MORAY OFFSHORE WINDFARM (WEST) LIMITED

Section 36 Consent Variation Screening Report

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Abbreviations and Acronyms

Abbreviation and Acronym	Expanded Term
AEoI	*Adverse Effect on Integrity*
Al	*Aluminium*
AR	*Avoidance Rates*
CAA	*Civil Aviation Authority*
CF	*Conversion Factor*
CfD	*Contracts for Difference*
Cu	*Copper*
EC	*European Commission*
EIA	*Environmental Impact Assessment*
EPR	*Ethylene propylene rubber insulated*
EPS	*European Protected Species*
GBBG	*Great Black-Backed Gull*
HAT	*Highest Astronomical Tide*
HRA	*Habitats Regulations Assessment*
Kj	*Kilojoules*
KV	*Kilovolt*
MCA	*Maritime and Coastguard Agency*
MOD	*Ministry of Defence*
MSLOT	*Marine Scotland Licensing and Operations Team*
MSS	*Marine Scotland Science*
MSS-MAU	*Marine Scotland Science Marine Analytical Unit*
MW	*Megawatt*
NATS	*National Air Traffic Services*
NETS	*National Electricity Transmission System*
NLB	*Northern Lighthouse Board*
NM	*Nautical Miles*
OSP	*Offshore Substation Platform*
OfTI	*Offshore Transmission Infrastructure*

Abbreviation and Acronym	Expanded Term
OnTI	*Onshore Transmission Infrastructure*
PCH	*Potential Collision Height*
pSPA	*Potential Special Protection Area*
PVA	*Population Viability Analysis*
RIAA	*Report to Inform Appropriate Assessment*
RSPB	*Royal Society for the Protection of Birds*
SFF	*Scottish Fishermen's Federation*
SNCB	*Statutory Nature Conservation Body*
SNH	*Scottish Natural Heritage*
SPA	*Special Protection Area*
TEC	*Transmission Entry Capacity*
THC	*The Highland Council*
WCS	*Worst Case Scenario*
WTG	*Wind Turbine Generator*
XLPE	*Cross-linked polyethylene*

1 Introduction

1.1 Purpose of this Document

In June 2019, Scottish Ministers granted Moray Offshore Windfarm (West) Limited "Moray West" consent under Section 36 of the Electricity Act 1989, Part 4 of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 to construct and operate the Moray West Offshore Wind Farm and associated Offshore Transmission Infrastructure (OfTI) "the Development".

An overview of the consented Development is provided in Section 1.2 below.

Moray West is now seeking to vary the Section 36 Consent for the Moray West Offshore Wind Farm (and associated Marine Licence for the Offshore Generating Station) in accordance with Section 36C of the Electricity Act 1989 (as amended) and Part 9 of the Electricity Works (Environmental Impact Assessment) Scotland Regulations 2017.

The main requirements for the variation include:

- Requirement to increase the blade width of Wind Turbine Generators (WTGs) specified in the Section 36 Consent – Annex 1 under the 72 turbine scenario from 6 m to 6.6 m; and
- Request for removal of reference to Moray West having a 'maximum generating capacity of around 850 MW'.

This Screening Report is intended to: (i) explain the purpose of and need for the variations sought; (ii) explain the potential impacts of these variations; (iii) demonstrate why the proposed variations can appropriately be authorised under Section 36C of the Electricity Act 1989; and (iv) explain why the proposed variations are not considered to constitute EIA development.

1.2 Overview of the Development (as consented)

The Moray West Offshore Wind Farm will be located within the Moray West Site which covers an area of approximately 225 km^2 on the Smith Bank in the Outer Moray Firth, approximately 22.5 km from the Caithness coastline (Figure 1.1). The associated Offshore Export Cable Corridor, which covers an area of approximately 185 km^2, runs south from the Moray West Site to the north Aberdeenshire Coast.

Key components of the Moray West Offshore Wind Farm are summarised below:

- Up to 85 WTGs with maximum blade tip height of 230 m (HAT) and rotor diameter of 195 m or up to 72 WTGs with maximum blade tip height of 265 m (HAT) and rotor diameter of 230 m;
- Up to 85 foundations and substructures, and associated fixtures, fittings and protections;
- Design of the WTG substructures will be chosen from the following options (monopiles, jacket foundations, gravity base structures or suction caissons);
- No more than 275 km of subsea inter array cables;
- Scour and inter array cable protection; and
- Monitoring equipment, such as metocean buoys (if required).

Up to two Offshore Substation Platform (OSP) will be installed in the Moray West Site to collect electricity generated by the wind farm. This electricity will then be exported to shore via two offshore export cable circuits which will make landfall at a location on the north Aberdeenshire Coast, approximately 65 km south of the Moray West Site. The OSPs, OSP interconnector cables and export cable circuits comprise the Offshore Transmission Infrastructure (OfTI).

Once onshore, electricity generated by the Development will be transmitted via underground cables to a substation at Whitehillock in Moray where the electricity will then be connected into the National Electricity Transmission System (NETS) at the existing Blackhillock substation. The landfall, onshore underground cables and substation comprise the Moray West Onshore Transmission Infrastructure (OnTI). The OnTI, together with the Development (Moray West Offshore Wind Farm and OfTI) comprise "the Project".

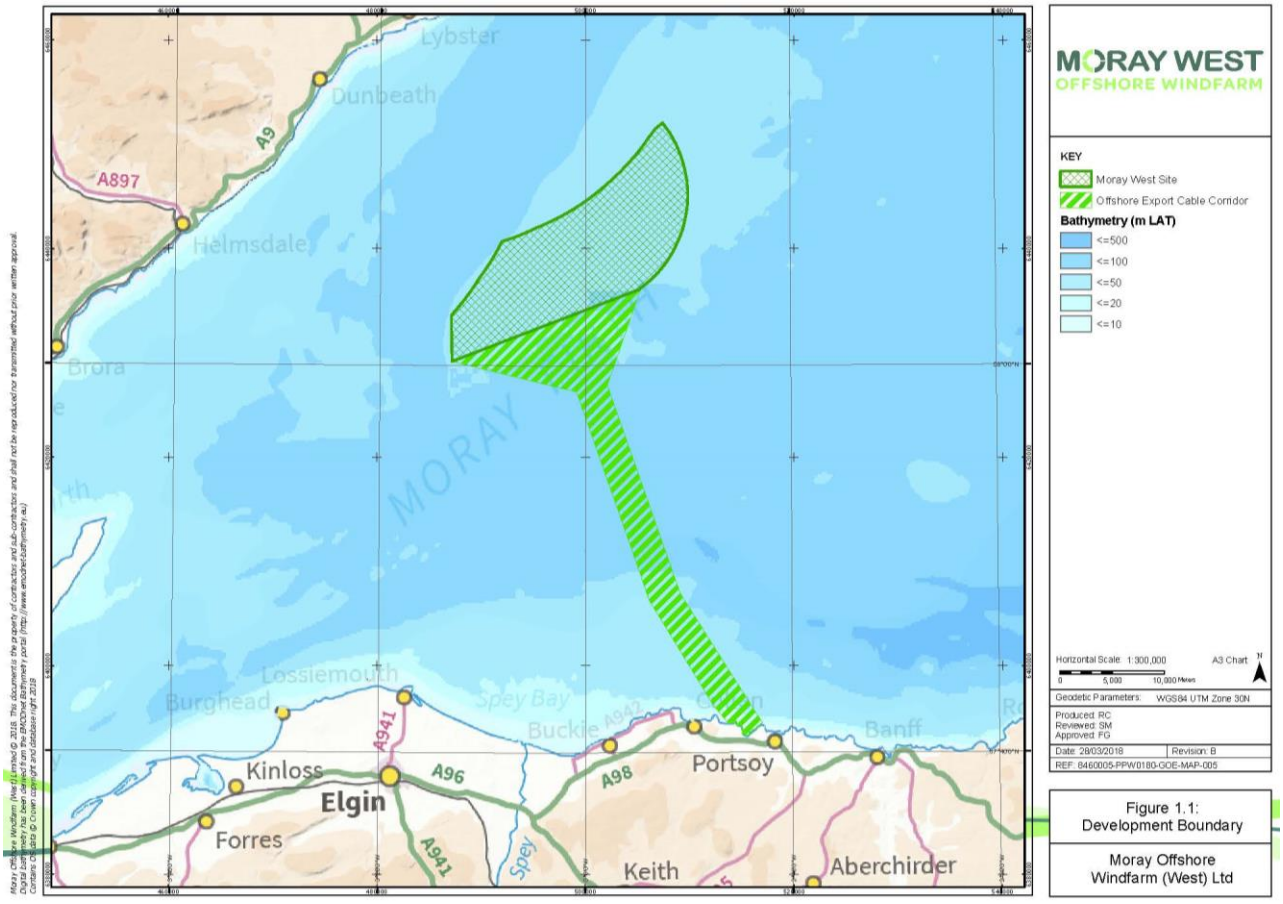

Figure 1.1: Development Boundary

2 Need for the Variation

2.1 Rationale

As discussed in Chapter 1, Moray West is seeking to vary the existing Section 36 Consent, and associated Generating Station Marine Licence, for the following reasons:

- Increase the WTG blade width from 6 m to 6.6 m; and
- Request for removal of reference to the 'maximum of around 850 MW' cap for installed capacity.

The rationale for each of the variations is provided below.

2.1.1 Requirement for increase in blade width

Blade width is one of the physical design parameters listed in *Section 1.5 - Application and Description of the Development* and *Annex 1*: *Description of the Development* of the Section 36 Consent, as well as in the *Description of Works* Section 2.1 of the associated Offshore Generating Station Marine Licence.

An extract of the wording from Annex 1 of the Section 36 Consent is provided below:

> 1.5 The Application is for the construction and operation of an offshore energy generating station, within a maximum generating capacity of around 850 megawatts ("MW"). The offshore generating station shall comprise either:
>
> 1. No more than 85 three-bladed horizontal axis Wind Turbine Generators ("WTG") each with:
>
> a. a maximum rotor tip height of 230 metres (measured from Highest Astronomical Tide ("HAT"));
> b. a maximum rotor diameter of 195 metres;
> c. a maximum hub height of 132.5 metres (measured from HAT);
> d. a minimum blade tip clearance of 35 metres (measured from HAT);
> e. **blade width of up to 6 metres**; and
> f. a minimum spacing of 1,050 metres crosswind and 1,200 metres downwind.
>
> **Or**
>
> If the rotor tip height of the WTGs exceeds 230 metres (measured from HAT), no more than 72 WTGs each with:
>
> a. a maximum rotor tip height of 265 metres (measured from HAT);
> b. a maximum rotor diameter of 230 metres;
> c. a maximum hub height of 150 metres (measured from HAT);
> d. a minimum blade tip clearance of 35 metres (measured from HAT);
> e. **blade width of up to 6 metres**; and
> f. a minimum spacing of 1,050 metres crosswind and 1,200 metres downwind.

Having been unsuccessful in the last CfD Auction round, Moray West has been exploring various options for developing the project, including the installation of larger WTGs. However, through further modelling and discussions with WTG suppliers it has become evident that, when looking at larger WTGs with larger rotor diameters, there is a corresponding increase in blade width.

Moray West is therefore seeking to increase the blade width specified for the 72 turbine scenario where tip height exceeds 230 m but is no greater than 265 m (measured from HAT) from 6 m to 6.6 m in order to accommodate these larger WTGs. Blade width for the smaller, 85 turbine scenario where tip height does not exceed 230 m (measured from HAT) will remain unchanged (6 m).

Based on information presented in Chapter 3 below, it is concluded that, while this variation does comprise a change to a physical design parameter specified in Annex 1 of the Section 36 Consent, the increase in blade width does not affect any of the conclusions presented in the EIA or HRA with respect to predicted effects including in relation to ornithology and landscape, seascape and visual amenity.

2.1.2 Request to remove reference to 'maximum generating capacity of around 850 MW'

Throughout the consenting process the size of the Moray West Offshore Wind Farm for which consent was sought was defined in terms of a physical Design Envelope comprising a maximum number of WTGs and maximum design parameters (e.g. maximum rotor diameter and maximum blade tip height). This application Design Envelope was described and assessed by reference to the theoretical physical WTG parameters (referred to in the Moray West EIA Report as WTG Model 1, 2, 3 and 4 (as submitted), with Model 1, 2 and 3 falling within the consented Design Envelope as presented in Annex 1 of the Section 36 Consent. At no stage was the size of the Offshore Wind Farm referred to in terms of maximum installed MW. There was also no reference made to the size (in MW) of the different WTG models.

As stated in the Moray West EIA Report - Volume 2, Chapter 4: Description of the Development, Section 4.4.1 Offshore Wind Turbine Generator (WTGs), Moray West requires flexibility in WTG choice to ensure that anticipated changes in available technology and project economics can be accommodated within the Development design.

Moray West also specifically states (paragraph 4.4.1.2) that "this development description, does not refer directly to the capacity of individual WTGs, but rather their number and physical dimensions. In recent years, the capacity of the current generation of WTGs has become more flexible and may be different depending on the environmental conditions at a particular site; therefore, it is not considered appropriate to constrain the Design Envelope based on WTG capacity. It should be noted that the EIA assessments presented in subsequent chapters are not linked to or affected by WTG capacity".

There are a number of WTGs available on the market that currently fall within the consented Design Envelope for Moray West (maximum rotor diameter (230 m) and maximum tip height (265 m above HAT)). The rated MW output capacity of these different WTGs varies depending on specific design specifications of each type of WTG, but generally increases with increased rotor diameter and maximum tip height. The final installed capacity of the wind farm therefore is dependent on these specific design specifications and the total number of turbines installed (up to 72 for WTGs with maximum 230 m rotor diameter and 265 m tip height).

Further variation in MW per WTG type is also expected when considering the rate of development of WTG technology. For example, WTG manufacturers are constantly working to improve the performance of the generator and other electrical components contained with the nacelle thereby increasing the output of a

WTG (in terms of MW) without making changes to any other design parameters associated with the WTG. The result of this is that within a couple of years a 10 MW WTG can become a 12 MW WTG or 13 MW WTG without a change to any of the design parameters up on which the consent is based.

At present, the wording within the Moray West Section 36 Consent and Marine Licences relating to the 'maximum generating capacity of around 850 MW' introduces an element of uncertainty with respect to Moray West's ability to optimise the Project in terms of WTG type and numbers. This uncertainty relates to both the maximum generating capacity of the wind farm and the extent to which overplanting can be achieved to ensure maximum generating capacity can be achieved at all times even when some WTGs are not operating (e.g. during routine maintenance) or WTG failure.

Given that the earliest commissioning date Moray West will be targeting is 2024, there remains scope for existing WTGs to increase their rated outputs (based on existing design parameters) and for new WTGs to enter the market prior to Moray West securing a deal with a WTG supplier. Removal of the reference to 'maximum generating capacity of around 850 MW' within the Section 36 consent and Marine Licences would enable Moray West to remain as flexible as possible to accommodating any new and improved WTGs that may come available in the future within its consented Design Envelope.

It should also be noted that, while the final capacity of the Offshore Wind Farm will be based on the rated output (MW) of the selected model of WTG which complies with the consented WTG design parameters and numbers, the total maximum generating capacity (MW) will also be influenced by the capacity of the OfTI and the grid connection (Transmission Entry Capacity (TEC)).

2.1.3 Overview of Moray West Offshore Wind Farm Design Envelope and proposed changes

Tables 2.1 (WTG and Substructure Design Parameters) and 2.2 (Inter Array Cable Design Parameters) below present the key design parameters for the Moray West Offshore Wind Farm as assessed in the Moray West consent application documents (Environmental Impact Assessment (EIA) and Habitat Regulation Assessment (HRA)), and identifies the proposed changes to those design parameters included in this variation application. Design parameter relating to the Moray West OfTI are not included in this table. This is on the basis that the proposed consent variation relates to the Moray West Offshore Wind Farm only (as defined in the Section 36 Consent, Section 1.5 and Annex 1, and the Moray West Generating Station Marine Licence).

Further detail on the implications of the proposed variations to specific design parameters with respect to conclusions of the EIA and HRA are presented in Chapter 3.

Table 2.1 WTG and Substructure Design Parameters Referred to in the 2018 Consent Application and Proposed Changes

Design Envelope Parameter	WTG Model 1	WTG Model 2 (parameters relating to the 85 turbine scenario presented in the Section 36 Consent)	WTG Model 3 (parameters relating to the 72 turbine scenario presented in the Section 36 Consent)	Change
Maximum WTG numbers	85	85	72	No change
Maximum rotor tip height (WTGs)	199 m	230 m	265 m	No change

Table 2.1 WTG and Substructure Design Parameters Referred to in the 2018 Consent Application and Proposed Changes				
Design Envelope Parameter	**WTG Model 1**	**WTG Model 2 (parameters relating to the 85 turbine scenario presented in the Section 36 Consent)**	**WTG Model 3 (parameters relating to the 72 turbine scenario presented in the Section 36 Consent)**	**Change**
Maximum rotor blade diameter	164 m	195 m	230 m	No change
Minimum blade tip clearance (m) for all WTG models	35 m	35 m	35 m	No change
Blade width	5.4 m	Up to 6 m	Up to 6 m	**Request increase up to 6.6 m for the 72 turbine scenario (Model 3 WTG)**
Minimum spacing (downwind)	1,200 m	1,200 m	1,200 m	No change
Minimum spacing (crosswind)	1,050 m	1,050 m	1,050 m	No change
Layout	Grid	Grid	Grid	No change
WTG colour	RAL 7035 (light grey)	RAL 7035 (light grey)	RAL 7035 (light grey)	No change
Oils and fluids	Lubricating oils, hydraulic oils and coolants etc.	Lubricating oils, hydraulic oils and coolants etc.	Lubricating oils, hydraulic oils and coolants etc.	No change
Substructures – Monopiles				
Number of monopiles	85	85	72	No change
Maximum diameter	12 m	12 m	15 m	No change
Maximum embedment depth (below seabed)	50 m	50 m	50 m	No change
Maximum hammer energy (kj)	5,000	5,000	5,000	No change
Substructures – Jacket Foundations				
Maximum number of jacket foundations	85	85	72	No change
Maximum number of legs per jacket	3 or 4	3 or 4	3 or 4	No change

Table 2.1 WTG and Substructure Design Parameters Referred to in the 2018 Consent Application and Proposed Changes				
Design Envelope Parameter	**WTG Model 1**	**WTG Model 2 (parameters relating to the 85 turbine scenario presented in the Section 36 Consent)**	**WTG Model 3 (parameters relating to the 72 turbine scenario presented in the Section 36 Consent)**	**Change**
Maximum separation of adjacent legs at seabed level (HAT)	35 m	35 m	35 m	No change
Maximum piles per jacket foundation	4	4	4	No change
Maximum pin-pile diameter	3.5 m	3.5 m	4 m	No change
Maximum embedment depth (below seabed)	60 m	60 m	60 m	No change
Maximum hammer energy (kj)	3,000	3,000	3,000	No change
Substructures – Gravity Base Structure (GBS) Foundations				
Number of GBS foundations	85	85	72	No change
External diameter at sea surface	12 m	12 m	13 m	No change
External diameter at seabed	45 m	45 m	50 m	No change
Height of installed base above seabed	20 m	20 m	20 m	No change
Substructures – Suction Caisson Parameters (for Jackets)				
Number of jacket foundations	85	85	72	No change
Maximum number of legs per jacket	4	4	4	No change
Suction caissons per foundation	4	4	4	No change
Maximum suction caisson diameter	20 m	20 m	25 m	No change
Maximum caisson penetration depth (below seabed)	15 m	15 m	20 m	No change

Table 2.1 WTG and Substructure Design Parameters Referred to in the 2018 Consent Application and Proposed Changes				
Design Envelope Parameter	**WTG Model 1**	**WTG Model 2 (parameters relating to the 85 turbine scenario presented in the Section 36 Consent)**	**WTG Model 3 (parameters relating to the 72 turbine scenario presented in the Section 36 Consent)**	**Change**
Height of caisson remaining above seabed once installed	10 m	10 m	10 m	No change
Substructures – Suction Caisson Parameters (for Monopile)				
Suction caissons per foundations	1	1	1	No change
Maximum number of monopile foundations	85	85	72	No change
Suction caisson diameter	45 m	45 m	50 m	No change
Caisson penetration depth (below seabed)	30 m	30 m	35 m	No change
Height of caisson remaining above seabed once installed	10 m	10 m	10 m	No change

Table 2.2 Inter Array Cable Design Parameters Referred to in the 2018 Consent Application and Proposed Changes		
Design Envelope Parameter	**Specification**	**Change**
Inter Array Cable Circuit Parameters		
Cable specification	Three core steel wired armour XLPE or EPR (wet design) submarine power cable with integrated fibre optic element	No change
Cable conductor (Al, Cu)	Aluminium (Al) or copper (Cu)	No change
Length of cable (km)	275 km	No change
Voltage range (kV)	33 - 72.5 kV	No change
Inter Array Cable Installation		
Burial technique (installation method)	Ploughing, Jetting, Cutting	No change
Typical trench depth (m)	1	No change

Table 2.2 Inter Array Cable Design Parameters Referred to in the 2018 Consent Application and Proposed Changes		
Design Envelope Parameter	**Specification**	**Change**
Maximum trench depth (m)	3	No change
Number of cable circuits per trench	1 (2 if fibre optic cables are installed separate from the power cable)	No change
Maximum trench width (m)	3	No change
Additional cable protection techniques where burial not possible	Rock placement, concrete mattressing, cable protection system (polymer or steel sleeves), grout bags	No change
% cable length where additional protection required	Up to 10 %	No change

3 Implications for EIA and HRA

3.1 Overview of Moray West EIA and HRA documentation

An overview of the various documents submitted as part of the Section 36 Consent and Marine Licence Applications for the Moray West Offshore Wind Farm and associated Offshore Transmission Infrastructure (OfTI) is provided below.

3.1.1 Application documents (July 2018)

The Section 36 Consent and associated Marine Licence applications submitted to Scottish Ministers in July 2018 were supported by the following documents:

- Moray West Environmental Impact Assessment (EIA) Report (July 2018) – Volumes 1 to 4 prepared in accordance with:
  - Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
  - Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and
  - Marine Works (Environmental Impact Assessment) Regulations 2007.
- Moray West Report to Inform an Appropriate Assessment (RIAA) (July 2018) prepared in accordance with:
  - The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (the Habitats Regulations) for Scottish Territorial Waters (0 to 12 nautical miles (nm)); and
  - The Conservation of Offshore Marine Habitats and Species Regulations 2017 (the Offshore Habitats Regulations) which apply to the offshore marine area (12 to 200 nm).

The July 2018 consent applications also included a draft Decommissioning Programme prepared in accordance with the Energy Act 2004; a Safety Zone Statement, also prepared in accordance with the Energy Act 2004 and the Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007; and information to support a European Protected Species (EPS) Licence Application which is required under the 1994 Habitats Regulations and the 2017 Offshore Habitats Regulations for any activities that would potentially disturb any species protected under Annex IV of the European Habitats Directive (EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna).

3.1.2 Application Addendum Document (November 2018)

In November 2018 Moray West submitted an Application Addendum Document. This included additional information provided in response to representations received during consultation on the application, with particular regard to the following:

- Provision of additional information to address comments raised by Scottish Natural Heritage (SNH); Royal Society for the Protection of Birds (RSPB) and Marine Scotland Science (MSS) in relation to potential effects on ornithology. This included objections to the Project received from both SNH and RSPB on the grounds of possible adverse effects on the integrity (AEoI) of a

number of Special Protection Areas (SPAs) including in particular the East Caithness Cliffs SPA and North Caithness Cliffs SPA;

- Results from additional underwater noise modelling undertaken to demonstrate any potential difference in the results from the assessment of effects on marine mammals when using Conversion Factors (CFs) of 1% and 0.5%;
- Additional information relating to the socio-economics of the project in response to an objection from Marine Scotland Science Marine Analytical Unit (MSS-MAU); and
- Additional information provided in relation to proposed variations to the application including an assessment of revised design parameters which included the removal of the largest (Model 4) WTG in order to mitigate potential adverse landscape and visual impacts and reduction in the operational period of the Development from 50 years to 25 years to further reduce the potential for any AEoI of the East Caithness Cliffs SPA and North Caithness Cliffs SPA.

3.1.3 Great Black-Backed Gull (GBBG) Report (March 2019)

In March 2019, Moray West submitted a report providing information on refinements to the assessment of in combination effects on the great black-backed gull feature of East Caithness Cliffs SPA (Moray West, 2019b).

Copies of all documents submitted as part of the Moray West Section 36 Consent and associated Marine Licence Applications are available to download from the Moray West Website or the Marine Scotland Website:

- https://www.moraywest.com/document-library
- http://marine.gov.scot/ml/moray-west-offshore-windfarm

3.2 Influence of design parameter in the impact assessment process

In accordance with current best practice Moray West adopted a Design Envelope approach (based on the Rochdale Principle) to defining the design of the Project. The basis of this approach is to maintain sufficient flexibility in the consented design parameters such that developments in WTG technology, substructure and / or OSP design, and installation methods or equipment can be accommodated in the final design of the Project.

The Design Envelope, by its nature, comprises a range of options in terms of sizes of WTG, substructure types, cable layouts and sizes and methods of installation. In order to determine the potential effects of these various options it is therefore necessary to identify the minimum or maximum parameters for each design feature. These parameters are then used to define the 'worst case scenario' (WCS) that is to be assessed in order to determine potential effects on the environment. The WCSs are highly receptor and impact specific, therefore can vary significantly across EIA topics. The extent of the variation between WCSs can be such that what might be a worst case for one receptor actually comprises the 'best case' for another.

With respect to the Moray West Project, of the four WTG models included in the original application (Moray West, 2018a), the WCSs generally comprised parameters associated with either the Model 1 (and 2) WTGs given this represented the highest number of turbines (85) or the Model 4 WTG (on the basis this comprised the largest turbine parameters). With the removal of the Model 4 WTG, the Model 3 WTG (the 72 turbine scenario as presented in the Section 36 Consent – Section 1.5 and Annex 1) became the new WCS for those topics / receptors where Model 4 had been the assessed WCS.

WCSs relating to the cables and OSPs were less variable on the basis that there were less options proposed for these components other than the substructures for the OSPs.

3.3 Request to vary blade width for the Model 3 turbine – potential EIA and HRA implications

The exception to the WCS comprising either the Model 1 or Model 4 WTGs was ornithology where the assessed WCS for collision impacts was based on the Model 2 WTG[1] (85 turbine scenario as presented in the Section 36 Consent, Section 1.5 and Annex 1).

Collision impacts are assessed by carrying out Collision Risk Modelling (CRM). This relies on a range of input parameters, some species specific such as flight heights and speeds, some project specific such as turbine parameters. The turbine parameters included in the CRM carried out to inform the assessment of collision impacts presented in the Moray West application documents and the subsequent Appropriate Assessment carried out by Scottish Ministers are listed in Table 3.1 below (column 2). These are based on the 85 turbine scenario.

Given that the 85 turbine scenario (Model 2 WTG) comprised the WCS for the CRM in the application it was not necessary to present any CRM input parameters or modelled outputs for the 72 turbine scenario (Model 3 WTG) as consented in any of the application documents.

The proposed changes considered in this Consent Variation Screening Report relate specifically to an increase in maximum blade width (from 6 m to 6.6 m) for the 72 turbine scenario (Model 3 WTG) only. There are no proposed changes to the 85 turbine scenario (Model 2 WTG) which will remain at 6 m. The consented parameters for the 72 turbine scenario (as specified in the Section 36 Consent) are presented in Table 3.1 below (column 3). The parameters included in the CRM carried out as part of this screening report with respect to the proposed changes to blade width for the 72 turbine scenario (Model 3 WTG) are presented in Table 3.1 (column 5).

It should be noted that, although listed as a design parameter in the Section 36 Consent, the only EIA topic where blade width is considered as an assessed WCS parameter is ornithology, specifically CRM. Blade width does not have any influence on the assessment of effects on any of the other topics e.g. landscape and visual, military and civil aviation included in the consent application documents (EIA and HRA). As such, there is no reference to blade width in any of the consent documents except for Chapter 10 of the EIA Report (Volume 1) and supporting Technical Appendix 10.2: Collision Risk Modelling and in Annex A: Collision Risk Modelling Parameters of the GBBG Report (March 2019).

[1] When using Band (2012) Collision Risk Model Option 2. See Moray West EIA Volume 4 - Technical Appendix 10.2: Collision Risk Modelling *CRM) for further detail.

Table 3.1 Turbine Parameters Used for Collision Risk Modelling (CRM) in the 2018 Application and CRM to inform this Consent Variation Screening Report					
Collision Risk Modelling (CRM) input parameters		**Design envelope parameters included in the Section 36 Consent – Annex 1**		**CRM parameters used in 2018 consent application (Model 2 WTG)**	**CRM parameters used to inform assessment of increased blade width for 72 turbine scenario**
		85 turbine scenario (Model 2 WTG)	**72 turbine scenario (Model 3 WTG)**		
Number of turbines		85	72	85	72
Rotor radius (m)		97.5 (195 m rotor diameter)	115 (230 m rotor diameter)	97.5	115
Hub height (m)		132.5	150	132.5	150
Minimum blade tip clearance		35	35	35	35
Max blade width (m)		6	6	6	6.6 (increase from 6 m as specified in the Section 36 Consent)
Monthly proportion of time operational (all moths) (%)		Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	85	85
Pitch (°)		Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	8	8
Rotor speed (rpm)	Minimum	Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	6.0	6.0
	Maximum	Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	9.8	9.8

3.3.1 Validation of conclusions from the assessment of collision risk impacts presented in the EIA Report and Application Addendum Document

The following section presents a summary of the results from additional CRM carried out to inform the validation of conclusions from the assessment of collision risk on kittiwake, great black-backed gull, gannet and herring gull with respect to an increase in blade width from 6 m to 6.6 m. Further detail on the approach to the additional CRM and results for kittiwake, great black-backed gull, herring gull and gannet are presented in Appendix A. The additional CRM has been carried out by NIRAS who carried out the original ornithological impact assessment for the Moray West application.

3.3.1.1 Validation of conclusions of effect significance – EIA (Project alone)

Results from the validation of conclusions of effect significance of collision mortality impacts on kittiwake, great black-backed gull, gannet and herring gull are summarised in Table 3.2. Results from the additional CRM carried out for the 6.6 m blade width for the 72 turbine scenario (Model 3 WTG) are presented in Appendix A of this document, along with an assessment of the implications of these results on the conclusions of effect significance presented in the Moray West EIA Report – Volume 2: Chapter 10 Ornithology (for all species) and the Moray West Application Addendum Document – Part 1 (kittiwake only). The CRM methodology used in Appendix A is exactly the same as that used in the Application Documents. No changes to the CRM methodology in terms of updated guidance or revised input parameters have been identified.

Based on the information presented in Table 3.2 and Appendix A it is concluded that there is no increase in predicted annual collision mortality rates associated with an increase in blade width from 6 m to 6.6 m for the 72 turbine scenario as defined in the Section 36 Consent – Annex 1 and Offshore Generating Station Marine Licence, Section 2.1. Conclusions of effect significance presented in the Moray West EIA – Volume 2 Chapter 10 (all species) and Moray West Application Addendum Document (2018) (kittiwake) therefore remain valid.

Table 3.2 Results from Validation of Conclusions of Effect Significance (EIA) of Collision Impacts

Band Model Option + Avoidance Rate (AR)	Results from Moray West Application Documents (Moray West 2018a; Moray West 2018b; and Moray West 2019)		Results from additional collision risk modelling (2020 assessment – proposed varied parameters for Model 3 WTG (6.6 m blade width)	
	Predicted annual collision mortality[Note 2 and 3]	Conclusions of effect significance	Predicted annual collision mortality	Validation of conclusions of effect significance
Kittiwake				
Option 2 [Note 1] (98.9%)	109	Minor adverse. Not significant in EIA terms.	107	Conclusions of effect significance presented in the Moray West EIA and Moray West Application Addendum Document remain valid.
Great black-backed gull				
Option 2 (99.5%)	9.3	Minor adverse. Not significant in EIA terms.	9.04	Conclusions of effect significance presented in the Moray West EIA remain valid.
Gannet				
Option 2 (98.9%)	12.4	Negligible to minor adverse. Not significant in EIA terms.	12.0	Conclusions of effect significance presented in the Moray West EIA remain valid.

Table 3.2 Results from Validation of Conclusions of Effect Significance (EIA) of Collision Impacts				
Band Model Option + Avoidance Rate (AR)	**Results from Moray West Application Documents (Moray West 2018a; Moray West 2018b; and Moray West 2019)**		**Results from additional collision risk modelling (2020 assessment – proposed varied parameters for Model 3 WTG (6.6 m blade width)**	
	Predicted annual collision mortality[Note 2 and 3]	**Conclusions of effect significance**	**Predicted annual collision mortality**	**Validation of conclusions of effect significance**
Herring gull				
Option 2 (99.5%)	12.6	Minor adverse. Not significant in EIA terms.	12.2	Conclusions of effect significance presented in the Moray West EIA remain valid.

Note 1: *Both the Basic and Extended models of Band (2012) allow for the use of two 'Options' termed Options 1-4. Options 1 and 2 use the Basic model with Options 3 and 4 utilising the Extended model. The difference between the two Options under each model is linked to the use of flight height data. Options 2 and 3 use generic data from Johnston et al. (2014) whereas Options 1 and 4 use site-specific data derived from site-specific surveys. Option 2 was used for the Moray West assessment for kittiwake on the basis that site specific flight height data was not available for the assessment.*

Note 2: *Results for predicted annual collision mortality for kittiwake are based on information presented in the Moray West Application Addendum Document – PART 1- Chapter 2, Table 2.5.*

Note 3: *Collision mortality rates for great black-backed gull are based on information presented in the Moray West EIA Report – Volume 2, Chapter 10, Table 10.8.9.*

3.3.1.2 Validation of conclusions of effect significance – EIA (cumulative effects)

Results presented above are in relation to the project level impacts only. Results from the cumulative assessment are not presented here on the basis that, as shown in Table 3.2, it is concluded that there is no change to the conclusions from the assessment of effect significance for the Project alone. It therefore can also be concluded that there will be no change or implications for the conclusions of cumulative effect significance as a result of the increase in blade width from 6 m to 6.6 m.

3.3.2 Validation of conclusions from the assessment of AEoI in relation to kittiwake feature of East Caithness Cliffs SPA

3.3.2.1 Conclusion from assessment of AEoI - kittiwake

The conclusions from the assessment of AEoI due to collision mortality impacts on the kittiwake feature of the East Caithness Cliffs SPA as presented in the Moray West Application Addendum Document 2018 (which updated information included in the Moray West RIAA 2018) are presented below.

For Moray West alone, the predicted kittiwake collision mortality apportioned to the East Caithness Cliffs SPA is 57 birds per annum (based on Band Option 2 and a 98.9% avoidance rate). The Population Viability Analysis (PVA) modelled outputs indicate that after 25 years, based on a predicted collision mortality of 57 the kittiwake population of the East Caithness Cliffs SPA would be 97% the size of the unimpacted population (ratio impacted to un-impacted population size of 0.966). It was therefore concluded that there would be no AEoI of the kittiwake feature of the East Caithness Cliffs SPA for Moray West alone.

Kittiwake collision mortalities apportioned to the East Caithness Cliffs SPA as a result of the Moray West Project in-combination with other projects range from 325 birds per annum to 172 birds per annum. This range in annual collision mortality takes into account the application of a range of refinements that were applied to the assessment of in-combination effects. These refinements included revised flight speeds, updated Design Envelopes for other projects (Moray East and Neart na Gaoithe), updated approaches to apportioning and a reduction in collisions from the Moray West project from 57 to 53 through a reduction in turbine numbers, design refinements or both (approx. 7% reduction in collision). Further detail on the various refinements applied to the assessment of in-combination effects presented in the Moray West Application Addendum Document (2018) PART 1, Chapter 3 Section 3.6.2.

Of the nine refinements presented in the Application Addendum Document, only four (refinements 1 to 4) were accepted by Scottish Natural Heritage (SNH). Taking these four refinements into account, the final accepted in-combination collision mortality rate for kittiwake presented in the Moray West Appropriate Assessment (Scottish Ministers, 2019) was 250 birds per annum (as presented in Table 3.47 of the Moray West Application Addendum Document 2018). The PVA modelled outputs indicate that after 25 years, based on 250 collisions per annum, the kittiwake population of the East Caithness Cliffs SPA would be 86% the size of the unimpacted population (ratio impacted to un-impacted population size of 0.858). It was concluded there would be no AEoI of the East Caithness Cliffs SPA.

3.3.2.2 Validation of conclusions from assessment of AEoI for kittiwake

Table 3.3 below presents unapportioned and apportioned collision risk estimates for kittiwake feature of East Caithness Cliffs SPA as presented in the Moray West Application Addendum Document 2018 compared with unapportioned and apportioned collision risk estimates calculated using the 72 turbine scenario (Model 3 WTG) parameters with increased blade width to 6.6 m.

Table 3.3 Collision risk estimates for kittiwake feature of East Caithness Cliffs SPA using the 72 turbine scenario (Model 3 WTG) parameters with increased blade width compared to results presented in the Moray West Application Addendum Document 2018.

Collisions	Results from Moray West Application Addendum Document 2018 (based on parameters for Model 2 WTG)				Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)			
	Breeding	Post-breeding	Pre-breeding	Annual	Breeding	Post-breeding	Pre-breeding	Annual
Unapportioned collisions	79	24	7	**109**	77	23	7	**107**
Collisions apportioned to East Caithness Cliffs SPA	55	1	1	**57**	54	1	1	**56**
Collisions apportioned to East Caithness	51	1	0	**53**[Note 1]	50	1	0	**52**[Note 2]

Table 3.3 Collision risk estimates for kittiwake feature of East Caithness Cliffs SPA using the 72 turbine scenario (Model 3 WTG) parameters with increased blade width compared to results presented in the Moray West Application Addendum Document 2018.								
Collisions	**Results from Moray West Application Addendum Document 2018 (based on parameters for Model 2 WTG)**				**Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)**			
	Breeding	**Post-breeding**	**Pre-breeding**	**Annual**	**Breeding**	**Post-breeding**	**Pre-breeding**	**Annual**
Cliffs SPA with 7% reduction								
Note 1 – Annual total presented as a rounded value. Actual values (breeding = 51.12, post breeding = 1.28 and pre-breeding = 0.48) = 52.88 **Note 2** - Annual total presented as a rounded value. Actual values (breeding = 50.25, post breeding = 1.26 and pre-breeding = 0.47) = 51.99								

As illustrated above, the recalculated collision rates based on the 72 turbine scenario (Model 3 WTG) parameters with an increased blade width from 6 m to 6.6 m, are lower than the collision rates used to support the conclusions reached in the Moray West Application Addendum Document 2018 and the Scottish Minister's Appropriate Assessment for the kittiwake feature of the East Caithness Cliffs SPA. It is therefore concluded that the conclusions reached by Moray West and the Scottish Ministers in relation to the effects of the Project alone on the integrity of the East Caithness Cliffs SPA remain valid.

The conclusions reached by Moray West and the Scottish Ministers with respect to the effect of the Project in-combination with other plans and projects on the integrity of the East Caithness Cliffs SPA therefore also remain valid.

3.3.3 Validation of conclusions from the assessment of AEoI in relation to the great black-backed gull feature of East Caithness Cliffs SPA

3.3.3.1 Conclusion of assessment of AEoI – great black-backed gull

Based on information presented in the GBBG Report (Moray West, 2019) it was concluded that, for Moray West alone, the predicted collision mortality apportioned to the East Caithness Cliffs SPA for GBBG is 1.96 birds per annum (GBBG Report – Table 1.4). The PVA modelled outputs indicate that after 25 years, based on 1.96 collisions per annum, the GBBG population of the East Caithness Cliffs SPA would be 90% the size of the unimpacted population (ratio impacted to un-impacted population size of 0.898).

As with the assessment of AEoI undertaken for the Moray West Project in combination with other projects for the kittiwake features of the East Caithness Cliffs SPA, a number of refinements were also applied to the assessment of AEoI on the East Caithness Cliffs SPA GBBG population. In total, seven refinements were presented in the GBBG Report. These were all accepted by Marine Scotland Science (MSS) and SNH. Based on the application of these refinements the predicted GBBG collision mortality for Moray West in combination with other projects apportioned to the East Caithness Cliffs SPA is 3.36 birds per annum (based on Band Option 3 and 98.9% avoidance rate) as stated in the Moray West Appropriate Assessment (Scottish Ministers, 2019).

The PVA modelled outputs as presented in the GBBG Report – Table 1.4 indicate that after 25 years, based on 3.36 collisions per annum as a result of Moray West in-combination with other projects, the GBBG population of the East Caithness Cliffs SPA would be 85% the size of the unimpacted population (ratio impacted to un-impacted population size of 0.851).

Based on these results it was concluded in the Moray West Appropriate Assessment (Scottish Ministers, 2019) that, subject to the application of conditions requiring pre-construction monitoring of GBBG through a programme of gull tagging, there will be no adverse effect on the site integrity of East Caithness Cliffs SPA in respect of GBBG as a result of Moray West alone or in-combination with the other Moray Firth Projects (Moray East and Beatrice).

3.3.3.2 Validation of conclusions from assessment of AEoI for great black-backed gull

Table 3.4 below presents unapportioned and apportioned collision risk estimates for great black-backed gull at East Caithness Cliffs using the 72 turbine scenario (Model 3 WTG) parameters with increased blade width to 6.6 m.

Table 3.4 Collision risk estimates for great black-backed gull feature of East Caithness Cliffs SPA using the 72 turbine scenario (Model 3 WTG) parameters with increased blade width compared to results presented in the Moray West Application Addendum Document 2018.

Collisions	Results from Moray West GBBG Report 2019 (based on parameters for Model 2 WTG)			Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)		
	Breeding	Non-breeding	Annual	Breeding	Non-breeding	Annual
Unapportioned collisions	5.30	4.00	9.30	3.89	5.15	9.04
Collisions apportioned to East Caithness Cliffs SPA	1.54	0.42	1.96	1.50	0.41	1.91

As illustrated above, the recalculated collision rates based on the 72 turbine scenario (Model 3 WTG) parameters with an increased blade width from 6 m to 6.6 m, are lower than the collision rates used to support the conclusions reached in the Moray West Application Addendum Document 2018, Moray West GBBG Report and the Scottish Minister's Appropriate Assessment for the great black-backed gull feature of the East Caithness Cliffs SPA. It is therefore concluded that the conclusions reached by Moray West and the Scottish Ministers in relation to the effects of the Project alone on the integrity of the great black-backed gull feature of the East Caithness Cliffs SPA remain valid.

The conclusions reached by Moray West and the Scottish Ministers with respect to the effect of the Project in-combination with other plans and projects on the integrity of the great black-backed gull feature of the East Caithness Cliffs SPA therefore also remain valid.

3.3.4 Validation of conclusions from the assessment of AEoI in relation to the herring gull feature of East Caithness Cliffs SPA

3.3.4.1 Conclusion from assessment of AEoI – herring gull

The conclusions from the assessment of AEoI due to collision mortality impacts on the herring gull feature of the East Caithness Cliffs SPA as presented in the Moray West RIAA 2018 are presented in Table 3.5 below against the collision estimates calculated for this variation proposal using the envelope for the 72 turbine scenario (Model 3 WTG) parameters with an increased blade width from 6 m to 6.6 m.

Table 3.5 Collision risk estimates for herring gull feature of East Caithness Cliffs SPA using 72 turbine scenario (Model 3 WTG) parameters with increased blade width to 6.6 m compared to results presented in the Moray West Application Addendum Document 2018.

Collisions	Results from Moray West RIAA 2018 (based on parameters for Model 2 WTG)			Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)		
	Breeding	Non-breeding	Annual	Breeding	Non-breeding	Annual
Unapportioned collisions	11.7	0.9	**12.6**	11.4	0.8	**12.2**
Collisions apportioned to East Caithness Cliffs SPA	3.8	0.01	**3.9**	3.7	0.01	**3.7**

Of the 13 herring gull collisions predicted per annum using Band Option 2 with 99.5% avoidance rate, four are apportioned to the East Caithness Cliffs SPA. This represents 0.02% of the SPA population and a 0.09% increase in baseline mortality.

It was concluded in the Moray West RIAA 2018 that predicted level of collision mortality apportioned to the East Caithness Cliffs SPA represents a negligible proportion of the SPA population and a negligible increase in the baseline mortality of the SPA population. It was therefore concluded there would be no AEoI on the herring gull feature of the East Caithness Cliffs SPA as a result of collision risk impacts.

3.3.4.2 Validation of conclusion from assessment of AEoI – herring gull

The collision risk estimates presented in Table 3.5 for the 72 turbine scenario (Model 3 WTG) with increased blade width to 6.6 m are lower than the corresponding collision risk estimates used to support the conclusions reached in the Moray West RIAA and Scottish Minister's Appropriate Assessment 2019 for the herring gull feature at East Caithness Cliffs SPA (i.e. those presented in Table 3.5). This confirms that the proposed changes to the turbine parameters considered in this report (i.e. an increase in blade width from 6 m to 6.6 m for the 72 turbine scenario) would not increase the collision rates for the herring gull feature of the East Caithness Cliffs SPA when compared to the collision risk estimates used to support previous assessments conducted by the Applicant and Scottish Ministers.

3.4 Request to remove reference to 'maximum generating capacity of around 850 MW'

As stated in Chapter 2, Section 2.1.2, and the Moray West EIA Report - Volume 2, Chapter 4: Description of the Development, Section 4.4.1 Offshore Wind Turbine Generator (WTGs), in order to retain flexibility in the choice of WTG to be installed at the Moray West Site and ensure that anticipated changes in available technology and project economics can be accommodated within the Project design, Moray West purposely avoided making any reference to either a maximum MW capacity for the offshore wind farm or MW capacity for any of the WTG models.

As such it was concluded in the Moray West EIA Report - Volume 2, Chapter 4: Description of the Development, Section 4.4.1 Offshore Wind Turbine Generator (WTGs) (paragraph 4.4.1.2) that the EIA assessments presented in the topic specific chapters were not linked to or affected by WTG capacity.

With respect to assessing the implications of the request to remove the reference to Moray West having a 'maximum generating capacity around 850 MW' given that no assessment of this MW cap was ever undertaken in the EIA, there are no conclusions of effect significance against which a validation exercise can be carried out. Therefore, given that the statement presented in paragraph 4.4.1.2 of the Moray West EIA Report - Volume 2 Chapter 4: Description of the Development, remains unchanged "the EIA assessments presented in the topic specific chapters are not linked to or affected by WTG capacity" it can also be concluded that the conclusions from the assessment of effect significance presented in these topic specific chapters remain valid with respect to removal of reference to a 'maximum generating capacity around 850 MW'.

4 Conclusions

4.1 Proposed change to blade width

As discussed in Chapter 3, results from additional collision risk modelling carried out for the 72 turbine scenario with an increase in blade width from 6 m to 6.6 m confirms that, for all four species assessed for collision risk impacts (kittiwake, great black-backed gull, gannet and herring gull) the revised collision risk estimates are lower than those used to support the Moray West Offshore Wind Farm application and the consent decision reached by Scottish Ministers.

It is therefore concluded that the conclusions reached in the Moray West Offshore Wind Farm consent application documents, and by Scottish Ministers, with respect to effect significance (EIA) for all four species (kittiwake, great black-backed gull, gannet and herring gull) in terms of both the project alone and in-combination with other projects, remain valid.

With regard to the assessment of AEoI (HRA), the conclusions reached by Moray West and the Scottish Ministers with respect to the effect of the Project alone and in-combination with other plans and projects on the integrity of the kittiwake, great black-backed gull and herring gull features[2] of the East Caithness Cliffs SPA also remain valid.

4.2 Removal of reference to 'maximum generating capacity of around 850 MW'

Given that there was no reference to a MW capacity included in the Moray West offshore wind farm consent application and that none of the EIA assessments presented in topic specific chapters of the EIA Report were linked to, or affected by WTG capacity, it is concluded that removal of reference to Moray West having a 'maximum generating capacity of around 850 MW' will not affect any of the conclusions of effect significance presented in these chapters of the EIA Report (and all other application documentation). The conclusions of effect significance therefore remain valid with respect to removal of reference to a 'maximum generating capacity of around 850 MW'.

[2] Gannet was not assessed in the Moray West application as an HRA species.

5 References

Moray West (2018a). Moray West EIA Report – Volumes 1 to 4. July 2018.

Moray West (2018b). Moray West Report to Inform an Appropriate Assessment (RIAA). July 2018.

Moray West (2019a). Moray West Letter Requesting Removal of Alternative Site Boundary. February 2019.

Moray West (2019b). Information to inform HRA - Refinement to the assessment of in-combination effects on great black-backed gull feature of East Caithness Cliffs SPA (Great Black-Backed Gull Report). March 2019.

Scottish Ministers. Section 36 Consent – Decision Notice and Conditions. 14th June 2019.

Scottish Ministers. Moray West Appropriate Assessment. 14th June 2019.

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Appendix A

MORAY OFFSHORE WINDFARM (WEST) LIMITED

Section 36 Consent Variation – Appendix A Collision Risk Modelling for Updated WTG Parameters (Blade Width)

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Prepared by:	Reviewed through Viewpoint by:	Approved through Viewpoint by:	Approved by (option):
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Table of Contents

1 Introduction

This appendix presents the results from the additional Collision Risk Modelling (CRM) carried out to inform the validation of conclusions from the assessment of collision risk on kittiwake, great black-backed gull, gannet and herring gull as presented in the Moray West consent application documents with respect to a proposed increase in blade width from 6 m to 6.6 m for the 72 turbine scenario (as presented in the Section 36 Consent – Annex 1, see section 2 below for further detail). This additional CRM has been carried out by NIRAS who carried out the original ornithological impact assessment for the Moray West application.

The results from the additional CRM are compared to those estimates calculated as part of the original application for Moray West Offshore Wind Farm and relevant submissions made during the determination phase of the consent application (for kittiwake and great black-backed gull). This report is therefore structured as follows:

- Section 2: Proposed turbine changes in relation to collision risk modelling;
- Section 3: Updated CRM undertaken for kittiwake, great black-backed gull, gannet and herring gull using the 72 turbine scenario (based on maximum 230 m rotor diameter and maximum 265 m tip height WTG design parameters) with proposed increase in blade width from 6 m to 6.6 m; and
- Section 4: Implications of the additional collision risk estimates in terms of the conclusions of effect significance (as presented in the Moray West EIA Report for all four species) and conclusions of Adverse Effects on Integrity (AEoI) presented in the Moray West Report to Inform Appropriate Assessment (RIAA) 2018, Moray West Application Addendum Document 2018 and the Scottish Ministers' Appropriate Assessment for kittiwake, great black-backed gull and herring gull[3].

2 Proposed turbine changes

The decision notice for the Section 36 consent for Moray West outlined two project design scenarios for the offshore generating station. The first of these scenarios was based on the parameters used in the collision risk modelling undertaken as part of the application (85 turbine scenario). The second was based on a maximum of 72 turbines and those design parameters presented in the "consented parameters" column of Table 3.1 below. When compared to this design scenario, Moray West are proposing to change only the maximum blade width from 6 m to 6.6 m (Table 2.1).

Two scenarios were included as part of the consent for Moray West (85 and 72 turbine scenarios) with the parameters associated with these scenarios presented in Table 2.1 (columns 2 and 3). The 85 turbine scenario was also the scenario used as part of the collision risk modelling that informed the assessments undertaken as part of the application and subsequently the Appropriate Assessment produced by the Scottish Ministers (column 4). The proposed changes considered in this report affect the 72 turbine scenario and represent an increase in the blade width associated with this scenario (see column 5 in Table

[3] Gannet was not identified as a HRA species in the Moray West consent application.

2.1). There are no proposed changes to the 85 turbine scenario which will remain part of the consent for Moray West.

Table 2.1 Turbine Parameters Used for Collision Risk Modelling (CRM) in the 2018 Application and CRM to inform this Consent Variation Screening Report

Collision Risk Modelling (CRM) input parameters		Design envelope parameters included in the Section 36 Consent – Annex 1		CRM parameters used in 2018 consent application (Model 2 WTG)	CRM parameters used to inform assessment of increased blade width for 72 turbine scenario
		85 turbine scenario (Model 2 WTG)	72 turbine scenario (Model 3 WTG)		
Number of turbines		85	72	85	72
Rotor radius (m)		97.5 (195 m rotor diameter)	115 (230 m rotor diameter)	97.5	115
Hub height (m)		132.5	150	132.5	150
Minimum blade tip clearance		35	35	35	35
Max blade width (m)		6	6	6	6.6 (increase from 6 m as specified in the Section 36 Consent)
Monthly proportion of time operational (all months) (%)		Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	85	85
Pitch (°)		Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	8	8
Rotor speed (rpm)	Minimum	Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	6.0	6.0
	Maximum	Not specified in Section 36 Consent - Annex 1	Not specified in Section 36 Consent - Annex 1	9.8	9.8

3 Updated collision risk modelling

3.1 Methodology

In order to provide a comparison with the collision risk modelling conducted as part of the application and post-application submissions all aspects of the modelling process (i.e. use of the Band (2012) CRM, species-specific parameters and other parameters for which changes are not proposed as identified in Table 3.1) and subsequent analyses (e.g. apportioning) are identical.

The following collision risk estimates are presented:

- Kittiwake
    - Total collision risk estimates (i.e. EIA scale/unapportioned) compared to the collision risk estimates presented in Table 3.32 in the Ornithological Addendum submitted in November 2018 (Table 3.1 in Section 3.2 below).
    - Apportioned collision risk estimates compared to the collision risk estimates presented in Table 3.32 in the Ornithological Addendum submitted in November 2018 and those upon which PVA metrics were based in the Scottish Ministers Appropriate Assessment (Table 3.1 in Section 3.2 below); and
    - Apportioned collision risk estimates compared to the collision risk estimates presented in Table 3.32 in the Ornithological Addendum submitted in November 2018 plus a commitment to reduce collision risk estimates by 7% and those upon which the Scottish Ministers decision were based in the Appropriate Assessment (Table 3.1 in Section 3.2 below).
- Great black-backed gull
    - Total collision risk estimates (i.e. EIA scale) compared to the total collision risk estimate presented in Table 3.2 (Section 3.2 below); and
    - Apportioned collision risk estimates compared to those calculated when applying those refinements described in Table 3.2 (Section 3.2 below) and those upon which decisions in the Scottish Ministers Appropriate Assessment were based.
- Gannet
    - Total collision risk estimates (i.e. EIA scale/unapportioned) compared to the collision risk estimates presented in Table 2.4 in the Ornithological Addendum submitted in November 2018 (Table 3.3 in Section 3.2 below).
- Herring gull
    - Total collision risk estimates (i.e. EIA scale) compared to the total collision risk estimate presented in Table 3.4 (Section 3.2 below); and
    - Apportioned collision risk estimates compared to those calculated when applying those refinements described in Table 3.4 (Section 3.2 below) and those upon which decisions in the Scottish Ministers Appropriate Assessment were based.

3.2 Results

3.2.1 Kittiwake

Table 3.1 below presents the unapportioned and apportioned collision risk estimates for kittiwake at East Caithness Cliffs SPA as presented in the Moray West application documents against the collision estimates calculated for this variation proposal using the envelope for the larger consented turbine (maximum 72 WTGs) with a proposed varied maximum blade width of 6.6 m. During the determination phase Moray West committed to reducing collision risk estimates by 7% (i.e. from 57 to 53 collisions apportioned to the East Caithness Cliffs SPA). This is to be achieved through either a reduction in maximum number of turbines installed or changes to other WTG design parameters.

Table 3.1 Collision risk estimates for kittiwake feature of East Caithness Cliffs SPA using proposed varied parameters for the Model 3 WTG (blade width) compared to results presented in the Moray West Application Addendum Document 2018.

Collisions	Results from Moray West Application Addendum Document 2018 (based on parameters for Model 2 WTG)				Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)			
	Breeding	Post-breeding	Pre-breeding	Annual	Breeding	Post-breeding	Pre-breeding	Annual
Unapportioned collisions	79	24	7	**109**	77	23	7	**107**
Collisions apportioned to East Caithness Cliffs SPA	55	1	1	**57**	54	1	1	**56**
Collisions apportioned to East Caithness Cliffs SPA with 7% reduction	51	1	0	**53**	50	1	0	**52**

The collision risk estimates presented in Table 3.1 are lower than the corresponding collision risk estimates used to support the conclusions reached in the Moray West RIAA 2018, Moray West Application Addendum Document 2018 and the Scottish Minister's Appropriate Assessment of 2019 for the kittiwake feature at East Caithness Cliffs SPA (i.e. those presented in Table 3.1). This confirms that the proposed changes to the turbine parameters considered in this report (i.e. an increase in blade width from 6 m to 6.6 m for the 72 turbine scenario) would not increase the collision rates for the kittiwake feature of the East Caithness Cliffs SPA when compared to the collision risk estimates used to support previous assessments conducted by the Applicant and Scottish Ministers.

3.2.2 Great black-backed gull

Table 3.2 below presents unapportioned and apportioned collision risk estimates for great black-backed gull at East Caithness Cliffs SPA as presented in the Moray West application documents against the collision estimates calculated for this variation proposal using the envelope for the larger consented turbine (maximum 72 WTGs) with a proposed varied maximum blade width of 6.6 m.

Table 3.2 Collision risk estimates for great black-backed gull feature of East Caithness Cliffs SPA using proposed varied parameters (blade width) compared to results presented in the Moray West Application Addendum Document 2018.						
Collisions	**Results from Moray West GBBG Report 2019 (based on parameters for Model 2 WTG)**			**Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)**		
	Breeding	**Non-breeding**	**Annual**	**Breeding**	**Non-breeding**	**Annual**
Unapportioned collisions	5.3	4.0	**9.3**	3.89	5.15	9.04
Collisions apportioned to East Caithness Cliffs SPA	1.54	0.42	**1.96**	1.50	0.41	1.91

The collision risk estimates presented in Table 3.2 are lower than the corresponding collision risk estimates used to support the conclusions reached in the Moray West Application Addendum Document 2018, the Great Black-Backed Gull (GBBG) Report 2019 and Scottish Minister's Appropriate Assessment 2019 for the great black-backed gull feature at East Caithness Cliffs SPA (i.e. those presented in Table 3.2). This confirms that the proposed changes to the turbine parameters considered in this report (i.e. an increase in blade width from 6 m to 6.6 m for the 72 turbine scenario) would not increase the collision rates for the great black-backed gull feature of the East Caithness Cliffs SPA when compared to the collision risk estimates used to support previous assessments conducted by the Applicant and Scottish Ministers.

3.2.3 Gannet

Table 3.3 below presents collision risk estimates for gannet at an EIA scale as presented in the Moray West application documents, against the collision estimates calculated for this variation proposal using the envelope for the larger consented turbine (maximum 72 WTGs) with a proposed varied maximum blade width of 6.6 m.

Table 3.3 Collision risk estimates for gannet using proposed varied parameters (blade width) compared to results presented in the Moray West Application Addendum Document 2018.								
Collisions	**Results from Moray West Application Addendum Document 2018 (based on parameters for Model 2 WTG)**				**Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)**			
	Breeding	**Post-breeding**	**Pre-breeding**	**Annual**	**Breeding**	**Post-breeding**	**Pre-breeding**	**Annual**
Unapportioned collisions (EIA scale)	10.2	1.5	0.7	**12.4**	9.8	1.5	0.7	**12.0**

The collision risk estimates presented in Table 3.3 are lower than the corresponding collision risk estimates used to support the conclusions reached in the Moray West Environmental Statement and those presented in the Moray West Application Addendum Document 2018 (i.e. those presented in Table 3.3). This confirms that the proposed changes to the turbine parameters considered in this report (i.e. an increase in blade width from 6 m to 6.6 m for the 72 turbine scenario) would not increase the collision rates for gannet when compared to the collision risk estimates used to support previous assessments conducted by the Applicant and Scottish Ministers.

3.2.4 Herring gull

Table 3.5 below presents unapportioned and apportioned collision risk estimates for herring gull at East Caithness Cliffs SPA as presented in the Moray West application documents against the collision estimates calculated for this variation proposal using the envelope for the larger consented turbine (maximum 72 WTGs) with a proposed varied maximum blade width of 6.6 m.

Table 3.4 Collision risk estimates for herring gull feature of East Caithness Cliffs SPA using proposed varied parameters (blade width) compared to results presented in the Moray West Application Addendum Document 2018.

Collisions	Results from Moray West RIAA 2018 (based on parameters for Model 2 WTG)			Results from additional collision risk modelling (2020 assessment) based on proposed varied parameters for Model 3 WTG (6.6 m blade width)		
	Breeding	Non-breeding	Annual	Breeding	Non-breeding	Annual
Unapportioned collisions	11.7	0.9	**12.6**	11.4	0.8	**12.2**
Collisions apportioned to East Caithness Cliffs SPA	3.8	0.01	**3.9**	3.7	0.01	**3.7**

The collision risk estimates presented in Table 3.5 are lower than the corresponding collision risk estimates used to support the conclusions reached in the Moray West RIAA and Scottish Minister's Appropriate Assessment 2019 for the herring gull feature at East Caithness Cliffs SPA (i.e. those presented in Table 3.5). This confirms that the proposed changes to the turbine parameters considered in this report (i.e. an increase in blade width from 6 m to 6.6 m for the 72 turbine scenario) would not increase the collision rates for the herring gull feature of the East Caithness Cliffs SPA when compared to the collision risk estimates used to support previous assessments conducted by the Applicant and Scottish Ministers.

4 Implications of updated collision risk estimates

4.1 Overview

This appendix has considered the changes proposed to the turbine parameters associated with Moray West and therefore the potential effects these changes may have on the assessments produced to support the Moray West application and the Scottish Minsters' Appropriate Assessment. This section

outlines the implications for these assessments as a result of the updated collision risk estimates for Moray West alone and, if any changes are identified that would affect those conclusions reached in relation to in-combination impacts (i.e. an increase in collision risk associated with Moray West), then the effect this has on cumulative/in-combination conclusions is discussed.

4.2 Implications for conclusions presented in the EIA and HRA (addendum) for kittiwake

Collision risk modelling undertaken for the Moray West application predicted collision mortality of 53-57 collisions / annum for kittiwakes from the East Caithness Cliffs SPA. On the basis of an impact of this magnitude the HRA addendum and Scottish Ministers' Appropriate Assessment concluded that there would not be an adverse effect on the integrity of the East Caithness Cliffs SPA.

Collision risk modelling of a 72 turbine project design with a blade width of 6.6 m predicts a lower collision rate (52-56 collisions / annum for kittiwake from the East Caithness Cliffs SPA) than that included in the application for Moray West and the consent decision reached by Scottish Ministers. A variation to increase the allowed maximum blade width to 6.6 m for the 72 turbine scenario would not, therefore, lead to a change to the conclusions reached by either the Applicant or the Scottish Ministers in relation to the Development in isolation or in-combination with other plans and projects (i.e. there would be no adverse effect on the integrity of the East Caithness Cliffs SPA).

4.3 Implications for conclusions presented in the EIA and HRA (addendum) for great black-backed gull

The HRA addendum predicted a total, EIA scale, collision mortality from the Moray West alone of 9-10 collisions/annum of which no more than 2.0 birds would comprise breeding adult great black-backed gulls from the East Caithness Cliff SPA. On the basis of an impact of this magnitude the HRA addendum and Scottish Ministers' Appropriate Assessment concluded that there would not be an adverse effect on the integrity of the East Caithness Cliff SPA.

Collision risk modelling of a 72 turbine project design with a blade width of 6.6 m predicts a lower collision rate 1.9 collisions / annum for great black-backed gull from the East Caithness Cliffs SPA) than that included in the application for Moray West and the consent decision reached by Scottish Ministers. A variation to increase the allowed maximum blade width to 6.6 m for the 72 turbine scenario would not, therefore, lead to a change in the conclusions reached by either the Applicant or the Scottish Ministers in relation to the Development in isolation or in-combination with other plans and projects (i.e. there would be no adverse effect on the integrity of the SPA).

4.4 Implications for conclusions presented in the EIA for gannet

The EIA predicted a total collision mortality from Moray West alone of 12.4 collisions/annum. On the basis of an impact of this magnitude the EIA concluded that the effect was of negligible or minor adverse significance which is not significant in EIA terms.

Collision risk modelling of a 72 turbine project design with a blade width of 6.6 m predicts a lower collision rate of 12.0 collisions / annum for gannet than that included in the application for Moray West and the

consent decision reached by Scottish Ministers. A variation to increase the allowed maximum blade width to 6.6 m for the 72 turbine scenario would not, therefore, lead to a change in the conclusions reached by either the Applicant or the Scottish Ministers in relation to the Development in isolation or cumulatively with other plans and projects (i.e. there would be no significant impact on gannet).

4.5 Implications for conclusions presented in the EIA and HRA for herring gull

The HRA addendum predicted a total, EIA scale, collision mortality from Moray West alone of 12.6 collisions/annum of which 3.9 birds would comprise breeding adult herring gulls from the East Caithness Cliff SPA. On the basis of an impact of this magnitude the HRA addendum and Scottish Ministers' Appropriate Assessment concluded that there would not be an adverse effect on the integrity of the East Caithness Cliff SPA.

Collision risk modelling of a 72 turbine project design with a blade width of 6.6 m predicts a lower collision rate 3.7 collisions / annum for herring gull from the East Caithness Cliffs SPA than that included in the application for Moray West and the consent decision reached by Scottish Ministers. A variation to increase the allowed maximum blade width to 6.6 m for the 72 turbine scenario would not, therefore, lead to a change in the conclusions reached by either the Applicant or the Scottish Ministers in relation to the Development in isolation or in-combination with other plans and projects (i.e. there would be no adverse effect on the integrity of the SPA).