MORAY OFFSHORE WINDFARM (WEST) LIMITED

European Protected Species (EPS) Risk Assessment for Construction at Moray West Offshore Wind Farm and Associated Offshore Transmission Infrastructure

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Table of Contents

Figures

Tables

Abbreviations and Acronyms

Acronym / Abbreviation	Description
ADD	Acoustic Deterrent Device
AEoSI	Adverse Effect on Site Integrity
AWS	Autumn, Winter and Spring
BEIS	Business Energy Industrial Strategy
bl/m	Blows per minute
BOWL	Beatrice Offshore Wind Farm
CCC	Climate Change Committee
CES	Coastal East Scotland
CF	Conversion Factor
CGNS	Celtic and Greater North Seas
CI	Confidence Interval
CV	Coefficient of Variation
dB	Decibel
EPS	European Protected Species
EIA	Environment Impact Assessment
ES	Environment Statement
FCS	Favourable Conservation Status
GHG	Greenhouse Gas
HLV	Heavy Lift Vessel
HRA	Habitats Regulations Appraisal
IAMMWG	Inter-Agency Marine Mammal Working Group
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
JUV	Jack-Up Vessel
kHz	kilohertz
kJ	Kilojoule
km	Kilometre
km^2	Kilometre squared

Acronym / Abbreviation	Description
LSE	Likely Significant Effects
M	Metre
m/s	Metres per second
MBES	Multibeam Echo Sounder
MD-LOT	Marine Directorate Licensing Operations Team
MSS	Marine Scotland Science
MU	Management Unit
NCMPA	Nature Conservation Marine Protected Areas
nm	Nautical miles
NS	North Sea
OfTI	Offshore transmission infrastructure
OSP	Offshore Substation Platform
PMP	Piling Mitigation Protocol
PS	Piling Strategy
PTS	Permanent Threshold Shift
RA	Risk Assessment
RoC	Review of Consents
S	Summer
SAC	Special Areas of Conservation
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCOS	Special Committee on Seals
SEL	Sound Exposure Level
SMRU	Sea Mammal Research Unit
SNCBs	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage (now NatureScot)
SNS	Southern North Sea SAC
SSS	Side Scan Sonar
TTS	Temporary Threshold Shift
UK	United Kingdom
VHF	Very High frequency

Acronym / Abbreviation	Description
WTG	Wind Turbine Generator

1 Introduction

1.1 Background

The Moray West Offshore Wind Farm and associated Offshore Transmission Infrastructure (OfTI) (referred to as 'the Development') is being developed by Moray Offshore Windfarm (West) Limited (known as 'Moray West'; see Appendix A – Defined Terms for defined terms). Consent for the Development was granted on 14 June 2019 under Section 36 (S36) of the Electricity Act 1989 (as amended), Part 4 of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 from Scottish Ministers. One S36 consent was granted by Scottish Ministers for the wind farm (012/OW/MORLW-8) and two Marine Licenses were granted by Scottish Ministers, one for the wind farm and another for the offshore transmission infrastructure. Variations of the S36 consent and wind farm Marine Licence were granted by the Scottish Ministers on 7 March 2022, and further variations of the Wind Farm Marine Licence (licence number: MS-00009774) and OfTI Marine Licence (licence number: MS-00009813) were granted on 7 March 2022 and 11 April 2022. The revised S36 consent and associated Marine Licences are referred to collectively as 'offshore consents'.

Construction activities required for the Development have the potential impact on European Protect Species (EPS) within the Development site and adjacent areas of the Moray Firth. This risk assessment has been produced in support of an application for a licence to potentially cause injury and/or to disturb EPS during the construction of the Development.

1.2 Aims and Objectives

All species of cetacean (whale, dolphin and porpoise) occurring in UK waters are listed in AnnexIV of the Habitats Directive as EPS, meaning that they are species of community interest in need of strict protection, as directed by relevant Habitats Regulations.

The objective of this report is to assess the risk of death, injury and deliberate disturbance to EPS as a result of proposed works required during construction of the Development both within and outwith 12 nm. This risk assessment considers construction of the Development as a whole and does not differentiate between activities within and outwith of 12 nm.

1.3 What constitutes disturbance?

1.3.1 Within 12 nautical miles

Whether or not a specific activity could cause 'disturbance' (for the purpose of Article 12(1) (b) of the Habitats Directive) depends on the nature of the particular activity and the impact on the particular species. Whilst 'disturbance' is not defined in the Habitats Regulations, Marine Scotland (2014) advise that the following matters should be taken into account when considering what constitutes disturbance:

- 'Disturbance' in Article 12(1) (b) should be interpreted in light of the purpose of the Habitats Directive to which this Article contributes. In particular, Article 2(2) of the Directive provides that measures taken pursuant to the Habitats Directive must be designed to maintain or restore protected species at *Favourable Conservation Status*[1];
- Article 12(1)(b) affords protection specifically to species and not to habitats;

- The prohibition relates to the protection of 'species' not 'specimens of species';
- Although the word 'significant' is omitted from Article 12(1)(b) in relation to the nature of the disturbance, that cannot preclude an assessment of the nature and extent of the negative impact and ultimately a judgement as to whether there is sufficient evidence to constitute prohibited 'disturbance' of the species;
- It is implicit that activity during this period of breeding, rearing, hibernation and migration is more likely to have a sufficient negative impact on the species and constitute prohibited 'disturbance' than activity at other times of the year;
- Article 12(1)(b) is transposed into domestic legislation by Regulation 39(1) and (2) of the Habitats Regulations 1994. Therefore, when considering what constitutes 'disturbance', thought should be given to Regulation 39(1)(b) which provides a number of specific circumstances wherean EPS could be disturbed, and which can potentially have an impact on the status of the species; and
- Disturbance that could be considered an offence may occur in other circumstances and therefore be covered under Regulation 39(2) of the Habitats Regulations which state that it is anoffence to 'deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)'.

Where there is the possibility for disturbance to any individual EPS occur, an EPS Risk Assessment must be carried out and the need for a Marine EPS Licence determined.

[1] The Habitats Directive defined the conservation status of a species to be taken as 'favourable' when population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, when the natural range of the species is not being reduced for the foreseeable future and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

1.3.2 Outside of 12 nautical miles

As Regulation 39(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) is not applicable to offshore waters, disturbance of an individual animal would not necessarily qualify as significant disturbance requiring a Marine EPS Licence. Instead, under the Conservation of Offshore Marine Habitats and Species Regulations 2017 disturbance must occur to a sufficiently large or important group of animals that the ability of that group of animals to survive, breed or rear or nurture their young would be compromised. Alternatively, disturbance could be also considered to occur if the local distribution or abundance of the species was significantly changed.

1.4 Determining the need for a Marine EPS Licence

The purpose of the EPS Risk Assessment presented in this report is to determine whether, when considering appropriate mitigation as presented in Section 5, there is still potential for the offshore construction activities of the Development to cause deliberate harm or inadvertently cause disturbance to cetaceans or other protected species. The need for a Marine EPS Licence will be determined by the Marine Directorate Licencing Operations Team (MD-LOT) with advice from NatureScot based on findings from the EPS Risk Assessment. MD-LOT's consideration of whether an EPS Licence will be required will comprise three tests:

1. To ascertain whether the licence is to be granted for one of the purposes specified in the Regulations;
2. To ascertain whether there are no satisfactory alternatives to the activity proposed (that wouldavoid the risk of offence); and
3. That the licencing of the activity will not be detrimental to the maintenance of the populationof the species concerned at a *Favourable Conservation Status*.

The report provides an assessment of the risk to EPS, both individually and in respect to the favourable conservation status[1] (FCS) on EPS populations. The assessment is based on the frequency and density of occurrence of EPS in the vicinity of the Development, together with estimates of the likely effects from the proposed works based on previous assessments.

The specific aims of the document are to:

- Outline which species and construction activities will be included within the risk assessment and EPS licence (Section 1.5);
- Outline EPS presence / abundance within the Development Site (Section 4) and identify reference populations;

[1] The Habitats Directive defined the conservation status of a species to be taken as 'favourable' when population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, when the natural range of the species is not being reduced for the foreseeable future and there is, a sufficiently large habitat to maintain its populations on a long-term basis.

- Demonstrate what measures have been taken, both through design parameters and mitigation, to reduce risk of injury and/or disturbance to EPS (Section 5);
- Provide information on construction activities which have the potential to result in injury or disturbance to EPS (Section 5);
- Provide an assessment of the potential effects from proposed construction activities on EPS (Section 6); and
- Conclude whether there is a significant risk of injury and/or disturbance to EPS as a result of construction of the Development (Section 7).

1.5 Scope of this document

To date, assessments of impacts on marine mammals due to construction of the Moray West Offshore Wind Farm and Transmission Infrastructure have been undertaken as part of the following documents:

- Moray Offshore Wind Farm Environmental Statement (ES) and Habitats Regulations Appraisal (HRA) (Moray East ES, (Moray Offshore Renewables Limited, 2012);
- Moray West Offshore Windfarm Environmental Impact Assessment Report (EIA) (Moray Offshore Renewables Ltd., 2018);
- Moray West Technical Note A – Protected Sites and Species Assessment (Moray West, 2018); and
- Moray West Revised Piling Strategy (8460005-DBHA04-MWW-PLN-000003) (Moray West, 2023).

It has been demonstrated through the Moray West Revised Piling Strategy (2023), that despite refinements to the Design Envelope since the approval of the Moray West EIA (Moray Offshore Renewables Ltd., 2018), the significance of impacts to marine mammals will be within those identified within the Moray West EIA (2018); Moray West Revised Piling Strategy (2023), and that the reduction in piling activity is predicted to reduce the overall risk of impact to marine mammals making the conclusions of the Moray West EIA and HRA very precautionary.

The risk assessment within this document is based on information previously presented and accepted within the above documents.

Specific construction activities deemed to have the potential to disturb EPS, which are considered within this assessment are:

- Impact piling of wind turbine generators (WTGs) and offshore substation platform (OSP) foundations;
- Vibro piling;
- Vessel activity during construction;
- Use of acoustic deterrent devices (ADDs) as proposed mitigation; and
- Post installation surveys

To date, assessments presented in previous documents have focused on species likely to be present within the Moray Firth as identified through extensive baseline studies. These assessments have focused on assessed impacts to harbour porpoise, minke whale and bottlenose dolphin. Whilst the risk to other species is low, there is the potential common dolphin and white-beaked dolphin to be present as they are seasonal visitors to the Moray Firth. Therefore, this document assesses the risk of disturbance to the following species of EPS commonly present within the Moray Firth (as outlined in Section 4);

- Harbour porpoise (*Phocoena phocoena*);
- Bottlenose dolphin (*Tursiops truncatus*);
- White-beaked dolphin *(Lagenorhynchus acutus*);
- Common dolphin (*Delphinus delphis*); and
- Minke whale (*Balaenopteraacutorostrata*).

2 Project Background

The Moray West Site covers an area of approximately 225 km^2 on the Smith Bank in the Outer Moray Firth approximately 22 km from the Caithness coastline (**Figure 2.1**). The Moray West Offshore Wind Farm will comprise 60 WTGs, associated substructures and seabed foundations, inter-array cables, one OSP inter-connector cable and any scour protection around substructures or cable protection. The OfTI comprises two OSPs which will be located within the Moray West Site, and two offshore export cable circuits which will be located within the OfTI Corridor and will be used to transmit the electricity generated by the offshore wind farm to shore.

The offshore export cable circuits will come ashore at Sandend Bay, which is located on the Aberdeenshire Coast at Broad Craig, approximately 65 km south of the Moray West Site. There will be two underground circuits from landfall at Sandend Bay to Whitehillock where the onshore substation will be located. Water depths vary from a minimum of approximately 35 m near the northern boundary, with Moray East to a maximum of 54 m near the southern limit of the site.

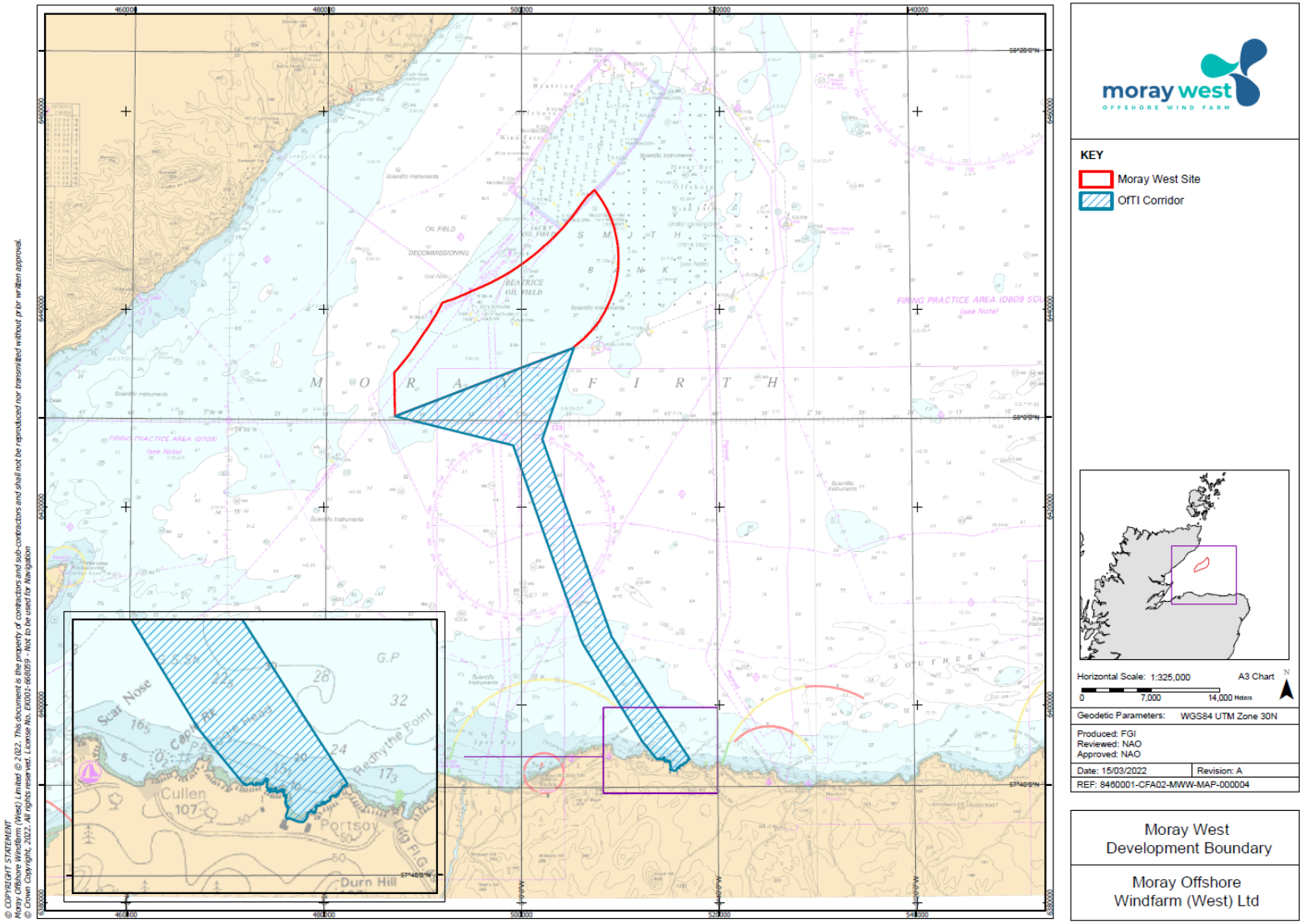

Figure 2.1 Moray West Site and OfTI Corridor.

3 Legal Requirements

3.1 Legislation

This EPS Stage 1 Risk Assessment (RA) has been undertaken to support the Marine EPS Licence application submitted to the Marine Directorate – Licensing Operations Team (MD-LOT) regarding construction activities for the Moray West Development.

The purpose of this RA is to determine whether there is potential for the proposed piling activity and other construction activities to cause deliberate harm, or inadvertently cause disturbance to cetaceans or other protected species and if mitigation would be required for offshore construction activities. The need for a Marine EPS Licence will be determined by the MD-LOT, with advice from Marine Scotland Science (MSS) and NatureScot, based on findings from the EPS RA. MD-LOT's consideration of whether an EPS Licence will be granted will comprise three tests:

4. To ascertain whether the licence is to be granted for one of the purposes specified in Regulation 44;
5. To ascertain whether there are no satisfactory alternatives to the activity proposed (that would avoid the risk of offence); and
6. That the licencing of the activity will not be detrimental to the maintenance of the population of the species concerned at a *Favourable Conservation Status* (FCS)[2].

3.2 EPS Protection

All species of cetacean (whale, dolphin, and porpoise) occurring in UK waters are listed in AnnexIV of the Habitats Directive as EPS, meaning that they are species of community interest in need of strict protection, as directed by Article 12 of the Directive.

This protection is afforded in Scottish territorial waters (out to 12 nautical miles (nm)) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Regulation 39(1) of these Regulations make it anoffence to:

a. Deliberately or recklessly capture, injure or kill a wild animal of an EPS;
b. Deliberately or recklessly:
    i. Harass a wild animal or group of wild animals of an EPS;
    ii. Disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;
    iii. Disturb such an animal while it is rearing or otherwise caring for its young;
    iv. Obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place;

[2] *The Habitats Directive defined the conservation status of a species to be taken as 'favourable' when population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, when the natural range of the species is not being reduced for the foreseeable future and there is, a sufficiently large habitat to maintain its populations on a long-term basis.*

v. Disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;
vi. Disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed, or reproduce, or rear or otherwise care for its young; or
vii. Disturb such an animal while it is migrating or hibernating.

Further protection is afforded through an additional disturbance offence given under Regulation 39(2) which states that "*it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)*".

Outside of 12 nm, the extent of legislative protection against injury is the same as within 12 nm. However, the definition of disturbance outside of 12 nm does not extend to individual animals. Therefore, whilst disturbance of a single animal within 12 nm may be considered an offence and thus require an EPS licence, for an EPS licence to be required outside of 12 nm there must be disturbance of a significant group of animals.

3.2.1 What constitutes disturbance?

3.2.1.1.1 Within 12 nautical miles

Whether or not a specific activity could cause 'disturbance' depends on the nature of the particular activity and the impact on the particular species. Whilst 'disturbance' is not defined in the Habitats Regulations, Marine Scotland (2020) advise that the following matters should be taken into account when considering what constitutes disturbance:

- 'Disturbance' in Article 12(1) (b) should be interpreted in light of the purpose of the Habitats Directive to which this Article contributes. In particular, Article 2(2) of the Directive provides that measures taken pursuant to the Habitats Directive must be designed to maintain or restore protected species at *Favourable Conservation Status*[1];
- Article 12(1)(b) affords protection specifically to species and not to habitats;
- The prohibition relates to the protection of 'species' not 'specimens of species';
- Although the word 'significant' is omitted from Article 12(1)(b) in relation to the nature of the disturbance, that cannot preclude an assessment of the nature and extent of the negative impact and ultimately a judgement as to whether there is sufficient evidence to constitute prohibited 'disturbance' of the species;
- It is implicit that activity during this period of breeding, rearing, hibernation and migration is more likely to have a sufficient negative impact on the species and constitute prohibited 'disturbance' than activity at other times of the year;
- Article 12(1)(b) is transposed into domestic legislation by Regulation 39(1) and (2) of the Habitats Regulations 1994. Therefore, when considering what constitutes 'disturbance', thought should be given to Regulation 39(1)(b) which provides a number of specific circumstances where an EPS could be disturbed, and which can potentially have an impact on the status of the species; and
- Disturbance that could be considered an offence may occur in other circumstances and therefore

be covered under Regulation 39(2) of the Habitats Regulations which state that it is an offence to 'deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)'.

Marine Scotland (2020) advise that while the likelihood of acute injury can be relatively easy to determine, auditory injury accumulated over a period of time and disturbance are not so straightforward so assessments will need to be based on a number of factors including:

- The spatial and temporal distribution of the animal in relation to the activity;
- The duration of the activity;
- Any behaviour learned from prior experience with the activity;
- Similarity of the activity to biologically important signals (particularly important in relation to activities creating sound); and
- The motivation for the animal to remain within the areas (e.g., food availability).

As noise can cause disturbance to cetaceans, any application for an EPS licence will require detailed information on the source level of the sound and its frequency. Where there is the possibility for disturbance to any individual EPS occur, an EPS RA must be carried out and the need for a Marine EPS Licence determined.

3.2.1.1.2 Outside of 12 nautical miles

As Regulation 39(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) is not applicable to offshore waters, disturbance of an individual animal would not necessarily qualify as significant disturbance requiring a Marine EPS Licence. Instead, under the Conservation of Offshore Marine Habitats and Species Regulations 2017, disturbance must occur to a sufficiently large or important group of animals that the ability of that group of animals to survive, breed or rear or nurture their young would be compromised. Alternatively, disturbance could be also considered to occur if the local distribution or abundance of the species was significantly changed.

Although the Moray West site is offshore, beyond 12 nm from land, the proposed construction activities could potentially affect both Scottish territorial and offshore waters therefore both the Conservation (Natural Habitats &c.) Regulations 1994 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 apply.

4 Species Included in the EPS

4.1 Species within the Moray Firth

A total of 19 cetacean species have been recorded in UK waters (Reid *et al.*, 2003). To date, a total of 14 cetacean species have been recorded alive within the Moray Firth (see Table 4-1). Other species have been found stranded within the Moray Firth area but are not discussed here due to the uncertainty of the animals' location before death. Cetaceans found within the Moray Firth can be divided into three groups – those present all year, those that occur seasonally and those which are considered rare visitors.

Species that are considered 'occasional' or 'rare' in Table 4-1 are included for illustration purposes only and have not been assessed further in this report.

Table 4-1: List of cetaceans recorded within the Moray Firth (adapted from a variety of sources). Species included in this assessment are highlighted in bold.

Common name	Latin name	Occurrence in the Moray Firth
Harbour porpoise	***Phocoena phocoena***	**Common, all year**
Bottlenose dolphin	***Tursiops truncatus***	**Common, all year**
Common dolphin	***Delphinus delphis***	**Common, seasonal**
White-beaked dolphin	***Lagenorhynchus albirostris***	**Common, seasonal**
Minke whale	***Balaenoptera acutorostrata***	**Common, seasonal**
Risso's dolphin	*Grampus griseus*	Occasional
White-sided dolphin	*Lagenorhynchus acutus*	Occasional
Killer whale	*Orcinus orca*	Occasional
Pilot whale	*Globicephala melas*	Rare
Humpbacked whale	*Megaptera novaengliae*	Rare
Fin whale	*Balaenoptera physalus*	Rare
Sperm whale	*Physeter macrocephalus*	Rare
Northern bottlenose whale	*Hyperoodon ampullatus*	Rare
Beluga whale	*Delphinapterus leucas*	Rare

4.2 Cetacean species potentially present in the Development Site

4.2.1 Harbour porpoise

Harbour porpoise are the most abundant cetacean species in Scottish waters (Reid *et al.* 2003; Hammond *et al.* 2021). They are also the most frequently encountered species in both visual and acousticsurveys in and around the proposed Moray West Offshore Wind Farm Site and are present throughout the Moray Firth throughout the year (Moray Offshore Renewables Ltd, 2018). The global population of harbour

porpoise is listed in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as *Least Concern*; however, the current population trend is unknown (Braulik *et al*., 2020). In the most recent 2013-2018 reporting by the Joint Nature Conservation Committee (JNCC), the conservation status for harbour porpoise within the species range in the North Sea is currently favourable; but the trend in the population covered by the National Site Network is currently classified as unknown (JNCC, 2019). Abundance estimates for this species occurring in the Moray Firth is approximately 0.152 individuals/km^2 (Hammond *et al.*, 2021), however the maximum density within the Moray West Site recorded form the site specific surveys was 1.468 individuals/km^2 (Moray West, 2018).

4.2.2 Bottlenose dolphin

The Moray Firth is an important habitat to the resident population of bottlenose dolphin in the North Sea, which is in the Coastal East Scotland (CES) Management Unit (MU)[3] (Moray Offshore Renewables Ltd, 2018; Inter-Agency Marine Mammal Working Group (IAMMWG), 2023). Whilst occupation of the Moray Firth by this population varies between years, recent survey data has confirmed that approximately half of the estimated population occupy the area regularly (Graham *et al.*, 2016). Designation of the Moray Firth Special Areas of Conservation (SAC) provides protection of bottlenose dolphin and their habitat, with the aim of maintaining the FCS (Scottish Natural Heritage (SNH), 2006; Moray West, 2018). The resident bottlenose dolphin of the Moray Firth SAC predominantly utilise the nearshore environment. Habitat modelling of survey data indicates that the southern coastline of the Firth is particularly important habitat to this population (Thompson *et al.*, 2014). Based on the most recent 2013-2018 reporting by the JNCC, the conservation status for bottlenose dolphin within the species range is currently favourable and the trend for the population covered by the National Site Network is currently classified as unknown (JNCC, 2019).

4.2.3 White-beaked dolphin

White-beaked dolphin are frequent the eastern extent of the Moray Firth year-round, predominantly occupying depths of 50 – 100 m (Reid *et al*., 2003). The density of white-beaked dolphin in the waters in and around the Moray Firth is 0.123 animals/km^2 (Waggitt *et al*., 2019). They are usually found in small groups of 10 or less but have also been observed in large groups of 50 and more. Based on the most recent 2013-2018 reporting by the JNCC, the conservation status for white-beaked dolphin within the species range is currently favourable and the trend for the population covered by the National Site Network is currently classified as unknown (JNCC, 2019).

4.2.4 Common dolphin

Common dolphin are abundant along shelf breaks and in deeper waters on the west coast of the UK and Europe (Reid *et al*., 2003). Recent data suggests an increasing occurrence of short-beaked common dolphin in the northern North Sea, including the Moray Firth (Robinson *et al.*, 2010; Moray Offshore Renewables Limited, 2018). Abundance estimates for this species occurring in the Moray Firth is approximately 0.074 individuals/km^2 (Hammond *et al*., 2021). Common dolphin are amongst the most

[3] Management Units (MUs) are agreed upon spatial scales at which the impacts of proposed activities on the UK's seven most common cetacean species are assessed by UK Statutory Nature Conservation Bodies (SNCBs)

gregarious cetacean species, often forming groups of 50 or more individuals, though groups of 200 or more are not uncommon (Robinson *et al.*, 2010). Based on the most recent 2013-2018 reporting by the JNCC, the conservation status for common dolphin within the species range is currently favourable and the trend for the population covered by the National Site Network is currently classified as unknown (JNCC, 2019).

4.2.5 Minke whale

Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid *et al.,* 2003; Hammond *et al.,* 2021). They often prefer water depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to15 individuals) while feeding. Based on the most recent 2013-2018 reporting by the JNCC, the conservation status for minke whale within the species range is currently favourable and the trend for the population covered by the National Site Network is currently classified as unknown (JNCC, 2019). Abundance estimates for this minke whales occurring in the Moray Firth is approximately 0.023 individuals/km^2 (Waggitt *et al.*, 2019). Minke whale are also one of the protected features of the Southern Trench Nature Conservation Marine Protected Area (NCMPA), through which the Offshore Export Cable Corridor passes. The Conservation Objectives of this site are to conserve the features, specifically to ensure "*minke whale in the Southern Trench NCMPA are not at significant risk from injury or killing, conserve the access to resources (e.g. for feeding) provided by the NCMPA for various stages of the minke whale life cycle, and conserve the distribution of* minke whale within the site by avoiding significant disturbance".

4.2.6 Summary

The density and abundance of the cetacean species which regularly occur in the Moray Firth is summarised in Table 4-2. Density estimates for harbour porpoise, bottlenose dolphin, and common dolphin are based on the SCANS-III survey for survey block S which includes the Moray Firth area as well as waters to the north, including around Orkney, with an area of 40,383 km^2 surveyed in June / July 2016 (Hammond *et al*., 2021). The estimated population abundance of white-beaked dolphin and minke whale in the Moray Firth is based on Waggitt *et al*. (2019) absolute densities.

Reference population for harbour porpoise is the North Sea (NS) MU (Hammond *et al*., 2021). The reference population for bottlenose dolphin is the CES MU, the reference population for common dolphin, white-beaked dolphin and minke whale is Celtic and Greater North Seas (CGNS) MU (IAMMWG, 2023; Table 4-2).

Table 4-2: Density and abundance estimates for the five regularly occurring cetacean species in the Moray Firth

Species	Density estimates (individuals/km^2)	Estimated population abundance in the relevant MU	References
Harbour porpoise	1.468*	346,601	Moray West (2018); IAMMWG (2023)
Bottlenosedolphin	0.0037	224	Hammond et al. (2021); Arso Civil *et al*. (2021); IAMMWG (2023)

Table 4-2: Density and abundance estimates for the five regularly occurring cetacean species in the Moray Firth			
Species	**Density estimates (individuals/km^2)**	**Estimated population abundance in the relevant MU**	**References**
White-beaked dolphin	0.123	43,951	Waggitt *et al*. (2019); IAMMWG (2023)
Common dolphin	0.074	102,656	Hammond *et al.* (2021); IAMMWG (2023)
Minke whale	0.023	20,118	Waggitt *et al*. (2019); IAMMWG (2023)

**Maximum density cell with the Moray West Site*

5 Consideration of alternatives and proposed mitigation

5.1 Reduction of worst-case scenarios from EIA

Since the submission of the Moray West EIA (2018), there have been significant reductions in the worst-case scenarios that were used in the Moray West EIA (2018). This includes the reduction in the maximum number of WTG foundations and maximum hammer energy.

This EPS risk assessment has been informed by a combination of results from assessments undertaken as part of the Moray West EIA (2018) and Moray West Revised Piling Strategy (2023). Where updated assessments or project information is available (such as within the PS), this EPS Risk Assessment will consider the Final Design Envelope. Where updated information is not available (such as vessel numbers) the risk assessment will be based on information presented in the Moray West EIA (2018) as this was used for the basis of Appropriate Assessment. For impacts which were not assessed within the EIA, best available information will be used to inform the risk assessment.

Table 5-1 outlines how the worst-case scenarios of the Design Envelope have reduced since the Moray West EIA (2018) assessment. The scenarios comprise of a single pile event in a 24-hour periods, concurrent piling with two monopiles being installed at the same time, and two consecutive and the final scenario is installing three monopiles in a 24-hour period (Table 5-1).

Table 5-1: Comparison of parameters used in Moray West EIA 2018 with the final design parameters, as presented in the Moray West Revised Piling Strategy

Parameter	Assessed Parameter Range (Moray West EIA, 2018)	Final Design Parameters (Moray West Revised Piling Strategy)
Foundation numbers		
Maximum number of WTG monopile foundations	85 WTG monopile foundations	60 WTG monopile foundations
Maximum number of OSP monopile foundations	2 OSPs monopile foundations	2 OSPs monopile foundations
Piling		
Maximum hammer energy	5,000 kJ	4,400 kJ
Maximum installation time	8 hours per foundation	4 hours per foundation
Pile installation programme	10 months	8 months, as a worst-case scenario
Consecutive Piling	No	Yes
Concurrent Piling	Yes	Yes
Maximum number of piles per 24 hours (assuming simultaneous piling events)	2	2 concurrent piling events 2 consecutive piling events 3 piling installation events

Table 5-1: Comparison of parameters used in Moray West EIA 2018 with the final design parameters, as presented in the Moray West Revised Piling Strategy		
Parameter	**Assessed Parameter Range (Moray West EIA, 2018)**	**Final Design Parameters (Moray West Revised Piling Strategy)**
Total number of piling days (single vessel)	87 (assuming 1 vessel) 44 (assuming 2 vessels)	62 (assuming one vessel and installation of 1 pile/day); or <31 (assuming two vessels)

As shown in Table 5-1 above, since the assessment for the Moray West EIA (2018) was undertaken, the overall amount of piling required has been significantly reduced, as a result, the maximum installation time per foundation has reduced by 50 % and the total number of piling days has reduced by 25 days.

5.2 Piling strategy

In the Moray West Revised Piling Strategy (2023), the modelling locations were selected based on proximity to the original modelling locations in the EIA and informed by the pile driveability assessment undertaken by Moray West. This driveability assessment identified three levels of pile driving refusal risk based on the soil profiles and the maximum blow count (blows per minute (bl/m)) required during pile driving at each location (see Figure 5-1):

- Locations with moderate risk of pile driving refusal (5 locations), which are locations with a hard-driving profile and would require a blow count above 925 bl/m.
- Locations with low risk of pile driving risk (10 locations), which would require blow counts above 602 bl/m but less than 925 bl/m.
- Locations with negligible risk of pile driving refusal (47 locations), which would require blow counts of 602 bl/m or less.

To model realistic worst case impacts of piling noise Moray West have selected the WTG monopile locations with moderate risk of pile driving refusal closest to each of the original EIA modelling locations (D03 nearest to Location 1, L13 nearest to Location 2 and G07 nearest to Location 3) (Figure 5-1). The grey seal assessment in the Moray West Revised Piling Strategy (2023) provides impacts for both D03 and L13 given the proximity of L13 to higher density grey seal areas to the north of the array area. In addition to this, one location with negligible risk of pile refusal was also modelled (N08) to provide a second location for concurrent and consecutive piling scenarios (Figure 5-1).

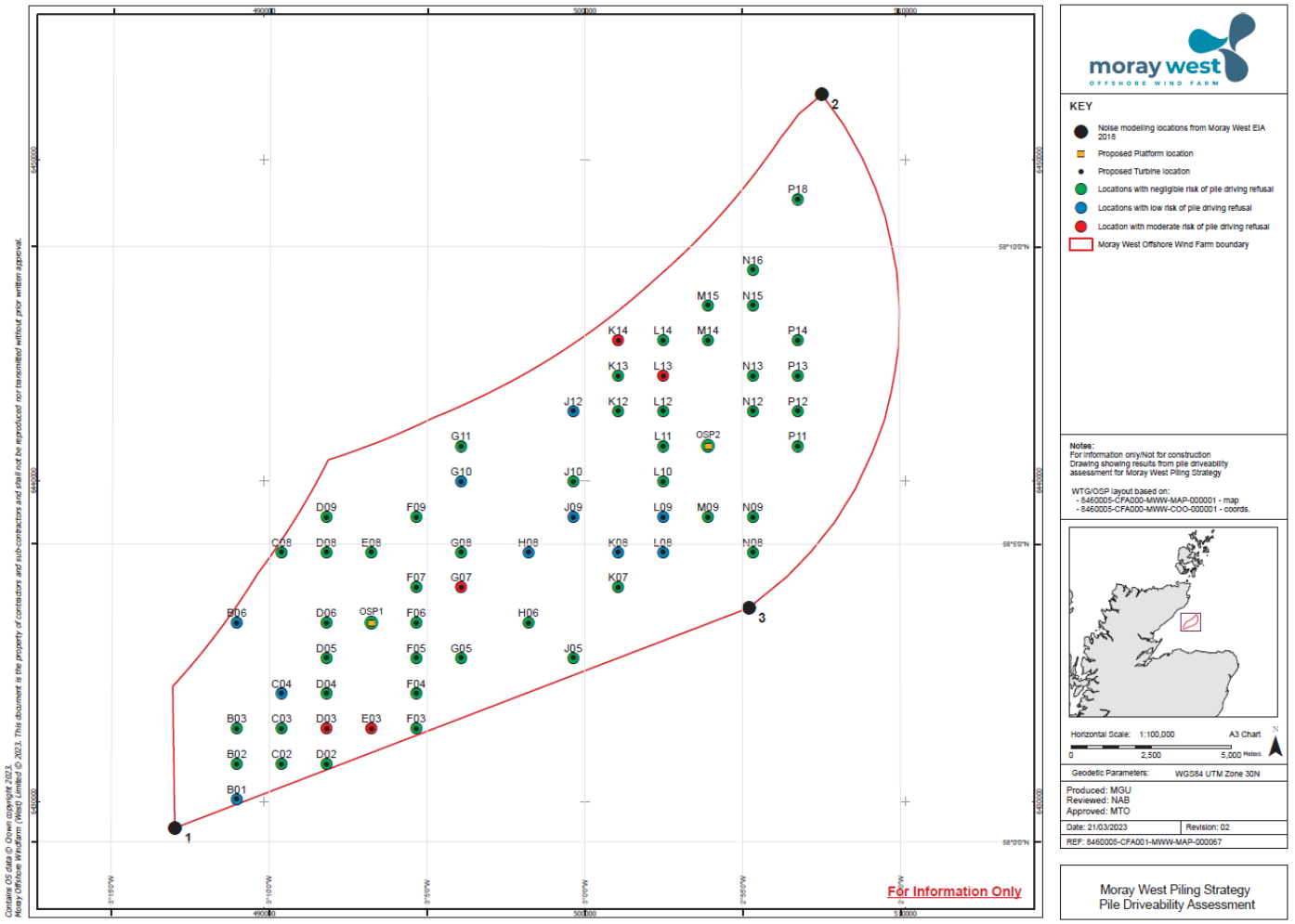

Figure 5-1 Full wind farm layout: 60 WTG locations are shown, those with moderate risk of pile driving refusal are shown in red (n=5, D03, E03, G07, K14, L13), low risk of pile driving refusal in blue (n=10, B01, B06, C04, G10, H08, J09, J12, K08, L08, L09) and negligible risk of pile driving refusal no drivability risk in green (n=45) as well as the 2 OSP locations (yellow squares inside green circles indicating no drivability risk). Black dots numbered 1, 2 and 3 represent modelling locations used in the EIA.

5.2.1 Mitigation

A Piling Mitigation Protocol (PMP) was designed to reduce the risk of injury to marine mammals during piling at Moray West Site, was developed and agreed through the Moray West Revised Piling Strategy (2023), Appendix D. The use of ADDs as mitigation is designed to displace marine mammals from an area in which there is the potential for them to be exposed to Sound Exposure Levels (SEL) sufficient to induce instantaneous death or permanent injury due to exposure single noise pulses at close range. Justification for the use of ADDs as mitigation is presented in Appendix D of the Moray West Revised Piling Strategy (2023).

The proposed mitigation will be undertaken prior to starting piling, and is summarised as follows;

- Vibro piling prior impact piling. The use of a vibro-hammer for intermediate driving may be required in some locations were identified by further installation engineering and will reduce the amount of time of impact pile driving.
- The recommended activation period for ADD is 10 minutes, which is based on the precautionary swimming speed of 1.4 m/s for harbour porpoise (SNH, 2016) to exit the maximum instantaneous Permanent Threshold Shift (PTS) range of 579 m and the maximum cumulative PTS range of 840 m. The ADD will be deployed and activated prior to commencement of piling for the purpose of displacing marine mammals to a distance where they would not be at risk from instantaneous death or injury. By inducing a flee response to lower levels of noise, it is anticipated that marine mammals would be able to swim to a distance of at least 900 m, beyond the impact range predicted for death and physical injury. ADD will not be used in those locations where vibro piling is used.
- For monopile locations where vibro-piling is not used, after the use of ADD, piling soft-start commences with a low hammer energy of 432 kJ with a minimum duration of 15 minutes[4].
- Following the 15-minutes soft start, hammer energy will ramp-up gradually until a suitable energy level is reached (Maximum hammer energy 4,400 kJ).

Therefore, with an activation of the ADD for a period of 10 min prior to impact piling commencing, we will ensure all marine mammals are outside of both the instantaneous and cumulative PTS impact ranges.

In most cases, (e.g. location L13, see Revised Appendix C of the Moray West Revised Piling Strategy (2023)), it is expected to take much longer before full hammer energy is reached (151 minutes), due to the extended soft-start (24 minutes) and ramp-up (120 minutes) periods. In this scenario, following ADD activation, the soft-start and the ramp-up periods, harbour porpoise will be 12.7 km away from the source

[4] JNCC (2010) guidance describes the soft-start as 'the gradual ramping up of piling power, incrementally over a set time period until full operational power is achieved'. The soft-start duration is to be a minimum of 20 minutes. For the Moray West Revised Piling Strategy (2023), the soft-start- procedure will consist of a 15-minute period where the hammer energy will not exceed 432 kJ and 28 blows/minute, followed by the gradual ramp-up of hammer energy towards maximum hammer energy. Overall, the combined soft-start and ramp-up procedures will be longer than the 20 minutes recommended by JNCC (2010) guidelines as full hammer energy will not be achieved during the first 20 minutes of piling, if at all.

and, therefore, even further outside the maximum full hammer energy instantaneous PTS-onset range (2,395 m).

5.2.2 Breaks in piling activity

Following a break in piling, the following mitigation protocols would be followed as summarised below:

- In order to minimise ADD use and therefore reduce any unnecessary disturbance to marine mammals, the ADD will not be re-deployed for breaks in piling that are less than 6 hours.
- In the event of breaks in piling of <10 minutes, no mitigation is required. The pile driving can continue from the last hammer energy and strike rate (or lower) used without the need for another ADD deployment.
- For breaks in piling <6 hours, pile driving will recommence with a full soft-start and ramp-up in hammer energy, wherever this is safe to do so, but without the need for pre-piling ADD deployment.
- If the break in piling is >6 hours, then the full pilling mitigation procedure of pre-piling ADD deployment, soft-start and ramp-up will be conducted.

5.3 Other mitigation

In order to reduce the risk of cumulative PTS on minke whales, all locations with a hard-driving profile with moderate risk of pile driving refusal (5 locations) and locations with a driving profile with low risk of pile driving refusal (10 locations) will be installed in non-summer months (between October and May inclusive) when the minke whale density is expected to be significantly lower.

6 EPS Risk Assessment

6.1 Overview of construction activities

A general summary of activities required for the construction of the Development that are included within this EPS risk assessment are provided below:

- Impact piling of WTG and OSP monopile foundations;
- Vibro piling;
- Vessel activity during construction;
- Use of ADDs as proposed mitigation; and
- Post installation surveys.

Within this document construction activities are discussed in the context of their potential to injure or disturb EPS.

6.2 Impact Piling

6.2.1 Overview of piling activities

This RA relates to piling activities at Moray West Site for the installation of the 60 WTGs and two OSP monopile foundations. The 62 monopiles foundations will be installed using a hydraulic impact hammer or using a combination of vibro-hammer and hydraulic impact hammer, as the use of a vibro-hammer for intermediate driving may be required in some locations were identified by further installation engineering. The vibro-hammer is a specialist pile driving hammer which can drive the pile through soft sediments during the initial pile driving operations. Impact energies using a vibro-hammer are significantly lower than those foreseen during soft start driving with the hydraulic impact hammer. The pile driving impact hammer will be required to complete driving operations.

6.2.1.1 Pile installation programme

The installation of the 62 monopile foundations is anticipated to commence in August 2023. The installation campaign is planned to be completed by March 2024. During the monopile installation period there will be an aggerated duration of approximately 284 hours of actual pile driving (noise generation) activity for 62 piles, based on up to 4 hours of pile driving at each location. It is anticipated that up to two piles could be installed within a 24-hour period. In the event that the overall duration of piling installation activities in a single location allows for the post-piling activities and the installation vessel to transit to the next location, piling operations would re-commence in the next location within the same 24-hour period. This would reduce the overall pile installation programme. Concurrent installation of two monopiles per day will only happen if there is an overlap between two installation vessels on Moray West Site. Concurrent piling could occur during a two-month window between October 2023 and February 2024.

6.2.1.2 Hammer energies

The outcomes of the pile driveability assessment have indicated that most of the pile foundations can be driven to the target penetration depth using pile driving hammer energies up to 4,000 kJ, which can be achieved by using a 4,000 or 4,400 kJ hammer (for example hammer models IHC S-4000 or MHU4400S) at

maximum hammer efficiency reduced to 95%. There is the potential for maximum hammer energies of up to 4,400 kJ to be required for those locations with harder ground conditions.

The maximum hammer energy required at all pile locations across Moray West Site will not exceed 4,400 kJ.

6.2.1.3 Piling sequence

The installation of each monopile foundation will involve a minimum of a 15-minute soft-start procedure where a maximum hammer energy of 432 kJ (10% of the MHU4400S hammer energy capability) will be used at a strike rate of approximately 28blows/minute unless there are technical reasons prohibiting this. Following the completion of the soft-start procedure, hammer energy will ramp-up gradually until a suitable energy level is reached, to maintain a steady rate of pile penetration, ensuring that the combined soft-start and ramp-up procedures exceed the minimum 20 minutes according to the JNCC (2010) guidelines.

6.2.2 Impact Piling Risk Assessment

6.2.2.1 Instantaneous auditory Injury/ Permanent Threshold Shift (PTS)

For all marine mammal species, except harbour porpoise, the instantaneous PTS-onset impact range for soft-start pile strikes (432 kJ) is <50 m. For harbour porpoise, the maximum instantaneous PTS-onset impact range at soft-start is 579 m. Based on empirical evidence, it is expected that harbour porpoise detections will decline due to the increasing vessel presence within Moray West Site, reducing the probability of a harbour porpoise being present within 579 m of the pile location prior to the commencement of pile driving operations.

For all marine mammal species, except harbour porpoise, the instantaneous PTS-onset impact range at maximum hammer energy consented (4,400 kJ) modelled with a Conversion Factor (CF) of 10% is <400 m. For harbour porpoise, the maximum instantaneous PTS-onset impact range at maximum hammer energy consented with a CF of 10% is 2.4 km (Table 6-1).

Table 6-1 Maximum instantaneous PTS onset impact ranges (based on a constant 10% CF) for worst case locations and species considered in the new noise modelling.

Species	Location	Hammer Energy (kJ)		Instantaneous PTS impact ranges (m) 10% CF	
		soft start	full hammer energy	soft start	full hammer energy
Harbour porpoise	L13	432	4,400	579	2,395
Minke whale	G07	432	4,400	<50	313
	N08	432	1,295	<50	84
Bottlenose dolphin	D03	432	4,400	<50	52

Grey and harbour seals	D03	432	4,400	<50	357

As described in section 3.1.1 of the Underwater Noise Impact Assessment (Appendix C of the Moray West Revised Piling Strategy (2023)), the likelihood of an animal being in the PTS-onset impact ranges is negligible, assuming the animals will not be stationary and given that they will have already been displaced by presence of installation vessels, the pre-piling ADD deployment, the soft-start and the ramp-up before the first strike at full hammer energy is reached. The impact of instantaneous PTS-onset from the soft-start and for the maximum hammer energy consented is therefore assessed as being of a negligible effect for all species (Table 6-2).

Table 6-2 Probability of animal being present within the instantaneous PTS-onset impact zone at full hammer energy.

Species	Instantaneous PTS-onset range (km)	Density (#/km^2)	No of animals	% of MU population
Harbour porpoise	*2.395*	*1.46875**	3.5	0.001% of NS MU
Bottlenose dolphin	*0.052*	*0.00048**	0.0002	0.00008% of CES MU
White-beaked dolphin	*0.052*	0.123	0.006	0.00001% of CGNS MU
Common dolphin	*0.052*	0.074	0.004	0.000003% of CGNS MU
Minke whale	*0.313*	*0.023*	0.31	0.007% of CGNS MU

* *Maximum density cell within the Moray West array area, and/or SCANS III density estimate*

6.2.2.2 Cumulative PTS

The conservative estimates for cumulative PTS impact ranges for bottlenose dolphin, white-beaked dolphin and common dolphin are less than 50 m with less than one animal potentially within the impact area. The risk of cumulative PTS-onset to these species groups is therefore of a **negligible** effect.

The conservative cumulative PTS-onset impact range for harbour porpoise is 2.5 km when considering a constant CF of 10% for location L13 with a moderate risk of pile driving refusal. The number of animals potentially within this impact area is 25 individuals. At the modelling locations with a moderate risk of pile driving refusal (L13), the impact ranges reach over 2.5 km for a constant CF of 10% (Table 6-3). The number of animals potentially within those impact areas are up to 5 individuals for the locations with a low risk of driving refusal, and up to 25 individuals for the locations with a moderate risk of pile driving refusal (Table 6-3). However, due to the conservative assumptions used to calculate the cumulative PTS-onset ranges these predicted impact ranges are considered unrealistically high and the number of animals likely to be at risk of experiencing cumulative PTS will be considerably fewer.

The worst-case cumulative PTS-onset impact ranges for minke whale at location G07 are over 28 km and 45 km for 4% and 10% CF, respectively. For the 47 monopile locations with negligible risk of pile refusal

(represented by N08) the impact ranges are much smaller 2.5 km and 11.3 km for 4% and 10% CF, respectively (Table 6-3). The conservative assumptions underlying our worst-case estimates mean that impact ranges for minke whales are unrealistically high. Although these worst-case cumulative PTS-onset impact ranges for minke whales are large, most individuals within such a radius will be exposed to piling noise at ranges of tens of kilometres, where impulsive exposure criteria for receivers are extremely precautionary (Southall *et al*., 2021). Furthermore, seasonal patterns of minke whale occurrence together with Moray West's commitment to install monopile locations with a risk of pile driving refusal outside the summer months reduce the already conservative numbers potentially affected. The risk of cumulative PTS on minke whales is assessed as being of negligible magnitude, given that the effect is on such a small proportion of the population that there is expected to be no change to the population size or trajectory.

Table 6-3 Maximum cumulative PTS impact ranges (m) and number of animals based on the assumption that 1 monopile is installed per day (10% CF). S = summer, AWS = autumn, winter and spring.

Species	Location	# Piles per day	Max cumulative PTS onset range (m)	Number of animals
Harbour porpoise	N08	1	1,702	5
	L13	1	2,834	25
Minke whale	N08	1	20,398	S: 4, AWS: <1
	G07	1	45,118	AWS:3

The conservative cumulative PTS-onset impact ranges for two consecutive monopiles installed within a 24-hour period has been assessed and presented for harbour porpoise and minke whale (Table 6.5). None of the locations with a moderate risk of pile driving refusal (E03, K14, D03, L13, G07) will be installed consecutively with each other. The realistic worst case scenario is for three monopiles being installed per day, one after the other. This will only occur at the 47 locations with negligible risk of pile driving refusal, therefore the impact as assessed is considered as negligible for both harbour porpoise and minke whale (Table 6-6).

In summary, the risk of cumulative PTS-onset is therefore of negligible for all species. Both the Moray West EIA Report (2018) and the Moray West Revised Piling Strategy (2023) assessment concluded no significant effect of instantaneous or cumulative PTS-onset for any marine mammal species when considering impacts against the entire MU.

Table 6-4 provides a summary of the maximum cumulative PTS onset impact ranges for harbour porpoise and minke whale, and maximum number of animals within these impact ranges, for two piling installation events per day.

Table 6-4 Maximum cumulative PTS impact range (m) and number of animals within that range based on the assumption that 2 monopiles are installed consecutively per day (10% CF). S = summer, AWS = autumn, winter and spring.			
Species	**# Piles per day**	**Max cumulative PTS onset range (m)**	**Number of animals**
Harbour porpoise	2	1,793	6
Minke whale	2	20,398	S: 4, AWS: <1

Table 6.5 shows the potential maximum number of harbour porpoise and minke whale that could be impacted by cumulative PTS with concurrent piling. Concurrent installation of two monopiles per day will only happen if there is overlap between two installation vessels on Moray West Site. If this happens, it will only result in concurrent piling during a two month window between October 2023 and February 2024 and no monopiles with a moderate risk of pile driving refusal (E03, K14, D03, L13, G07) will be installed concurrently with each other.

Table 6-5 Maximum cumulative PTS impact range and number of animals within that range for concurrent piling based on a constant CF of 4% and 10%, compared with the 2018 EIA.						
Assessment (Location)	**1% CF**		**4% CF**		**10% CF**	
	Impact range (m)	**# animals**	**Impact range (km^2)**	**# animals**	**Impact range (km^2)**	**# animals**
2018 EIA	324	….	….	….	….	….
Harbour porpoise	….	….	8	6	105	82
Minke whale	….	…..	533	AWS:1	2,092	AWS:4

The installation of three monopiles per day results in a small increase in the cumulative PTS-onset impact range for harbour porpoise (1,870 m at 10% CF) but no change in number of animals potentially affected (n=6) compared with installing two monopiles consecutively (Table 6-6).

For minke whale the cumulative PTS-onset impact range increases to 45.2 km with a potential impact to one animal in non-summer months (Table 6-6).

Table 6-6 Maximum cumulative PTS impact range (m) and number of animals within that range based on the assumption that 3 monopiles are installed per day (one after the other) (10% CF). AWS = autumn, winter and spring.			
Species	**# Piles per day**	**Max cumulative PTS onset range (m)**	**Number of animals**
Harbour porpoise	3	1,870	6
Minke whale	3	45,200	AWS: 1

6.2.2.3 Disturbance

The impact of disturbance from pile driving for harbour porpoise and bottlenose dolphin is assessed as low, whereby the impact is short-term and temporary behavioural effects are expected in only a small proportion of the populations, resulting in potential impacts to individual vital rates but only over the short-term, such that the population trajectory would not be altered.

The impact of disturbance from pile driving for minke whale is assessed as negligible since there was predicted to be no change to the population size or trajectory.

Both the Moray West EIA Report (2018) and the Moray West Revised Piling Strategy (2023) assessment concluded no significant effect of behavioural disturbance to any marine mammal species (Table 6-7).

Table 6-7 Numbers of marine mammals and proportion of relevant MUs predicted to be disturbed resulting from worst case scenarios in the underwater noise impact assessment (red text for location indicates potential for driving refusal and green text for location indicates no driveability risk).						
Assessment Location	**Hammer Energy**	**Species**	**4% CF**		**10% CF**	
			Number	**% MU**	**Number**	**% MU**
Revised PS single piling event (L13)	4,400	Harbour porpoise	3,533	1.02%	4,681	1.35%
Revised PS concurrent piling events (N08 and D03)	4,400 (D03) 1,295 (N08)		3,284	0.95%	4,381	1.26%
Revised PS single piling event (D03)	4,400	Bottlenose dolphin	41	18.30%	53	23.75%
Revised PS concurrent piling events	4,400 (D03)		37	17.69%	54	24.07%

Table 6-7 Numbers of marine mammals and proportion of relevant MUs predicted to be disturbed resulting from worst case scenarios in the underwater noise impact assessment (red text for location indicates potential for driving refusal and green text for location indicates no driveability risk).

Assessment Location	Hammer Energy	Species	4% CF		10% CF	
			Number	% MU	Number	% MU
(N08 and D03)	1,295 (N08)					
Revised PS -single piling event (G07)	4,400	Minke whale (non-summer)	10	0.05%	13	0.06%
Revised PS -single piling event (N08)	1,295		7	0.03%	10	0.05%
Revised PS - concurrent piling events (D03 and N08)	4,400 (D03) 1,295 (N08)		10	0.05%	13	0.07%
Revised PS – single piling event (N08)	1,295	Minke whale (summer)	77	0.38%	117	0.58%

The realistic worst-case scenario for disturbance to bottlenose dolphin from concurrent piling was evaluated for the installation of monopiles at location D03 (potential for driving refusal) and N08 (no driveability risk) assuming a maximum hammer energy of 4,400 kJ for D03 and a 10% CF. This resulted in a prediction of up to 54 bottlenose dolphins being disturbed on a single day of piling (this represents 24.07% of the CES MU).

6.3 Vibro piling

It is expected that vibro piling will be used prior to impact piling at 53 of the 62 piling locations (1 OSP and 52 WTGs monopile locations). The source level for vibro piling has been measured as 192 dB re 1 µPa (Graham *et al*., 2017a). Since vibro piling produces a continuous (non-impulsive) sound, it is subject to different PTS onset thresholds (173 dB re 1 µPa SEL weighted for very high frequency (VHF) cetaceans) compared to impact piling (155 dB re 1 µPa SEL weighted for VHF cetaceans). It is, therefore, expected that PTS onset ranges from vibro piling will be minimal and impacts to marine mammals are not assessed further.

Evidence of the behavioural responses of marine mammals to vibro piling activities is scarce; however, a study has shown responses of both bottlenose dolphins and harbour porpoise during vibro piling activities (Graham *et al*., 2017a). Bottlenose dolphins showed minor but significant reductions in presence and encounter durations in the vicinity (<5 km) of construction works during vibro piling, while harbour porpoise showed significantly reduced presence. In both cases, effect sizes were very small, and the extent to which a reduction in detections equates to displacement of individuals rather than, for example,

masking of detections remains unclear. Disturbance impacts from vibro piling are therefore not assessed in the Moray West Revised Piling Strategy as disturbance from impact pile driving is expected to present the worst-case scenario.

6.4 Vessel Activity

6.4.1 Overview of vessel activity during the Moray West construction phase

The Moray West Vessel Management and Navigation Safety Plan (8460005-DBHA07-MWW-PLN-000001) outline the type of vessels that will be used during Moray West construction. Piling will be undertaken from a jack-up vessel (JUV) or a heavy lift vessel (HLV). However, other construction vessels will be present in the Moray West Site and OfTI Corridor. The number of construction vessels present within the Development Site at any one time will vary during the construction period, with peaks in vessel activity reflecting the timing of major installation works.

6.4.2 Vessel activity risk assessment

6.4.2.1 Physical injury (Collision)

Any increased collision risk with vessels is unlikely, as vessels would be relatively slow moving or in a fixed position during piling and other construction activities. Therefore, giving any marine mammals ample opportunity to detect and avoid the vessels. With regard to collision risk, Laist *et al*. (2001) predicted that the most severe injuries from collision with vessels travelling at over 14 knots, and Vanderlaan and Taggart (2007) predicted that the probability of lethal injury of a large whale species (North Atlantic right whale) decreases from 0.79 at speeds of 15 knots to 0.21 at 8.6 knots. Given that the vessels involved in construction activities will follow an approved indicative transit speed and transit routes, which are included in the Vessel Management Plan and Navigation Safety Plan (VMNSP; 8460005-DBHA07-MWW-PLN-000001), therefore potential for collisions to occur is negligible.

Vessels movements to and from the port would be on agreed indicative transit routes, where possible. The vessels required for the construction activities would be a very small proportion of current vessel activity in and around the Development Site and routes to and from port.

To reduce the risk of increased collision risk with vessels, vessel movements, where possible, will be incorporated into recognised vessel routes, and therefore to areas where marine mammals are accustomed to vessels, in order to reduce any increased collision risk. All vessel movements will be kept to the minimum number that is required to reduce any potential for collision risk. Additionally, all vessel operators will use good practice to reduce any risk of collisions with marine mammals, this includes following the Scottish Marine Wildlife Watching Code (SNH, 2017).

Given that there is predicted to be no risk of injury to any species of cetacean as a result of collision risk, there is no potential to commit an offence with regards injury. There will, therefore, be no impact on the FCS of any species.

6.4.2.2 Disturbance

Disturbance from underwater noise and the presence of vessels is likely to be restricted to the area around the vessel. For example, underwater noise modelling for the East Anglia TWO ES (East Anglia TWO Limited, 2019), indicated that the impact range for TTS (Temporary Threshold Shift)/ fleeing response for marine mammals, including harbour porpoise, dolphin species, minke whale, grey and harbour seal, was less than 100 m for large and medium sized vessels. Therefore, any potential disturbance as a result of vessel noise or the presence of vessels associated with the construction activities would be significantly less than the area of potential disturbance assessed for total piling activity. Also, these vessels would be within the area of potential disturbance assessed for piling activity, therefore there would be no increase in disturbance as a result of vessels. As a result, the potential effect for any increased disturbance from vessels during the proposed piling works has been assessed as negligible.

Although noise levels from vessels are highly unlikely to cause physical or auditory injury, they could be sufficient to cause local disturbance to sensitive marine mammals in the immediate vicinity of the vessels, depending on ambient noise levels.

Thomsen *et al.* (2006) used species hearing detection thresholds to conclude that noise from larger vessels around 0.25 Kilohertz (kHz) will be detected by harbour porpoise at distances of approximately 1 km, and noise from smaller vessels around 2 kHz will be detected at around 3 km.

The distance at which animals may react to vessels is difficult to predict. Behavioural responses can vary a great deal depending on context and data specific to harbour porpoise are limited. According to Thomsen *et al*. (2006), harbour porpoise might be expected to respond to vessels of this type at approximately 400 m.

As a precautionary approach, based on the studies by Brandt *et al*. (2018) and Benhemma-Le Gall *et al*. (2021) that harbour porpoise could be disturbed up to 2 km from construction vessels and activities, assessments for all species has been based on a disturbance impact range of 2 km and an area of 12.57 km^2 per vessel (Table 6-8).

Table 6-8 Maximum number of individuals (and % of reference population) that could be at risk of disturbance as a result of underwater noise associated with construction vessels

Species	Area (km^2)	Maximum number of individuals impacted from one vessel	Maximum number of % of reference population for one vessel
Harbour porpoise	12.57	18.5	0.0053% of NS MU
Bottlenose dolphin	12.57	0.05	0.0208% of CES MU
White-beaked dolphin	12.57	1.5	0.0035% of CGNS MU
Common dolphin	12.57	0.9	0.0009% of CGNS MU
Minke whale	12.57	0.3	0.0014 of CGNS MU

The level of disturbance for vessels in isolation will be lower than the predicted disturbance impact range and areas, based on the worst-case for impact pilling. Any disturbance would be temporary and marine mammals would be expected to return to the area once the vessel(s) had passed and the noise source ceased. As such, vessel noise is not anticipated to negatively impact the FCS of any EPS. No further mitigation measures are proposed for the potential increased collision risk or increased disturbance from vessels during piling works.

6.5 The Use of Acoustic Deterrent Devices

6.5.1 Overview of ADD use

It is proposed that ADDs will be used as part of the agreed mitigation measures for reducing the risk of injury to marine mammals from piling noise. ADDs will be used to displace marine mammals from an area where they are likely to receive SELs high enough to result in injury, death or permanent hearing damage. As part of pre-piling mitigation, an ADD device would be deployed and activated prior to the start of piling, and then is deactivated after piling soft-start has commenced. ADDs would also be deployed if there was a break in piling greater than 6 hours.

ADD would be activated for a period of 10 minutes. Therefore, following ADD activation, the soft-start and the ramp-up, all animals will be 6.1 km away from the source and, therefore, even further outside the maximum instantaneous PTS-onset range (2,395 m) for harbour porpoise at the point full hammer energy is reached.

For monopile locations where vibropiling is not used, or when the break between vibropiling and impact piling is more than 6 hours, the ADD should be activated for 10 minutes prior to impact piling commencing

The protocol will require the deployment of an ADD for:

1) piling locations where vibro-piling is not used.
2) instances where the break between vibro-piling ending and impact piling commencing is > 6 hours.

6.5.2 ADD Risk Assessment

The purpose of the deploying the ADD is to displace individuals from an area where they may receive permanent injury from the initial stages of piling. A study into the effectiveness of ADDs was undertaken as part of Appendix 2 of the Moray East Wind Farm Piling Strategy (Moray East, 2019). Studies into the effectiveness show that the Lofitech Seal Scarer device is likely to be effective at displacing harbour porpoise to up to 3,000 m and harbour porpoise and were reported to return within 6 hours (Brandt *et al*., 2013).

Based on a precautionary swim speed of 1.4 m/s of harbour porpoise (SNH, 2016), the ADD would need to be activated for a period of 10 minutes to ensure harbour porpoise were beyond the maximum 2,395 m instantaneous PTS range. Precautionary swim speeds of 1.52 m/s for dolphin species and 2.1 m/s for minke whale was applied to the assessment (SNH, 2016). Evidence shows that harbour porpoises are displaced by vessel activity (Benhemma-Le Gall *et al*., 2021), ADD and piling noise (Graham *et al*., 2019,

Graham *et al*., 2023). Assuming a fleeing speed of 1.4 m/s upon the first pile strike, animals should be at minimum 2km away from the piling location due to the activation of the ADD for a period of 10 minutes.

Table 6-9 present the number animals that have the potential to be disturbed during a 10 minute activation period. ADD would only be activated for the minimum time required to ensure effective mitigation.

Table 6-9 The maximum number of marine mammals that could be temporary disturbed during ADD activation

Species	Maximum number of animals and % of reference population based on maximum potential impact area	Impact of population effect
Harbour porpoise	3.6 (0.00001% of NS MU)	Negligible (i.e. less than 1% of the NS MU reference population anticipated to be exposed to the temporary impact).
Bottlenose dolphin	0.01 (0.00005% of CES MU)	Negligible (i.e. less than 1% of the CES MU reference population anticipated to be exposed to the temporary impact).
White-beaked dolphin	0.4 (0.000009% of CGNS MU)	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).
Common dolphin	0.2 (0.000002% of CGNS MU)	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).
Minke whale	0.07 (0.000003% of CGNS MU)	Negligible (i.e. less than 1% of the CGNS MU reference population anticipated to be exposed to the temporary impact).

ADD activation will not result in any significant disturbance of marine mammals, but would ensure effective mitigation to reduce the risk of PTS.

Herschel *et al*. (2013) presented information on the potential for PTS from various ADD devices, based on an analysis by Gotz and Janik (2013). This analysis calculated the combination of exposure times and distances that would be required for marine mammals to receive a sound exposure which puts them at risk of hearing damage. For the Lofitech device, individuals would need to remain within 76 m for 10 hours or within 9 m for 8 minutes. The likelihood of any individual at sea remaining within this size of

area for that time period is extremely low, given the presence of a deterrence signal (Sparling *et al.*, 2015). Therefore, there would be no risk of PTS during ADD activation.

Therefore, the potential impact for disturbance from ADD has been assessed as negligible for harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin and minke whale. Given that there is predicted to be a negligible risk of disturbance to any species of cetacean as a result of ADDs, there is no potential to commit an offence with regards injury and disturbance. There will, therefore, be no impact on the FCS of any species. As such, there is no offence and therefore no requirement for a Marine EPS licence for injury and disturbance.

6.6 Post Installation Surveys

Throughout the construction works there will be the requirement to undertake short surveys post installation of some infrastructure, such as inter-array cables for positioning, and protection measures such as rock or gravel to ensure adequate thickness has been achieved.

To undertake these works Multibeam Echosounder (MBES) and Side Scan Sonar (SSS) may be required to image the seabed. An overview of the equipment is given in Table 6-10. If additional equipment is required for any post-installation surveys (such as Sub Bottoms Profilers), additional EPS assessments will be undertaken and a licence application submitted if required.

Table 6-10 Overview of potential impacts of geophysical survey equipment

Equipment	Potential impacts	Predicted sourcelevels and frequencies relevant to the marine environment
MBES	High frequency pulses created by multi- beam echo sounder equipment generate sound waves which produce underwater noise. Depending on the frequency of the pulses, location and duration of the operations, and the species present, therecould be potential impacts on cetaceans.	MBES source levels range from 190 – 240 dB re 1µPa (rms), The equipment specifications describe the MBES to emit noise at a frequency of 240kHz.
SSS	Side-scan sonar equipment produces sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to cetaceans depend upon the frequency, location, and duration of the pulses.	SSS source levels range from 200 – 230 dB re 1µPa (rms). The SSS specifications report frequencies between 200 – 500 kHz.

6.6.1 Multibeam Echosounders (MBES) and Side Scan Sonar (SSS)

6.6.1.1 Injury impact

The JNCC guidelines (2010) confirm the potential for echosounders operating in mid-range and full ocean depth to cause injury when very close to cetaceans of the mid-frequency hearing group. In the shallower depths where the proposed surveys will take place, sound emitted by SSS and MBES may be audible to

some cetaceans, particularly high frequency species such as harbour porpoise. However, higher frequency sounds attenuate faster such that the received sound level rapidly decreases with distance from the source. As such, the animals would have to remain in close proximity to the sound source for potential physical injury to occur. The likelihood of this occurring is low, particularly as the source will be emitted from a moving vessel, thus the subsequent risk to cetaceans in the survey area is very low (DECC, 2016; JNCC 2010).

For the proposed surveys, the expected frequency range for such operations is likely to be between 300 kHz and 600 kHz. These frequencies are generally beyond the hearing range of all cetaceans, including high-frequency sensitive species such as harbour porpoise. Given the increased attenuation associated with these high frequencies, it can be concluded that use these survey technologies present a negligible risk of injury to cetaceans (JNCC, 2010; DECC, 2016). Consequently, the potential to commit an offence is negligible and thus there is norequirement for a Marine EPS licence in this respect.

MBES surveys in shallower waters (<200 m) are not subject to mitigation requirements as it is thought the higher frequencies (<100 kHz) fall outside the hearing frequencies of cetaceans and the sounds produced are likely to attenuate more quickly than the lower frequencies used in deeper waters. JNCC do not, therefore, advise that mitigation is required for MBES surveys in shallow waters. (JNCC, 2017). As the SSS will also be operating at higher frequencies no mitigation measures are proposed for the use of this equipment.

6.6.1.2 Disturbance

In addition to physical injury, noise emissions from geophysical surveys have the potential to modify the behaviours of animals in the vicinity of the noise source. Significant disturbance may occur when an animal is at risk of a sustained or chronic disruption of behaviour or habitat use resulting in population- level effects. SSS and MBES largely operate beyond the most sensitive frequencies of most cetaceans (JNCC, 2010); thus, the potential for a disturbance having negative repercussions onthe FCS of a species is extremely low.

For a disturbance to occur during the intermittent geophysical surveys, the animals would have to stay in close proximity to, and potentially follow, the vessels using MBES and SSS while they were actively emitting noise. Given the temporary and relatively short-term nature of the survey activities, it is highly unlikely that MBES and SSS would negatively impact upon the FCS of any of the cetacean species which may be present in the survey area. This is on the basis that the level of disturbance caused is unlikely to affect the ability of an animal to survive or reproduce or result in a significant population level impact (e.g. by modifying the abundance or distribution of a localised population). However, it is possible that a small number of individual animals may experience some disturbance for a short period that they encounter noise emissions. The number of animals with the potential to be disturbed by MBES and SSS is expected to be less than the number effected by the vessel itself as outlined in Section 6.4.2.2 (Table 6-8). As such, disturbance from MBES and SSS is not anticipated to negatively impact the FCS of any EPS.

7 Consideration of Cumulative Impacts

For wide ranging species such as cetaceans, it is important to consider other projects and activities over a wider area. Taking into account the potential impacts associated with the proposed site investigation surveys; this has been based on the Scottish east coast area. The following activities and projects have been identified and considered for potential cumulative impacts with the proposed construction at Moray West, presented in Table 7-1.

Table 7-1 Potential for Cumulative Impacts

Projects in the vicinity of Moray West (within 26 km)	Licensed Activity	Description and Sound Sources	Estimated Impact
Beatrice Offshore Wind Farm (BOWL)	Post-construction geophysical surveys. BOWL holds an active EPS Licence valid from 7 July 2020 to 31 December 2023	Presence of vessels undertaking geophysical surveys and the deployment of typical geophysical equipment.	Timescales for the post-construction geophysical surveys are unknown; therefore, a temporal overlap with proposed geophysical surveys at Moray West cannot be identified. Given the short-term nature of the Moray West proposal and provided that the conditions set out in EPS Licence are complied with and implemented, no cumulative impacts are likely to arise in the event of temporal overlap.
Caledonia Offshore Wind farm	Geophysical surveys	Presence of vessels undertaking geophysical surveys and the deployment of typical geophysical equipment to survey the full offshore export cable route.	The geophysical surveys for the cable route commenced March 2023. Construction is due to start early 2025.
Broadshore Offshore Windfarm	Geophysical surveys	Presence of vessels undertaking geophysical surveys and the deployment of typical geophysical equipment to survey the full offshore export cable route.	The geophysical surveys for the cable route commenced March 2023. Construction is due to start early 2025.

NnG Offshore Wind Farm	Offshore Construction	Anticipated programme: Pile Installation 2023 -2024	The project location from Moray West location is greater than 26km (largest disturbance impact range), therefore no cumulative impacts are likely to result in the event of temporal overlap. Given the short-term nature of the Moray West proposal and provided that the conditions set out in EPS Licence are complied with and implemented, no cumulative impacts will arise in the event of temporal overlap. Given the distance between the project locations and the relatively temporary nature of the Moray West proposal, it is unlikely that cumulative impacts will arise.
Seagreen Alpha and Bravo	Offshore Construction	WTG Piled Foundation Substructures: Pile installation April 2023 – July 2023	The exact timing and nature of the actives are unknown, and therefore it is not possible to undertake a cumulative impact assessment. Given the distance between the project locations and the relatively temporary nature of the Moray West proposal, it is unlikely that cumulative impacts will arise.

Based on currently available information, there is very little information on activities and projects in the Scottish east coast area that could have potential cumulative impacts with the proposed construction works at Moray West. The characterisation of effects as presented in Section 6 of this report has identified that all effects will be highly localised and short term in nature and not result in significant adverse impacts. The potential for the proposed construction works contributing in a cumulative manner is,

therefore, highly remote. Additionally, there are no other surveys or activities planned within Moray West Site and OfTI Corridor during this period of time that could result on cumulative impacts on EPS.

Taking into account that cetacean species are not as sensitive to disturbance impacts as they are to the potential for injury, for which mitigation measure would be put in place for each project to prevent any injury or PTS to marine mammals and that they would not be permanently disturbed from any area (as the impact is temporary and individuals will return to the area once the relevant activity has ceased), the overall conclusion is that there would be no potential for a population level impact to harbour porpoise, bottlenose dolphin, white-beaked dolphin, common dolphin, or minke whale.

As noted above, the cumulative assessment indicates no significant disturbance of cetaceans at a population level. It is possible that a small number of individual animals may experience some level of disturbance. The characterisation of effects as presented in this report has identified that the potential for impact will be highly localised and short term in nature, and not result in significant effects. The potential for the proposed construction works contributing to cumulative impacts is, therefore, highly unlikely. It is, therefore, predicted that the relatively localised areas of disturbance, and the short period of time that cumulative effects could arise, are such that they will not cause an impact that will affect the FCS of any EPS. As such, a Marine EPS Licence is required for disturbance.

Based on the assumption that all the planned projects and activities with the potential for injury or significant disturbance will have mitigation in place, which is similar to or more extensive than the measures being undertaken for the construction works, no EPS will be at risk of injury from these activities. No cumulative effects are considered likely to arise as a result of the proposed construction work at Moray West offshore find farm site and export cable route with any other project. Given that there is predicted to be no risk of injury to any species of cetacean as a result of cumulative impacts, there is no potential to commit an offence with regards injury. There will, therefore, be no impact on the FCS of any species. As such, there is no offence and therefore no requirement for a Marine EPS licence for injury.

8 Consideration of Designated Sites

This section provides information in order to determine the potential for piling activity to have adverse effect on the integrity of marine mammal designated sites:

- Moray Firth SAC;
- Southern Trench NCMPA; and
- Dornoch Firth and Morrich More SAC.

8.1 Designated sites

8.1.1 Moray Firth SAC

The Moray Firth SAC (approximately 17 km from the Development) was designated in 2005 under the European Habitats Directive (92/43/EEC) and includes bottlenose dolphin as a qualifying feature. The Moray Firth SAC extends from the inner firths to Helmsdale on the north coast and Lossiemouth on the south coast covers an area of 1,510 km^2 (NatureScot, 2021). The Moray Firth supports the only known

resident population of bottlenose dolphin in the North Sea, with an estimated 224 individuals (Coefficient of Variation (CV) = 0.023; 95% Confidence Interval (CI) = 214 - 234; Arso Civil *et al*., 2021; IAMMWG, 2023).

The population is present year-round within the Firth, but they do appear to favour particular areas. The Conservation Objectives are "*to avoid deterioration of the habitats of the qualifying species (bottlenose dolphin) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest*." (Nature Scot, 2021).

Assessments indicate vessels during the proposed piling at the Development will not increase the collision risk or disturbance of bottlenose dolphin, therefore there is no potential for any significant effects.

Assessments indicate there would be no significant disturbance from ADD as a result of ADD activation.

There could be the potential for the proposed construction activities in the Development to disturb bottlenose dolphin. As a precautionary approach it has been assumed that any bottlenose dolphin in the Development could be from the Moray Firth SAC, therefore the assessments have been presented in the context of the latest estimate for the east coast of Scotland population of 224 bottlenose dolphin.

In both realistic worst case scenarios modelled for bottlenose dolphin disturbance there is overlap with the Moray Firth SAC with up to 54 bottlenose dolphins predicted to be disturbed on a given piling day across the entire impact area (Table 6-7). There is the potential for animals within the SAC to be disturbed which may result in very short-term changes to the bottlenose dolphin distribution within the SAC. Despite the number of animals predicted to be disturbed, the disturbance is expected to be non-significant as effects are not expected to be long term or prohibit recovery. Fernandez-Betelu *et al*. (2021) showed that bottlenose dolphins were not displaced from the southern coast of the Moray Firth by impulsive noise generated by pile driving at Beatrice or Moray East and that they continued using the southern coast during impact pile driving. Given these findings, the piling for Moray West (expected to occur on 62 days spread over 8 months) is not expected to contribute to a long-term decline in the use of the SAC site by bottlenose dolphins, nor result in changes to their distribution on a continued or sustained basis, nor result in a behavioural change that would reduce survival or reproduction.

The assessment indicates that through the application of mitigation there is no potential Adverse Effect on Site Integrity (AEoSI) of the Moray Firth SAC in relation to the conservation objectives for bottlenose dolphin as a result of any disturbance from underwater noise during piling.

8.1.2 Southern Trench NCMPA

Southern Trench NCMPA is located on the east coast of Scotland, and is proposed to protect minke whale, burrowed mud, fronts and shelf deeps. Fronts in the Southern Trench are created by mixing of warm and cold waters, which creates an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. NatureScot (2020) advises that, in order to conserve minke whale, risk of injury and death should be minimised, access to resources within the site should be maintained, and supporting features should also be conserved. The Conservation Objectives of this site are to conserve the features, specifically to ensure "*Minke whale in the Southern Trench NCMPA are not at significant risk*

from injury or killing, conserve the access to resources (e.g. for feeding) provided by the NCMPA for various stages of the minke whale life cycle, and conserve the distribution of minke whale within the site by avoiding significant disturbance". The supporting features of the minke whale is also protected under these Conservation Objectives (NatureScot, 2020).

Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid *et al*., 2003; Hammond *et al*., 2021). They often prefer water depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to 15 individuals) while feeding.

The implementation of the PMP during pile installation at Moray West Site will reduce the risk of PTS for minke whale and therefore there would be no potential for any significant effects. Those locations with a moderate or low risk of pile driving refusal (locations with harder ground conditions where hammer energies will likely reach 4,400 kJ) will be installed in non-summer months (between October and May inclusive) when the minke whale density is expected to be significantly lower.

Assessments indicate that vessels during the proposed piling at the Development will not increase the collision risk or disturbance of minke whale, therefore there is no potential for any significant effects.

The assessments indicate there would be no significant disturbance from ADD as a result of ADD activation.

There could be the potential for the proposed piling in the Development to disturb minke whale associated with the Southern Trench NCMPA. As a precautionary approach it has been assumed that any minke whale in the Development could be from the Southern Trench NCMPA, therefore the assessments have been presented in the context of the latest estimate for the in the Moray Firth is based on SCANS-III abundance for survey block S of 383 animals (Hammond *et al*., 2021).

The number of minke whale that could potentially be disturbed due to the piling, based on the precautionary 38.29 km^2 disturbance range, is less than one animal (0.002% of estimated Moray Firth population) based on the 160 dB threshold for disturbance from the assessment on the underwater noise modelling undertaken for Greenvolt (Greenvolt, 2023).

The assessment of disturbance indicates that through the application of mitigation as outlined in the PMP there is no potential of impact on the Southern Trench NCMPA in relation to the conservation objectives for minke whale as a result of any disturbance from underwater noise during piling activity.

8.1.3 Dornoch Firth and Morrich More SAC

Although seals are not EPS, an assessment in relation to the nearby Dornoch Firth and Morrich More SAC (approximately 46 km from the Development) has been included in this report.

The Dornoch Firth is the most northerly large estuary in Britain and supports a significant proportion of the inner Moray Firth population of the harbour seal. The seals, which utilise sandbars and shores at the mouth of the estuary as haul-out and breeding sites, are the most northerly population to utilise sandbanks. Their numbers represent almost 2% of the UK population. The Conservation Objectives ensure

that the obligations of the Habitats Directive are met; that is, there should not be deterioration or significant disturbance of the qualifying interest. This will also ensure that the integrity of the site is maintained and that it makes a full contribution to achieving favourable conservation status for its qualifying interests (NatureScot, 2023). The total population of harbour seals in Scotland was 26,846 in 2016-2021, with an estimated 1,077 within the Moray Firth MU (Special Committee on Seals (SCOS), 2021).

The implementation of the PMP during pile installation at Moray West Site will reduce the risk of PTS in seals and therefore there would be no potential for any significant effects. As part of the Strategic Regional Marine Mammal Monitoring Programme for the Moray Firth, a total of 57 harbour seals were tagged at Loch Fleet with GPS/GSM tags in September 2014, February 2015 and February-March 2017 (Graham *et al*., 2017b). These telemetry data show that harbour seals tagged in the Moray Firth MU do not all remain within the Moray Firth, with seals showing movement out of the Moray Firth and into the North Coast and Orkney MU (Graham *et al*., 2017b). Therefore, there is connectivity between the two MUs and as such it is most appropriate to consider that the relevant population against which to assess impacts on the Dornoch Firth and Morrich More SAC population is the combined Moray Firth and North Coast and Orkney MUs. Combining the most recent haul-out count for the Moray Firth MU (1,077) with the most recent haul-out count for the North Coast and Orkney MU (1,405), results in a total August haul-out count of 2,482 harbour seals (SCOS, 2021).

The number of harbour seal that could potentially be disturbed due to the piling, based on the precautionary 25 km disturbance range (Russel *et al*., 2016), is up to 16 animals (based on the 0.633 individuals per km^2, as calculated from the Carter *et al*., 2022), or 0.459% of the combined Moray Firth and North Coast and Orkney MUs.

The sensitivity of marine mammals to temporary disturbance as a result of piling is considered to be medium in this assessment as a precautionary approach. The impact for temporary disturbance from piling has been assessed as negligible for harbour seal with less to 1% of the reference population anticipated to be exposed to effect.

The assessment indicates that through the application of mitigation as outlined in the PMP there is no potential AEoSI of the Dornoch Firth and Morrich More SAC in relation to the conservation objectives for harbour seal as a result of any disturbance from underwater noise during piling activity.

8.2 Protected Seal Haul-out Sites

Under Section 117 of the Marine (Scotland) Act 2010, specific seal haul-out sites have been designated to provide protection for seals from intentional or reckless harassment. There are seven harbour seal designated haul-out sites in the Moray Firth MU that were designated in 2014 based on the Sea Mammal Research Unit (SMRU) annual August survey counts in preceding years. There are also three grey seal designated haul-out sites in the Moray Firth MU that were designated based on the presence of grey seal breeding colonies. These haul-outs range from 22 to 86 km from the Moray West Site (Table 8-1).

Seal haul-out sites are coastal locations that seals use to breed, moult and rest. Almost 200 seal haul-out sites have been protected through The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order

2014 which was amended with additional sites in 2017. These haul-out sites are protected under Section 117 of the Marine (Scotland) Act 2010. The Act is designed to assist in protecting the seals when they are at their most vulnerable, as such provide additional protection from intentional or reckless harassment at significant haul-out sites (NatureScot, 2023; Marine Scotland, 2023).

The survey area is located 22 km from the nearest protected seal haul-out site.

Table 8-1 Protected seal haul-out sites in the Moray Firth MU

Haul-Out Sites	Distance to survey area (km)
Dunbeath-Helmsdale	22
Dunbeath-Wick	22
Lothmore	30
Brora	38
Findhorn	45
Loch Fleet	49
Duncansby Head	56
Ardersier	65
Cromarty Firth	80
Beauly	86

The closest protected seal haul-out site to the survey area is Dunbeath-Helmsdale and Dunbeath-wick at approximately 22 km. Given the distance between the survey area and the protected seal haul-out sites, there is no potential for direct impact due to the construction works. However, there is the potential for transiting vessels to disturb seals at haul-out sites, depending on the port used and vessel route.

The response of seals to disturbance at haul-out sites can range from increased alertness to moving (stampeding) into the water (Wilson, 2014). The potential impact on pupping groups can include temporary or permanent pup separation, disruption of suckling, energetic costs and energetic deficit to pups, physiological stress and, sometimes, enforced move to distant or suboptimal habitat. Potential impacts on moulting groups can include energy loss and stress, while impacts on other haul-out groups can cause loss of resting and digestion time and stress (Wilson, 2014). The potential impacts will be determined by the response of the seals, the duration and proximity of the disturbance to the seals.

For grey seal, mothers responded by moving into the water more due to boat speed than as a result of the distance, although movement into the water was generally observed to occur at distances of between 20 m and 70 m, with no detectable disturbance at 150 m (Wilson, 2014; Strong and Morris, 2010). However, grey and harbour seals have also been reported to move into the water when vessels are at a distance of approximately 200 m to 300 m (Wilson, 2014).

In a study of the reaction of harbour seal to cruise ships, harbour seal were 25 times more likely to flee into the water when cruise ships passed 100 m from haul-out sites than when ships passed within 500 m, beyond 600 m there was no discernible effect on the behaviour of harbour seal (Jansen *et al*., 2010). Similarly, disturbance of harbour seals from vessel noise and presence has been demonstrated at up to 500 m from UK haul-out sites (Cates and Acevedo-Gutierrez, 2017).

To reduce potential disturbance at seal haul-out sites along vessel routes, all vessels transiting to the survey area will remain at a distance of at least 500 m from the protected seal haul-out sites and use existing shipping lanes and transit routes, wherever possible.

In addition, all vessel operators will use good practice to reduce any risk of collisions with marine mammals or significant disturbance at seal haul-out sites, this includes following the Scottish Marine Wildlife Watching Code (SNH, 2017).

With these proposed measures, there would be no potential for significant disturbance to protected seal haul-out sites.

8.3 Potential effects

As outlined in Section 6.2 to 6.5 there are potential effects from underwater noise produced by piling and vessels to cause disturbance of the designated features of these sites. However, with adequate mitigation in place, there would be negligible disturbance effects as a result of underwater noise during the proposed piling activity.

Due to the proximity of these designated sites to the proposed survey areas, there is potential for interaction with qualifying and interest features associated with these designated sites. However, as there is no potential for injury or significant disturbance to marine mammals in the vicinity of the survey, it is considered that there is no potential for any adverse effect on the integrity of the designated sites in relation to the conservation objectives for marine mammals.

9 Conclusion – meeting the Three EPS Licence tests

In order to demonstrate that an EPS licence is justified, applications must demonstrate that they meet three tests;

1. The licence relates to one of the purposes referred to the Conservation of Offshore Marine Habitats and Species Regulations in 44; and the Conservation of Offshore Marine Habitats and Species Regulations 2017;

2. There is no satisfactory alternative (Regulation 44, 3a); and

3. The action authorised will not be detrimental to the maintenance of the population of the species concerned at a FCS in their natural range (Regulation 44, 3b).

It is considered that an EPS disturbance licence is required that includes impact piling, vibro-piling vessel movements and the use of an ADD. Section 6 outlines that the risk of injury to EPS is negligible and will be mitigated, it is therefore considered that an EPS licence for injury to EPS is not required. The following Sections conclude how Moray West meet the above tests required for the granting of an EPS licence.

9.1 Purpose of development

Scotland, and the UK as a whole, require new, renewable, sources of energy to combat climate change and ensure that a secure supply of electricity is available to meet increased future demand. The provision of new renewable energy projects will help the government meet legally binding national and international targets on climate change.

Offshore wind generation has been identified at European and national level as being capable of providing a significant contribution towards such targets. The UK Round 3 Zone projects, of which Moray West is one, are recognised as being important contributors to Scottish and UK targets for reducing greenhouse gas (GHG) emissions and generating electricity from renewable energy sources by both the Scottish and UK Governments (Scottish Government, 2017; Climate Change Committee (CCC), 2017).

9.2 No satisfactory alternative

Moray West have undertaken extensive design and cost analysis in the development of the Moray West Offshore Wind Farm and have designed the Development to minimise environmental impacts whilst remaining economically viable and providing the best value for UK consumers as possible.

Several alternatives were considered at design stage for the Development but the use of alternative foundation designs that would not require piling was not feasible. As it is not possible to construct without some disturbance to EPS, measures that Moray West have taken to reduce potential risks to EPS include;

- A significant reduction in piling activity of that consented within the Moray West EIA (2018).
- The development and use of mitigation protocols designed to reduce the risk of physical injury to EPS as a result of piling.

- Moray West has committed to install monopile locations with a moderate or low risk of pile driving refusal to be installed outside of the summer months to reduce risk to any minke whales associated with the Southern Trench NCMPA.
- The risk of collision between vessels and EPS will be minimised through the use of regular vessel routes and vessel operators following the Scottish Marine Wildlife Code (SNH, 2017) maintaining a suitable buffer between vessels and visible EPS.

9.3 Maintaining Favourable Conservation

The risk assessment presented above demonstrates that there is no risk to the FCS of bottlenose dolphin, harbour porpoise, minke whale, common dolphin or white-beaked dolphin management unit populations as a result of the Development. The risk assessment demonstrates that conclusions made in the Moray West EIA (2018) that no significant effect on marine mammal populations is predicted and that there is no significant effect on the site integrity of the Moray Firth SAC where bottlenose dolphins are an interest feature remain valid.

There are significant areas of the Design Envelope which have been reduced since the Moray East EIA (2018) submission, most notably:

- A reduction in piling activity (by approximately 77%, including pile refusal);
- A reduction in the number of piling vessels that will be active from six to two;
- A reduction in the number of WTG that will be installed, therefore reducing overall construction activity; and
- A reduction in the maximum construction programme duration from five years to approximately two and a half years.

Therefore, this risk assessment concludes that there is no risk to the FCS of the EPS species considered within this assessment from the construction of the Moray West Offshore Windfarm.

10 References

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11 Appendix A – Defined Terms

Term	Description
Conversion Factor	The proportion of hammer energy that is converted into acoustic energy (%) is referred as the conversion factor
Design Envelope	The range of design parameters used to inform the assessment of impacts.
Marine Licence for the Generating Station	Marine Licence for the Moray West Offshore Wind Farm - Licence Number: MS-00008731 - granted under the 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 UK Marine Licensing Area granted to Moray West on 14 June 2019, varied on 7 March 2022 and on 11 April 2022.
Marine Licence for the Transmission Works	Marine Licence for the Offshore Transmission Infrastructure – Licence Number MS-06764/19/0 – granted under the Marine and Coastal Access Act 2009, & Marine (Scotland) Act 2010, Part 4 Marine Licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the UK Marine Licensing Area (referred to as the "OfTI Marine Licence"), granted to Moray West on 14 June 2019 and varied on 11 April 2022.
Moray Offshore Windfarm (West) Limited	The legal entity submitting this EPS Risk Assessment.
Moray West EIA Report	The Environmental Impact Assessment Report for the Moray West Offshore Wind Farm and Associated Transmission Infrastructure, submitted July 2018. Additional information was provided in the Moray West Report to Inform an Appropriate Assessment (RIAA) July 2018 and Moray West Application Addendum Document November 2018.
Moray West Offshore Wind Farm	The wind farm to be developed in the Moray West site (also referred as the Wind Farm).
Offshore Consents	Collective term for the two Marine Licences and the Section 36 consent
Offshore Consent Conditions	Collective term for the conditions attached to the Section 36 Consent and Marine Licences
Offshore Transmission Infrastructure (OfTI)	The offshore elements of the transmission infrastructure.
OfTI Corridor	The export cable route corridor, i.e., the OfTI area excluding the Moray West site.
Section 36 Consent	Section 36 consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Moray West Offshore Wind Farm was granted on 14 June 2019 and varied on 7 March 2022.
The Development	The Moray West Offshore Wind Farm and OfTI.
The Development Site	The area outlined in Figure 1 attached to the Section 36 Consent Annex 1, Figure 1 attached to the two Marine Licences, and Figure 2.1 of this EPS Risk Assessment

Term	Description
The Moray West Site	The area in which the Moray West Offshore Wind Farm will be located. Section 36 Consents and associated Marine Licence to construct and operate generating stations on the Moray West site were granted in June 2019 and varied in March 2022.
The Works	The construction and O&M activities undertaken for the Development.
Transmission Infrastructure (TI)	Includes both offshore and onshore electricity transmission infrastructure for the consented wind farm. Includes connection to the national electricity transmission system near Broad Craig in Aberdeenshire encompassing Alternating Current (AC) Offshore Substation Platforms (OSPs), AC export cables offshore to landfall point at Broad Craig, near Sandend in Aberdeenshire continuing onshore to the AC collector station (onshore substation) at Whitehillock and the additional regional Transmission Operator substation at Blackhillock near Keith. A Marine Licence for the OfTI was granted in June 2019 and varied on 11 April 2022.