spudcans. The seabed disturbance will be limited to each WTG and OSP location where the backfill material is placed and will only occur for a short duration after each discrete backfill rock (or rock bag) operation. It is expected that suspended sediments will be mobilised into the water column and then begin to resettle immediately through natural hydrodynamic processes. Where multiple backfilling operations are required at a single location the first backfilling operation is likely to be the worst case event in terms of SSC, as subsequent backfilling will be on top of previous rock dumps, not the more mobile bed sediments (noting that some, minor sedimentation will take place between operations).

The backfill activities will occur at one location at any one time, limiting the amount of suspended sediment temporally to no greater than the original assessment. The required multiple operations at any single location, and additional locations for such operations, is highly unlikely to cause any additional significant SSC concentrations that would be unacceptable.

Noting that tidal currents are largely incapable of mobilising anything larger than fine sand-sized material the larger fractions (e.g. fine to medium grained sand and shells found relatively homogenously across the Development) will settle out relatively quickly. Any muddy sand will take longer to settle but the volumes involved will be small and not elevate SSC to any significant degree near the bed or in mid-water. It is also noted that levels of sediment contaminants were below guideline levels at all sampling locations within the Development.

Due to the short-term, temporary and localised nature of the impact (with no sediment contamination present), the effects of increased SSC and deposition on the seabed is considered to be **negligible** and no mitigation is considered necessary.

## 4.3 Biological Environment

### *4.3.1 Benthic Ecology*

#### 4.3.1.1 Direct Habitat Change

The placement of backfill material within the Moray East site has the potential to result in a direct change of benthic habitat and associated fauna within the backfill footprint. The dominant habitats recorded within the Moray East site, as reported in the Moray East 2012 ES, were slightly gravelly sand with patches of shelly gravelly sand, sandy gravel and gravel. These habitats are also expected to be present in the surrounding area of the Moray East site. Therefore, the placement of the rock material will change the substrate from soft to hard.

The habitats present across the Moray East Site are common and widely distributed throughout the Moray Firth. Therefore, although there will be a change of habitat where the backfill material is placed, the original habitat will still be present in the surrounding area and throughout the Moray Firth.

Due to the ubiquitous nature of habitat which will be directly lost within the footprint of the backfill placement, coupled with the minor spatial change from the original Backfill Marine Licence Environmental Report (Moray East, 2019), the impact of change on benthic ecology is considered to be **minor** and no mitigation is considered necessary.

#### 4.3.1.2 Increase in Sediment Deposition affecting Benthic Communities

The sensitivity of benthic communities within the Moray East site was assessed in relation to seabed disturbances and increases in SSC in the Moray East ES 2012. Local receiving habitats are predominately sedimentary in nature and are characterised by sediment burrowing animals and are thus expected to be tolerant to temporary light sediment deposition.

The increase in the number of backfilling operations will lead to an increase in sediment deposition over the relevant construction period but effects will be localised, with long periods between discrete operations at each location and impacting on existing sedimentary habitats.

Due to the low sensitivity of the benthic communities present and the localised nature of the impact, the impacts of increased SSC and sediment deposition on benthic ecology are considered to be **negligible**.

#### 4.3.1.3 Release of Sediment Contamination

As stated in Section 3.1 levels of sediment contaminants have previously been reported to be below guideline levels at all sampling locations (Moray East, 2012) and no change to this baseline is expected since this date. Due to the low sediment contamination levels across the Development area the effect of resuspension of sediment contaminants on benthic ecology is considered to be **negligible**.

### *4.3.2 Fish and Shellfish Ecology*

#### 4.3.2.1 Noise

The backfilling activity within the Moray East site has the potential to cause direct disturbance to fish species in the vicinity of the works due to generation of underwater noise. The extent of the impact relates to the proximity of the receptor to the backfilling activity.

The timings of the backfilling activities are not currently known; therefore, it is not known if the backfilling activity will overlap with sensitive times for fish and shellfish species present in the Moray Firth, including migration or spawning periods. However, the noise produced is not expected to be as noisy as other construction activities, such as piling and UXO clearance. Additionally, the noise generated will be intermittent in nature, with each backfilling operation taking approximately 6 hours, and at one location at a time.

Whilst there is an increase in number of backfilling operations than previously assessed, the relatively low level of noise being produced will still only cause disturbance impacts limited to fish in proximity of the backfilling activity, causing a temporary behavioural response of avoidance. A **negligible** impact is predicted at a population level to any fish species in the Moray Firth.

#### 4.3.2.2 Increase in SSC and Subsequent Deposition

Indirect disturbance can occur to fish and shellfish species due to increases in SSC following placement of backfill material on the seabed. Increased sediment deposition also has the potential to impact spawning and nursery grounds, as eggs and larvae have relatively high susceptibility to significant deposition which may smother eggs starving them of oxygen. However, as set out above, seabed disturbance will be limited to each WTG and OSP meaning the increase in SSC will be localised and repeat, minor, deposition is not predicted to significantly alter the residual effect.

Although there will be an increase in SSC above background concentrations this expected to begin to settle immediately through natural physical processes. Additionally, the spawning and nursery areas present in the vicinity of the Moray East site are extensive and given the highly localised area that will be affected by backfilling it is unlikely that large proportions of any nursery and spawning grounds will be affected.

Mobile fish species are able to avoid localised areas disturbed by increased SSC. Juveniles and adults would be able to move to adjacent undisturbed areas within their normal distribution range and avoid any areas of increased SSC. Therefore, indirect disturbance due to increases in SSC are expected to be **negligible**.

#### 4.3.2.3 Habitat Change

The direct area affected by the proposed backfill operations is set out in Section 4.3.1.1 and, although there will be a change of habitat where the backfill material is placed, there will be extensive feeding, nursery and spawning habitat unaffected in the wider area and throughout the Moray Firth.

Due to the small and ubiquitous nature of habitat which will be lost within the footprint of the backfill material, the impact of habitat change on fish ecology is considered to be **negligible** for all species.

#### 4.3.2.4 Release of Contaminants

As stated in Section 3.1 levels of sediment contaminants have previously been reported to be below guideline levels at all sampling locations (Moray East, 2012) and no change to this baseline is expected since this date. Due to the low sediment contamination levels across the Development the effect of resuspension of sediment contaminants on benthic ecology is considered to be **negligible**.

### *4.3.3 Birds*

#### 4.3.3.1 Noise Disturbance

Backfilling has the potential to cause disturbance to birds due to an increase in vessel traffic during the backfilling activities. The Moray East ES 2012 determined that construction and decommissioning effects are limited to disturbance arising from WTG installation / removal and associated vessel traffic. The impacts were determined to be short-term, reversible and no significant effects were predicted.

Given the level of vessel traffic required during the construction phase, the addition of the backfilling vessel (and the number of operations it will undertake) is not expected to lead to significant noise impacts. The noise generated will be short-term, temporary and reversible in nature. Therefore, **no impact** is predicted due to disturbance from the backfilling activities to ornithology.

#### 4.3.3.2 Changes to Prey Availability

Potential impacts from backfilling activities to prey species has potential to indirectly impact birds. Given that potential impacts to benthic ecology and fish and shellfish ecology have been determined to be minor or negligible, the indirect impact on seabirds during the backfilling activities would be **negligible**.

### *4.3.4 Marine Mammals*

#### 4.3.4.1 Noise Disturbance

The backfilling activity within the Moray East site has the potential to cause direct disturbance to marine mammals present in the vicinity of the works due to generation of underwater noise. The extent of the impact relates to the proximity of the receptor to the backfilling activity.

The timings of the backfilling activities are not currently known; therefore, it is not known if the backfilling activity will overlap with sensitive times for marine mammal species present in the Moray Firth. However, the noise produced is not expected to be louder than other construction activities such as piling and UXO clearance. Additionally, the noise generated will be intermittent in nature, with each backfilling operation taking approximately 6 hours, and noise ceasing as soon as the rock is placed.

Whilst there is an increase in number of backfilling operations than previously assessed the relatively low level of noise being produced will still only cause disturbance impacts limited to marine mammals in proximity of the backfilling activity, causing a temporary behavioural response of avoidance. A **negligible** impact is predicted at a population level are predicted to any fish species in the Moray Firth.

#### 4.3.4.2 Increases in SSC and release of sediment contaminants

As set out in Sections 4.2.1 and 4.3.1.3, increases in SSC will be limited and there is a lack of sediment contamination present within the Development above guideline levels. The effects on SSC would still be localised and of short duration for each backfilling operation around the WTGs and OSPs, affecting only a small volume of the available water column. Following disturbance, any liberated sediment will resettle through natural physical processes, with normal currents velocities not sufficient to significantly affect sediment transport over a large area. Marine mammal species are able to avoid areas that have been disturbed by the increase in SSC.

Even considering the cumulative increase in backfilling operations from the original assessment now being considered, the zones of effects and temporal durations of any SSC increases within the Moray Firth is considered to result in a **negligible** impact on marine mammal species.

#### 4.3.4.3 Changes to Prey Availability

There are no significant impacts expected to occur to fish and shellfish species as a result of the backfilling activities, due to either behavioural disturbance of the fish species from the area, habitat change or the release of SSC. Therefore, any potential indirect effects to marine mammals that target these species are expected to be **negligible**.

#### 4.3.4.4 Vessel Collision

There is potential for impacts to marine mammals due to vessel collision during the construction phase. The Moray East ES 2012 concluded that any vessel traffic would be slow moving in a predictable manner (along a predefined corridor). As a result, the effects of increased vessel traffic on marine mammals (all species) was considered probable in the immediate vicinity of the vessel but overall, effects would be of low magnitude, medium duration and minor significance. The vessel required for the backfilling activity will also be slow moving and in a predictable manor. Whilst the vessel will be in operation for a longer duration than the original backfilling assessment no change to the impact of significance determined during the ES is predicted, with impacts to marine mammals due to vessel collision expected to be **minor**.

### *4.3.5 Commercial Fisheries*

During the construction phase there are mandatory “rolling” 500 metres (m) safety zones established where construction works are taking place that include sensitive activities being undertaken by vessels with restricted ability to manoeuver (RAM) (Marine Scotland, 2019) within the limit of granted concurrent safety zones. The backfilling works are within the safety zone that are already in place during the construction phase; therefore, no change in impacts on commercial fishing activity assessed during the

Moray East ES 2012 and original backfilling assessment are predicted and impacts are considered to be **negligible**.

The Moray East ES 2012 identified that the presence of infrastructure and associated safety zones which may be required during the operational phase would result in loss of fishing grounds to fishing vessels. In the Moray East ES 2012, the combined footprint of 50 m advisory safety zones around WTGs/OSPs was estimated to represent around 1% of the total area of the Moray East site.

It should be noted that the area of seabed affected by the proposed backfilling (161,150m$^2$) would represent a very small percentage of the site (approximately 0.05%). Furthermore, when jacked-up, the JUVs will be located in the immediate proximity of each WTG/OSP structure. As such, the majority of depressions requiring backfilling would fall within the 50 m advisory safety zones, and hence within the 1% area previously assessed in the Moray East ES 2012. Therefore, change in impacts assessed during the Moray East ES 2012 and original backfilling assessment remains as predicted and impacts are considered **negligible**.

### *4.3.6 Marine Infrastructure, Shipping and Navigation*

#### 4.3.6.1 Construction Impacts

During the backfilling activities, there will be an existing safety zone of 500 m in place around each WTG and OSP while work is being undertaken (Moray East, 2018). Therefore, there are **no impacts** expected in relation to the shipping and navigation above that already identified in the ES.

#### 4.3.6.2 Operation and Maintenance Impacts

During the operational phase there is potential for impacts from the backfilling material to vessels that interact with the seabed (such as vessel anchoring). However, the footprint of the backfilling, scour and foundation now proposed is smaller than assessed in the Moray East ES 2012. The area of seabed which will be backfilled will all be in close proximity to either WTGs or OSPs and the likelihood for anchoring near such structures is small. Additionally, the area of seabed affected will be 161,150m$^2$ compared to the 37,969.92 m$^2$ assessed in the original Backfill Marine Licence Environmental Report (Moray East, 2019). The additional seabed take will not increase significantly the impact on vessels during the operational phase and no change in impacts assessed during the Moray Firth ES 2012 or original backfilling assessment are predicted and impacts are considered to be **negligible**.

No other impacts on marine infrastructure / operators (e.g. oil and gas) are predicted.

## 4.4 Designated Conservation Sites

Information on potential effects to Atlantic salmon (the qualifying features of the Berriedale and Langwell Waters SAC and River Spey SAC) are provided in Section 4.3.2.

Potential effects on qualifying features of East Caithness Cliffs SPA, North Caithness Cliffs SPA, Troup, Pennan and Lion's Heads SPA and Moray Firth pSPA have been considered in Section 4.3.3.

Details of the potential effects on bottlenose dolphin (the qualifying feature for the Moray Firth SAC) and for harbour seals (the qualifying feature for the Dornoch Firth and Morrich More SAC) are provided in Section 4.3.4.

Overall **no significant effects** are predicted in relation to the designated sites listed in Section 3.3 from the backfilling activities.

## 4.5 Cumulative Impacts

As set out in Section 3.10, the main activity occurring within the vicinity of the Moray East site is Moray West OWF, due to the close proximity to the Moray East site. Construction of the Moray West OWF is expected to commence in quarter 3 of 2022. Given that backfilling activities are expected to be completed by June 2022, there will be no overlap of the backfilling activity with the construction phase of Moray West OWF.

There is potential for cumulative impacts in relation to any vessels required during the operation phase of Beatrice OWF and the backfilling vessel. However, embedded mitigation measures will be in place including a 500 m safety zone and a Notice to Mariners. Therefore, **no cumulative impacts** are predicted.

# 5 Conclusions

This report assesses whether increasing the rock volume that is licensed to be used for the backfilling of depressions from 106,600 $m^3$ in total to 189,106 $m^3$, will change the conclusions of previous impact assessment undertaken to inform the original Moray East Marine Licence for backfilling of spudcans.

Table 5-1 summarises the worst-case assessment of potential impacts made by the original Moray East Backfill Environmental Report (Moray East, 2019) and compares this with the worst-case assessment of impacts given the increase in rock volume as described in Section 4.

**Table 5-1 Summary of worst-case impacts and changes to impact assessment**

| Receptor | Potential Impact | Original worst case impact assessment | Worst-case assessment with increased rock volume |
|---|---|---|---|
| Physical Processes | Increased suspended sediment concentrations and deposition on the seabed | Negligible | Negligible |
| Benthic Ecology | Direct Habitat Change | Minor | Minor |
| | Increase in Sediment Deposition affecting Benthic Communities | Negligible | Negligible |
| | Effects from Sediment Contamination | Negligible | Negligible |
| Fish and Shellfish | Underwater Noise | No impact | No impact |
| | Increase in SSC and subsequent deposition | Negligible | Negligible |
| | Habitat Change | Minor | Minor |
| | Release of Contaminants | Negligible | No Impact |
| Ornithology | Noise disturbance | No impact | Negligible |
| | Changes to Prey Availability | Negligible | Negligible |
| Marine Mammals | Noise Disturbance | No impact | Negligible |
| | Increased suspended sediment concentrations and contamination | Negligible | Negligible |
| | Changes to prey availability | Negligible | Negligible |
| | Vessel Collision | Minor | Minor |
| Commercial Fisheries | Construction Impacts | Negligible | Negligible |
| | Loss of fishing grounds | Negligible | Negligible |
| Marine Infrastructure, Shipping and Navigation | Construction Impacts | Negligible | No Impacts |
| | Operation and Maintenance Impacts | | Negligible |
| Cumulative Impacts | Notable those associated with Beatrice OWF | No Impact | No Impacts |

The conclusion of this assessment is that an increase in the volume of rock required to backfill the JUV depressions, with additional backfill operations and some new locations within the Development does not change the impact of any effect previously assessed for the original Backfill Marine Licence.

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MORAY EAST
OFFSHORE WINDFARM

## Contact

Moray Offshore Windfarm (East) Limited
5th Floor, Atria One, 144 Morrison Street,
Edinburgh, EH3 8EX
Tel: +44 (0)131 556 7602