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Consideration of HRA – WTG Pile Driving Inch Cape Offshore Wind Farm

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Contents

Contents.....	2
Table of Figures.....	4
Table of Tables.....	5
1 Document Purpose	6
2 HRA Process	6
3 Screening Summary	7
4 Conservation Objectives	8
5 EIA and HRA (2018).....	13
6 Generating Station Piling Strategy (2025).....	14
6.1 Piling schedule	14
6.2 Marine Mammal Mitigation.....	14
6.3 Project Alone Assessment Summary	15
6.3.1 Injury	15
6.3.2 Behavioural disturbance	15
6.3.3 iPCoD results	16
6.4 In-Combination Impact Assessment Screening	19
6.4.1 Completed Projects with Potential Piling Activities.....	19
6.4.2 Upcoming Projects	20
6.4.3 Projects with Limited Information	20
6.4.4 In-combination Summary.....	21
7 Assessment of AEoI.....	21
7.1 Assessment Comparison	21
7.1.1 Auditory injury.....	21
7.1.2 Disturbance	22
7.2 Assessment against COs.....	23

7.2.1	Isle of May SAC.....	23
7.2.2	Berwickshire and North Northumberland Coast SAC	26
7.2.3	Firth of Tay and Eden Estuary SAC	29
7.2.4	Moray Firth SAC	31
8	Conclusions	34
9	References	35

Table of Figures

FIGURE 6-1: PREDICTED POPULATION TRAJECTORIES FOR THE UN-IMPACTED (BASELINE) AND IMPACTED BOTTLENOSE DOLPHIN IPCoD SIMULATIONS FOR THE CES MU (PILING SCHEDULE 1 – TOP; PILING SCHEDULE 2 – BOTTOM)	17
FIGURE 6-2: PREDICTED POPULATION TRAJECTORIES FOR THE UN-IMPACTED (BASELINE) AND IMPACTED HARBOUR SEAL IPCoD SIMULATIONS FOR THE ES SMU (PILING SCHEDULE 1 – TOP; PILING SCHEDULE 2 – BOTTOM).....	18
FIGURE 6-3: PREDICTED POPULATION TRAJECTORIES FOR THE UN-IMPACTED (BASELINE) AND IMPACTED GREY SEAL IPCoD SIMULATIONS FOR THE ES SMU (PILING SCHEDULE 1 – TOP; PILING SCHEDULE 2 – BOTTOM).....	19
FIGURE 7-1: OVERLAP OF NOISE DISTURBANCE CONTOURS AT THE MODELLED PILING LOCATION CLOSEST TO THE ISLE OF MAY SAC (L010) AND THE MEAN PERCENTAGE OF THE ISLE OF MAY SAC POPULATION ESTIMATED TO BE PRESENT IN EACH GRID CELL AT ANY ONE TIME IN THE SUMMER FORAGING SEASON (CARTER ET AL., 2022).	25
FIGURE 7-2: OVERLAP OF NOISE DISTURBANCE CONTOURS AT THE MODELLED PILING LOCATION CLOSEST TO THE BERWICKSHIRE AND NORTH NORTHUMBERLAND COAST SAC (L010) AND THE MEAN PERCENTAGE OF THE BERWICKSHIRE AND NORTH NORTHUMBERLAND COAST SAC POPULATION ESTIMATED TO BE PRESENT IN EACH GRID CELL AT ANY ONE TIME IN THE SUMMER FORAGING SEASON (CARTER ET AL., 2022).	28
FIGURE 7-3: OVERLAP OF NOISE DISTURBANCE CONTOURS AT THE MODELLED PILING LOCATION CLOSEST TO THE FORTH OF TAY AND EDEN ESTUARY SAC (L019) AND THE MEAN PERCENTAGE OF THE FIRTH OF TAY AND EDEN ESTUARY SAC POPULATION ESTIMATED TO BE PRESENT IN EACH GRID CELL AT ANY ONE TIME IN THE SPRING FORAGING SEASON (CARTER ET AL., 2022).....	31
FIGURE 7-4: OVERLAP OF NOISE DISTURBANCE CONTOURS AT THE MODELLED PILING LOCATION CLOSEST TO THE BOTTLENOSE DOLPHIN HABITAT (L019)	33

Table of Tables

TABLE 1: CONSERVATION OBJECTIVES FOR ISLE OF MAY SAC, FIRTH OF TAY AND EDEN ESTUARY SAC, BERWICKSHIRE AND NORTH NORTHUMBERLAND COAST SAC AND MORAY FIRTH SAC	8
TABLE 2: CONSERVATION OBJECTIVES AND SITE SPECIFIC ADVICE CONSIDERED IN THE REPORT	10
TABLE 3: MAXIMUM NUMBER OF INDIVIDUALS WITH POTENTIAL TO EXPERIENCE CUMULATIVE PTS (USING THE SEL _{CUM} METRIC AND SOUTHALL <i>ET AL.</i> (2007) CRITERIA) AND BEHAVIOURAL DISTURBANCE (USING GRAHAM <i>ET AL.</i> (2017) DOSE-RESPONSE CURVE) BASED ON THE 2018 ASSESSMENT.	13
TABLE 4: MAXIMUM NUMBER OF INDIVIDUALS WITH POTENTIAL TO EXPERIENCE BEHAVIOURAL DISTURBANCE BASED ON PS-GS (INCH CAPE OFFSHORE LIMITED, 2025)	15
TABLE 5: COMPARISON BETWEEN 2018 HRA (INCH CAPE OFFSHORE LIMITED, 2018A) AND PS-GS (INCH CAPE OFFSHORE LIMITED, 2025) – NUMBER OF ANIMALS PREDICTED TO EXPERIENCE AUDITORY INJURY.....	21
TABLE 6: COMPARISON BETWEEN 2018 HRA (INCH CAPE OFFSHORE LIMITED, 2018A) AND PS-GS (INCH CAPE OFFSHORE LIMITED, 2025) – NUMBER OF ANIMALS PREDICTED TO EXPERIENCE BEHAVIOURAL DISTURBANCE	22

1 Document Purpose

This document aims to determine if the conclusions from the 2018 Habitat Regulations Assessment (HRA) conducted for the Inch Cape Offshore Wind Farm (OWF) Generating Station (GS) with respect to pile driving of the Wind Turbine Generators (WTGs) remain valid (Inch Cape Offshore Limited, 2018a). The document has been divided into the following sections:

- ▶ Section 2 - Summary of HRA process;
- ▶ Section 3 – Summary of European sites and impacts screened into the AA;
- ▶ Section 4 - Conservation Objectives;
- ▶ Section 5 - Summary of findings in 2018 EIA and HRA (Inch Cape Offshore Limited, 2018a, b);
- ▶ Section 6 - Summary of the Piling strategy for the Generating Station (PS-GS) (Inch Cape Offshore Limited, 2025), including In-combination Screening;
- ▶ Section 7 – Assessment of potential Adverse Effects on the Integrity (AEoI) of European sites;
- ▶ Section 8 – Conclusions; and
- ▶ Section 9 – References.

2 HRA Process

The Habitats Directive (92/43/EEC), on the conservation of natural habitats and of wild fauna and flora, protects habitats and species of European nature conservation importance. Together with Council Directive (2009/147/EC) on the conservation of wild birds (the 'Birds Directive'), the Directive provides the European Union's legal framework for the protection of wild fauna and flora and birds.

Although the UK is no longer a member of the EU, the Habitats Directive, along with the transposing Habitats Regulations, continues to serve as the legislative foundation for HRA in the UK via the EU Exit Regulations. The HRA process under the Habitats Regulations remains applicable, with minor modifications introduced by the EU Exit Regulations¹. Consequently, this document has been prepared on the assumption that all pertinent HRA-related legislation is still in effect, adhering to the Habitats Regulations that incorporated European HRA requirements into UK law. With respect to marine mammals, the objective of the Habitats Regulations is to maintain Favourable Conservation Status

¹ The EU (Withdrawal) Act 2018, as amended as by the EU (Withdrawal Agreement) Act 2020, gives Ministers in the UK Government and in the devolved administrations of Northern Ireland, Scotland and Wales, powers to make subordinate legislation amending laws that otherwise would not work appropriately as a result of the UK leaving EU, or to implement the Withdrawal Agreement.

(FCS) for the habitats and species listed in Annex II of the Habitats Directive. Post-EU Exit, the Habitats Regulations continue to reference these annexes, and accordingly, this report refers to the annexes of the Habitats Directive.

HRA is a multistage process which aims to determine the potential for Likely Significant Effects (LSE), assesses the potential for adverse impact on the integrity of a European site, examines alternative solutions and provides justification of Imperative Reasons of Overriding Public Interest (IROPI), as required. Defra (2021) guidance describes that the process can have up to three stages as outlined below:

- ▶ Screening - the first stage involves a screening for LSE which is a simple assessment to check or screen if, in the absence of mitigation, a proposal:
 - is directly connected with or necessary for the conservation management of a European site; and
 - risks having a significant effect on a European site on its own or in-combination with other proposals.
- ▶ Appropriate Assessment - the second stage is an Appropriate Assessment, which must be carried out if it is decided that there is a risk of a LSE on a European site or if there is not enough evidence to rule out a risk (as required by Article 6(3) of the Habitats Directive). The Appropriate Assessment (AA) should assess the likely significant effects of a proposal on the integrity of the site and its conservation objectives and consider ways to avoid or reduce (mitigate) any potential for an 'adverse effect on the integrity of the site'.
- ▶ Derogations - the third stage is known as a derogation (as outlined in Article 6(4) of the Habitats Directive) where, in certain circumstances, a proposal that has failed the integrity test may be allowed to go ahead. To decide if the proposal qualifies for a derogation, three legal tests must be applied. All three tests must be passed in sequence for a derogation to be granted:
 - there are no feasible alternative solutions that would be less damaging or avoid damage to the site;
 - the proposal needs to be carried out for imperative reasons of overriding public interest; and
 - the necessary compensatory measures can be secured.

3 Screening Summary

In support of the HRA process in the 2018 application, a screening exercise was carried out to identify which European Sites should be included within the 2018 HRA report and to outline the methodology to be used to assess LSE and/or adverse effects on European Sites (Inch Cape Offshore Limited, 2017). The following European Sites with marine mammal qualifying features (for which there is potential connectivity with an impact from the construction) were screened in:

- ▶ Berwickshire and North Northumberland Coast SAC (grey seal);
- ▶ Firth of Tay and Eden Estuary SAC (harbour seal);
- ▶ Isle of May SAC (grey seal); and
- ▶ Moray Firth SAC (bottlenose dolphin).

It was not possible to conclude no LSE for potential effects at the screening stage and therefore all four European Sites were taken forward to the AA (see section 5). It should be noted that this document refers only to impacts that are associated with piling. As such, although the Scoping Report considered a number of potential effects associated with construction, not all of these are associated with piling activities. As such, this report will focus only on two impacts:

- ▶ Behavioural disturbance from piling of WTGs; and
- ▶ Auditory injury, namely Permanent Threshold Shift (PTS), from piling of WTGs.

4 Conservation Objectives

The Conservation Objectives (COs) presented in the Scoping Report and 2018 HRA (Inch Cape Offshore Limited, 2017, 2018a) have since changed for all European Sites.

Table 1 shows the most up-to-date COs for all four SACs.

Table 1: Conservation Objectives for Isle of May SAC, Firth of Tay and Eden Estuary SAC, Berwickshire and North Northumberland Coast SAC and Moray Firth SAC

Site	Conservation Objective
Isle of May SAC (NatureScot, 2024c)	1) To ensure that the qualifying features of Isle of May SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. 2) To ensure that the integrity of Isle of May SAC is maintained or restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature: 2a - Grey seals are a viable component of the Isle of May SAC. 2b - The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals. 2c - The supporting habitats relevant to grey seal are maintained.
Berwickshire and North Northumberland Coast SAC	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the FCS of its Qualifying Features, by maintaining or restoring:

Site	Conservation Objective
(Natural England, 2018)	<ul style="list-style-type: none"> ▶ The extent and distribution of qualifying natural habitats and habitats of qualifying species; ▶ The structure and function (including typical species) of qualifying natural habitats; ▶ The structure and function of the habitats of qualifying species; ▶ The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely; ▶ The populations of qualifying species; and ▶ The distribution of qualifying species within the site.
Firth of Tay and Eden Estuary SAC (NatureScot, 2024b)	<ol style="list-style-type: none"> 1) To ensure that the qualifying features of Firth of Tay and Eden Estuary SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. 2) To ensure that the integrity of Firth of Tay and Eden Estuary SAC is maintained in the context of environmental changes by meeting objectives 2a, 2b and 2c: <ul style="list-style-type: none"> 2a - Harbour seal within the Firth of Tay and Eden Estuary SAC are not at significant risk from injury or mortality. 2b - The distribution of harbour seal throughout the site is maintained by avoiding significant disturbance. 2c - The supporting habitats and processes relevant to harbour seal are maintained.
Moray Firth SAC (NatureScot, 2024a)	<ol style="list-style-type: none"> 1) To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. 2) To ensure that the integrity of Moray Firth SAC is maintained or restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for bottlenose dolphin: <ul style="list-style-type: none"> 2a - the population of bottlenose dolphin is a viable component of the site; 2b - the distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance; 2c - the supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained.

Given that this report refers only to the underwater noise generated during piling, not all conservation objectives can be affected by this activity. Given that there is no impact – receptor pathway, increased underwater noise during piling does not have the potential to affect the CO of “*distribution and extent of habitats supporting the species*”. Table 2 summarises the COs that have the potential to be affected by the impacts of auditory injury and disturbance to marine mammals from pile driving and are therefore considered further in this report.

Table 2: Conservation Objectives and site specific advice considered in the report

Site	Conservation Objective	Site specific advice
Isle of May SAC (NatureScot, 2024c)	1) To ensure that the qualifying features of Isle of May SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. 2) To ensure that the integrity of Isle of May SAC is maintained or restored in the context of environmental changes: 2a - Grey seals are a viable component of the Isle of May SAC. 2b - The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seals.	Grey seals are considered to be in favourable condition at the Isle of May SAC. The SAC trend is stable/declining. <ul style="list-style-type: none"> ▶ Maintain a stable or increasing trend in grey seal numbers within the SAC, taking into account the population trend for the East Scotland Management Area. ▶ Ensure grey seal can move safely between the site and important areas of functionally linked sea outwith the site. To ensure that grey seal continue to use and access all areas within the Isle of May SAC used for pupping and nursing by avoiding significant disturbance (main grey seal breeding colonies are located at Rona, Kirkhaven jetties and Pilgrims Haven). <p>Impacts and effects are considered ‘significant’ where they could result in a permanent reduction or continued decline in the population such that recovery cannot be expected and consequently, further reduction in the contribution Isle of May SAC makes to the maintenance of grey seal in their natural range in the UK.</p> <p>‘Significant disturbance’ should be interpreted to mean disturbance that affects the integrity of the SAC through alteration of the distribution of grey seals such that recovery cannot be expected or effects can be considered long term. Significant disturbance should be assessed at the level of the site. It is expected that significant disturbance will lead to more than a transient effect on the distribution of grey seals. It may result in the following types of effect: • Contributes to the long-term decline in the use of the site by grey seal. • Changes to the distribution of grey seal on a continuing or sustained basis. • Changes to grey seal behaviour such that it reduces the ability of the species to survive, breed or rear their young.</p> <p>Temporary short-term disturbances for example a localised disturbance outwith the breeding season may be considered not to compromise the Conservation Objectives provided it can be demonstrated with a high degree of certainty that the population can fully recover.</p>
Berwickshire and North	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to	This site crosses the border between England and Scotland.

Site	Conservation Objective	Site specific advice
<p>Northumberland Coast SAC (Natural England, 2018)</p>	<p>achieving the FCS of its Qualifying Features, by maintaining or restoring:</p> <ul style="list-style-type: none"> ▶ The populations of qualifying species; and ▶ The distribution of qualifying species within the site. 	<p>The southern half of the SAC is an important haul-out area for grey seals. There are two main haul out sites in the SAC including the Farne Islands and Lindisfarne National Nature Reserve (NNR). Lying partly within the SAC, Fast Castle is a colony on the Berwickshire mainland coast.</p> <p>Throughout the year and during the breeding period in particular, grey seals also spend a large proportion of their time in waters within the SAC, particularly near the shore, often foraging for food or resting.</p> <p>Disturbance is defined by the Seal Conservation Society: “Human interaction with individuals or colonies of seals, sea lions and fur seals can be considered to cause disturbance if the interaction disrupts or alters the animals’ normal behaviour.”</p> <p>From a conservation perspective disturbance is important if it results in decreased survival, reproductive rate, population shifts or declines.</p>
<p>Firth of Tay and Eden Estuary (NatureScot, 2024b)</p>	<p>1) To ensure that the qualifying features of Firth of Tay and Eden Estuary SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.</p> <p>2) To ensure that the integrity of Firth of Tay and Eden Estuary SAC is maintained in the context of environmental changes by meeting objectives 2a, and 2b:</p> <p>2a - Harbour seal within the Firth of Tay and Eden Estuary SAC are not at significant risk from injury or mortality</p> <p>2b - The distribution of harbour seal throughout the site is maintained by avoiding significant disturbance.</p>	<p>Harbour seals at Firth of Tay and Eden Estuary SAC are in an unfavourable condition.</p> <ul style="list-style-type: none"> ▶ Ensure the harbour seal population has the ability to recover. ▶ Ensure harbour seal can move safely between the site and important areas of functionally linked sea outwith the site. ▶ Ensure harbour seal continue to have access to and can utilise all habitats suitable for haul-outs and breeding associated within the site. <p>Any assessment of impacts on the trend in harbour seal numbers within the SAC should take into account the population trend of the East Coast of Scotland Seal Management Area.</p> <p>Temporary impacts on these objectives resulting from plans or projects can only be permitted where there is a high degree of certainty that the harbour seal numbers within the East Coast of Scotland Seal Management Area will be able to quickly recover from the impact and that impacts do not prevent the ability of harbour seal to fully recover in the long-term.</p> <p><u>‘Significant disturbance’</u> should be interpreted to mean disturbance that affects the integrity of the SAC through alteration of the distribution of harbour seals such that recovery cannot be expected or effects can be considered long term. Significant disturbance should be assessed at the level of the site. It is expected that significant disturbance will lead to more than a transient effect on the distribution of harbour seals. It</p>

Site	Conservation Objective	Site specific advice
		<p>may result in the following types of effect: • Contributes to the long-term decline in the use of the site by harbour seal. • Changes to the distribution of harbour seal on a continuing or sustained basis. • Changes to harbour seal behaviour such that it reduces the ability of the species to survive, breed or rear their young.</p> <p>Temporary short-term disturbances for example a localised disturbance outwith the breeding season may be considered not to compromise the Conservation Objectives provided it can be demonstrated with a high degree of certainty that the species can fully recover. Factors determining the potential for harbour seal to recover include the timing, frequency and duration of the activity around vulnerable stages of their life cycle.</p>
Moray Firth SAC (NatureScot, 2024a)	<p>1) To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.</p> <p>2) To ensure that the integrity of Moray Firth SAC is maintained or restored in the context of environmental changes:</p> <p>2a - the population of bottlenose dolphin is a viable component of the site;</p> <p>2b - the distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance.</p>	<p>The population of the Moray Firth SAC is taken as being equivalent to that of the CES Management Unit. The SAC appears to be stable.</p> <p>Interpretation of '<u>significant disturbance</u>' will depend on the context, including the information that is provided through the plan or project, and is then subject to the appraisal to assess risk. It should be interpreted to mean disturbance that affects the integrity of the site through alteration of the distribution of bottlenose dolphin within the SAC such that recovery cannot be expected, or effects can be considered long term. Bottlenose dolphin calves are highly dependent on their mothers for up to 2 years therefore prolonged disturbance is more likely to constitute significant disturbance and to have an impact on site integrity. It is expected that significant disturbance will lead to more than a transient effect on the distribution of bottlenose dolphin. It may result in the following effects: • Contributes to the long-term decline in the use of the site by bottlenose dolphin. • Changes to the distribution of bottlenose dolphin on a continuing or sustained basis. • Changes to bottlenose dolphin behaviour such that it reduces the ability of the species to survive, breed or rear their young.</p>

5 EIA and HRA (2018)

The number of animals potentially affected by auditory injury and behavioural disturbance, based on the worst-case scenario assessed in the 2018 HRA (Inch Cape Offshore Limited, 2018a), is presented in Table 3.

For PTS onset, the instantaneous injury ranges were assessed as below 50 m for bottlenose dolphins and both species of seals, and as such the number of animals potentially affected was not quantified. The cumulative PTS injury contours based on the Southall *et al.* (2007) criteria and species-specific density surfaces were used to estimate the number of individuals of each species which have the potential to be exposed to levels of noise sufficient to induce the onset of PTS (Inch Cape Offshore Limited, 2018b). For disturbance, numbers of animals were determined using a dose-response function (Graham *et al.*, 2017, Inch Cape Offshore Limited, 2018b). The results presented in Table 3 include single (one vessel) and concurrent piling (two vessels).

Table 3: Maximum number of individuals with potential to experience cumulative PTS (using the SEL_{cum} metric and Southall *et al.* (2007) criteria) and behavioural disturbance (using Graham *et al.* (2017) dose-response curve) based on the 2018 assessment.

Impact	Pile type	Number of bottlenose dolphins		Number of harbour seals		Number of grey seals	
		Single	Concurrent	Single	Concurrent	Single	Concurrent
Auditory Injury (cumulative PTS)	Pin pile	0	0	0	<1	0	<1
	Monopile	0	0	<1	<2	<13	47
Behavioural Disturbance	Pin pile	5	6	12	17	675	810
	Monopile	7	7	15	20	1,085	1,236

The 2018 HRA (Inch Cape Offshore Limited, 2018a) concluded the following:

- ▶ The long-term viability of the populations using the SACs was unlikely to be adversely affected by the Development;
- ▶ While some individuals may be temporarily displaced, it is likely that they will use suitable alternative local habitat. Any changes to the distribution of the species within the site are likely to be short-term;
- ▶ No change to the distribution and extent of habitats supporting the species anticipated as a result of increased underwater noise;

- ▶ No change to the structure, function and supporting processes of habitats supporting the species anticipated as a result of increased underwater noise;
- ▶ No significant disturbance of the species is anticipated.

6 Generating Station Piling Strategy (2025)

6.1 Piling schedule

In line with the information presented in the ICOL PS-GS (Inch Cape Offshore Limited, 2025), piling works may take place between December 2025 and September 2026. For the purpose of disturbance assessment (using iPCoD model), two piling schedule scenarios were considered, as described below.

Piling Schedule 1: piling between December 2025 and May 2026. This consists of 47 days piling for monopiles only (Dec-May), 11 days piling for jackets only (Mar-Apr) and 7 days with concurrent monopile and jacket piling (Mar-Apr). Total number of piling days = 65.

Piling Schedule 2: piling between February 2026 and September 2026. This consists of 51 days piling for monopiles only (Feb-Jul), 15 days piling for jackets only (9 between Feb-Apr, then 6 between Aug-Sep) and 3 days with concurrent monopile and jacket piling (Mar). Total number of piling days = 69.

It is noted that the detailed programme for pile installation activities is being finalised, and the final piling schedule is subject to several factors, such as vessel availability windows, coordination with other construction activities (e.g. installation of transition piece and Inter Array Cables), weather conditions and other unanticipated programme constraints. Moreover, there is a risk that piling works could run over to October, in the event of unfavourable weather conditions, breakdowns and other unplanned delays.

6.2 Marine Mammal Mitigation

In order to ensure a negligible risk of PTS from the WTG piling, mitigation will be applied. The mitigation has been designed around the greatest (i.e., worst case) potential impact ranges as outlined in PS-GS (Inch Cape Offshore Limited, 2025). All WTG pile driving will include a soft start of 30 minutes at 10% of the maximum hammer energy, before the ramp up of hammer energy commences. ADDs will be applied for 10 minutes for pin piles and 15 minutes for monopiles to ensure that marine mammals are deterred from the instantaneous injury zone (Inch Cape Offshore Limited, 2025).

6.3 Project Alone Assessment Summary

6.3.1 Injury

Across all piling locations and foundation types considered in the PS-GS, the maximum instantaneous injury ranges (using the SPL_{peak} metric) for bottlenose dolphin and seal species are 50 m and 90 m, respectively for a monopile WTG, and <50 and 60 m respectively for a jacket WTG (Inch Cape Offshore Limited, 2025). The maximum cumulative injury ranges (using the SEL_{cum} metric) for single piling across all piling locations and foundation types is less than 100 m for bottlenose dolphin and seals for both monopile and jacket WTGs (Inch Cape Offshore Limited, 2025). There is no risk for Coastal East Scotland bottlenose dolphins to experience additional injury during concurrent piling as the overlap of cumulative PTS contours with the key dolphin habitat is not expected. For seals the maximum cumulative PTS range for concurrent piling is also expected to be less than 100 m (Inch Cape Offshore Limited, 2025).

ADD use duration has been calculated to balance the time required to mitigate against PTS onset from piling with the additional disturbance to marine mammals caused by the ADD (Graham *et al.*, 2019)). Use of pre-piling ADD for 10 minutes for jackets and 15 minutes for monopiles was concluded for harbour porpoise but is considered appropriate to also ensure that no bottlenose dolphins or harbour and grey seals are present within the instantaneous injury zone before piling commences at monopiles and jackets.

6.3.2 Behavioural disturbance

The behavioural disturbance assessment utilises the dose-response approach, with the results presented in Table 4 reflecting the worst-case scenario across all modelled locations. For more detailed information, refer to the Inch Cape Offshore Limited (2025).

Table 4: Maximum number of individuals with potential to experience behavioural disturbance based on PS-GS (Inch Cape Offshore Limited, 2025)

Pile type	Number of bottlenose dolphins		Number of harbour seals		Number of grey seals	
	Single	Concurrent	Single	Concurrent	Single	Concurrent
Pin pile	12	18	12	21	2,568	2,974
Monopile	16		21		2,752	

6.3.3 iPCoD results

To determine if this level of disturbance results in a population level effect, the interim Population Consequences of Disturbance (iPCoD) model was run for two piling schedules and the following species:

- ▶ Bottlenose dolphin against Coastal East Scotland (CES) Management Unit (MU) population (Figure 6-1). The level of disturbance predicted for ICOL is for both piling schedules is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is within <1%). The impacted population is predicted to continue on an increasing trajectory, the same as the un-impacted population.
- ▶ Harbour seal (Figure 6-2) against East Scotland (ES) Seal Monitoring Unit (SMU) population. The level of disturbance predicted for ICOL for both piling schedules is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is 0.00%). The impacted population is predicted to decrease, at exactly the same size of the un-impacted population
- ▶ Grey seal (Figure 6-3) against ES SMU population. The level of disturbance predicted for ICOL for both piling schedules is not sufficient to result in any change at the population level (deviation in the mean impacted population size from the mean un-impacted population size is between 0.00% and 0.02%). The impacted population is predicted to increase, at 99.98 – 100% the size of the un-impacted population. It should be noted that the numbers of grey seals at risk of being disturbed taken forward to the iPCoD modelling are based on Carter et al. (2022) density surface which represent the distribution of grey seals during the main foraging season (summer). Additionally, the population size that the iPCoD was run against is based on the August haul-out counts (summer). Therefore, the results of the iPCoD do not account for the grey seal distribution during the moult or breeding periods.

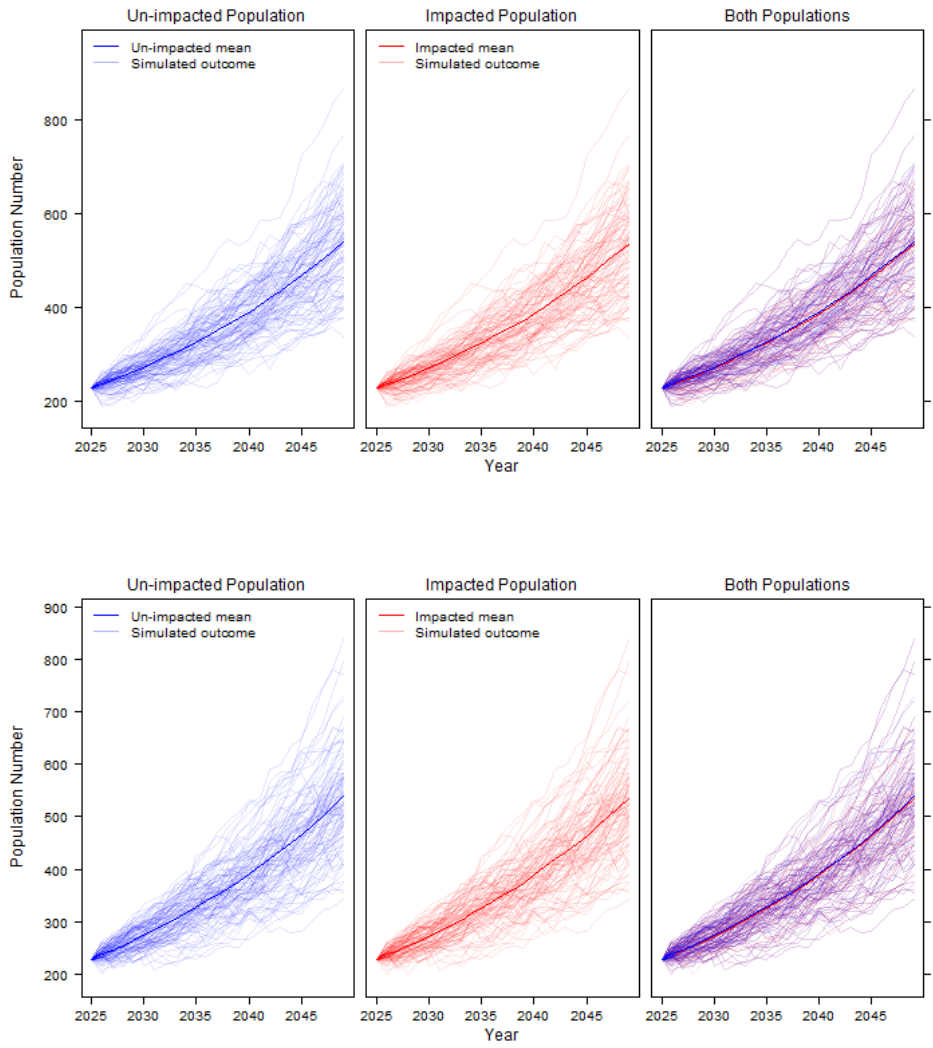


Figure 6-1: Predicted population trajectories for the un-impacted (baseline) and impacted bottlenose dolphin iPCoD simulations for the CES MU (Piling Schedule 1 – top; Piling Schedule 2 – bottom)

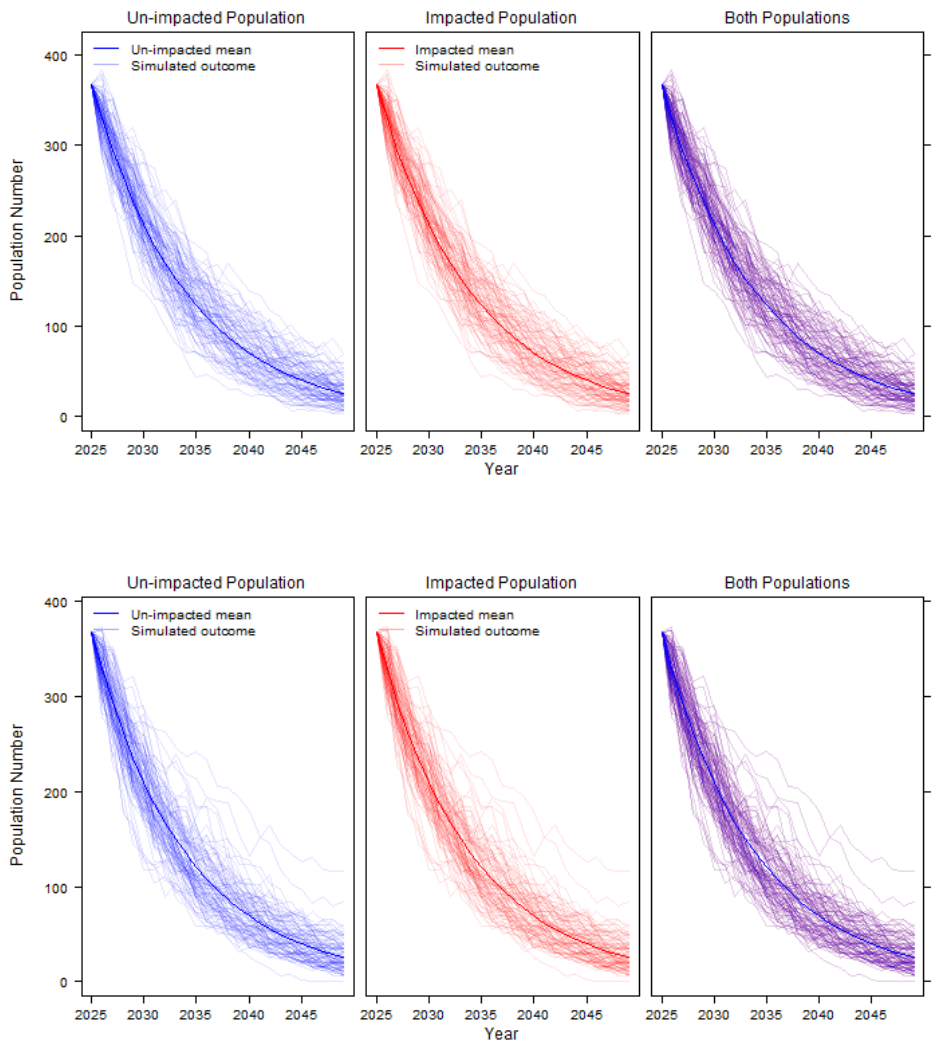
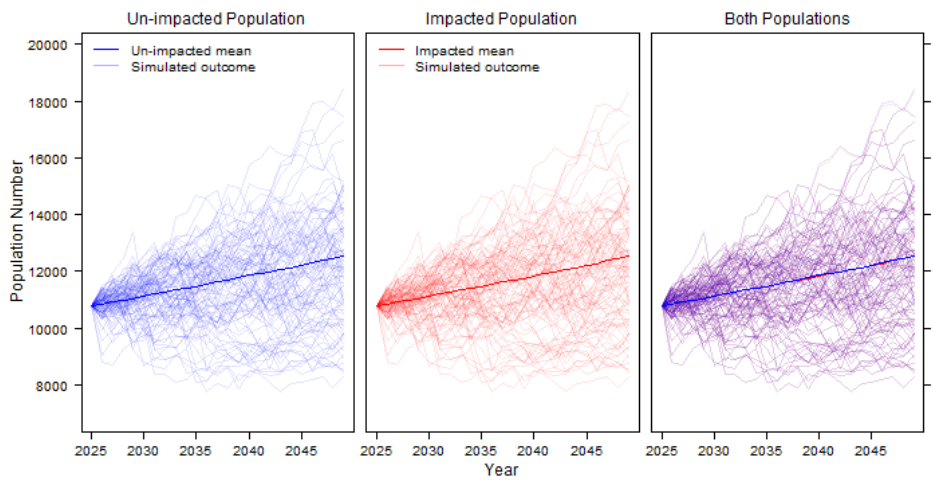


Figure 6-2: Predicted population trajectories for the un-impacted (baseline) and impacted harbour seal iPCoD simulations for the ES SMU (Piling Schedule 1 – top; Piling Schedule 2 – bottom)



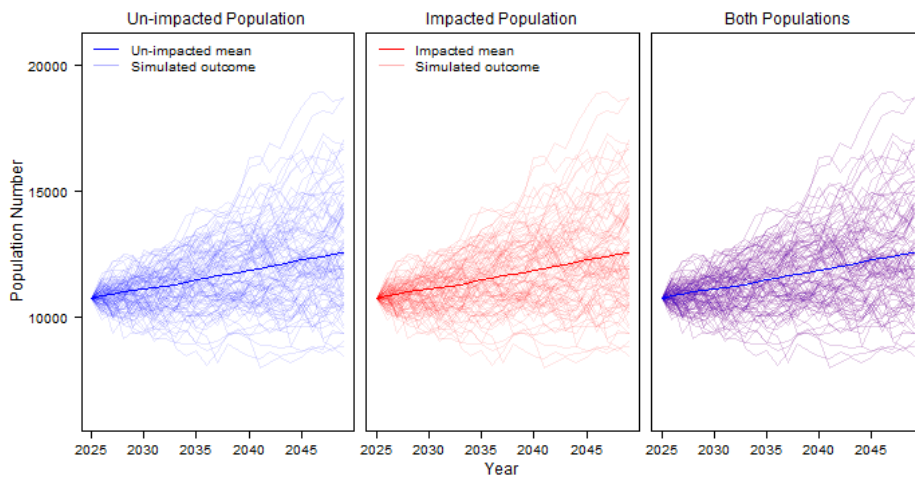


Figure 6-3: Predicted population trajectories for the un-impacted (baseline) and impacted grey seal iPCoD simulations for the ES SMU (Piling Schedule 1 – top; Piling Schedule 2 – bottom)

6.4 In-Combination Impact Assessment Screening

A review of publicly available data was conducted to identify projects that involved piling or other construction activities within one year before and after the piling of WTGs at Inch Cape OWF. Below is a summary of the identified projects for which data was collected, along with their respective timeframes where available.

6.4.1 Completed Projects with Potential Piling Activities

Port of Leith Outer Berth

The deepening of the approach channel to the Port of Leith was expected to take approximately 15 months (Royal Haskoning DHV, 2023). This included sheet piling works for an improved quay, utilising either percussive or vibratory piling methods. Given that these methods produce significantly lower noise levels, they result in more localised effects compared to impact piling. The works were anticipated to be completed by Q3 2024.

Re-development of Dundee Port

The re-development of port at Dundee involved both impact and vibratory piling (Wildlife Consulting Ltd., 2020). The piling activities occurred between October 2020 and June 2022 (with impact piling limited to a maximum of four hours within a 24 hour period), and the project has since been completed.

Levenmouth Demonstration Turbine

Also known as the Fife Energy Park Offshore Demonstration Wind Turbine, this project is located at the Fife Energy Park in Methil, within the Firth of Forth. The turbine is currently operational, and there are no additional in-combination effects beyond the established baseline.

Neart na Gaoithe

All foundation jacket installations for this offshore wind farm have been completed². Wind turbine installations are now also complete. Guard vessels remain present in the wind farm area and within the export cable corridor.

Seagreen

The Seagreen offshore wind farm has been fully commissioned. Current and future operations are focused on operations and maintenance³.

6.4.2 Upcoming Projects

Seagreen 1A

This project is requesting a variation in its consent to allow construction between January 2029 and December 2032, which is significantly later than the originally planned 2025 start (Seagreen, 2024).

Berwick Bank

This project has not yet received consent. The construction is not expected to take place between 2025 and 2027, as indicated in the EIA Report (RPS, 2022).

6.4.3 Projects with Limited Information

Port of Dundee Expansion and Marine Aggregate Extraction

A scoping report for this project was submitted in 2013 (Royal Haskoning DHV, 2013), however, there have been no further updates on the Marine Scotland Government website.

Edinburgh Marine & Granton Harbour

There is no available information regarding the timing of this project on the Marine Scotland Government website⁴. Dredging activities have been mentioned, but no further details are provided.

² [Neart na Gaoithe Weekly Notice of Operations](#)

³ [Seagreen Offshore Wind Farm Weekly Notice of Operations](#)

⁴ [Edinburgh Marina, Granton Harbour Redevelopment | marine.gov.scot](#)

6.4.4 In-combination Summary

All identified projects that could contribute to in-combination effects associated with piling on marine mammals have now been completed or are anticipated to occur more than one year after pile driving at Inch Cape. While vessel activity may continue in the area due to other construction activities at Neart na Gaoithe and operation and maintenance Seagreen, the most noise-intensive construction activities at these wind farms have concluded. As a result, there is no potential for in-combination effects from piling on the protected features of the SACs and further consideration of the in-combination effects is not necessary.

7 Assessment of AEol

7.1 Assessment Comparison

7.1.1 Auditory injury

The maximum number of animals, across single and concurrent scenarios for monopiles and jackets, predicted to experience PTS in the 2018 HRA (Inch Cape Offshore Limited, 2018a) and in PS-GS (Inch Cape Offshore Limited, 2025) are presented in Table 5. The 2018 HRA does not provide the number of animals affected by instantaneous PTS. Therefore, the number of animals for the 2018 assessment is provided based on cumulative PTS. For the current assessment, in order to align with the 2018 assessment, the numbers presented in Table 5 refer to the maximum number of animals affected across both – instantaneous and cumulative injury (Inch Cape Offshore Limited, 2025).

Table 5: Comparison between 2018 HRA (Inch Cape Offshore Limited, 2018a) and PS-GS (Inch Cape Offshore Limited, 2025) – number of animals predicted to experience auditory injury

Pile type	Number of bottlenose dolphins		Number of harbour seals		Number of grey seals	
	2018	2025	2018	2025	2018	2025
Pin pile	0	0	<1	<1	<13	<1
Monopile	0	0	<2	<1	47	51

Depending on the species considered, the number of animals that could be potentially affected by auditory injury is similar or reduced compared to the assessment presented in the 2018 HRA . The exception is installation of monopiles and associated effects on grey seal, as PS-GS assessment (Inch Cape Offshore Limited, 2025) predicted a slightly larger number of grey seals that could experience injury compared to the 2018 HRA assessment (Inch Cape Offshore Limited, 2018a). However, it is

noted that there are significant uncertainties with modelling cumulative PTS, and therefore the results are considered highly precautionary. It is expected that following the application of embedded mitigation (soft-start and ramp-up) as well as ADD activation, no animals will experience auditory injury during piling of WTGs.

7.1.2 Disturbance

The maximum numbers of animals, for single and concurrent scenarios, predicted to experience behavioural disturbance in the 2018 HRA (Inch Cape Offshore Limited, 2018a) and in PS-GS (Inch Cape Offshore Limited, 2025) are presented in Table 6.

Table 6: Comparison between 2018 HRA (Inch Cape Offshore Limited, 2018a) and PS-GS (Inch Cape Offshore Limited, 2025) – number of animals predicted to experience behavioural disturbance

Species / # animals disturbed	HRA (2018)		PS-GS (2025)	
	Single	Concurrent	Single	Concurrent
Bottlenose dolphin	7	7	16	18
Harbour seal	15	20	21	21
Grey seal	1,085	1,236	2,752	2,974

The number of animals predicted to experience behavioural disturbance based on the PS-GS is greater than the estimates from the 2018 HRA (Inch Cape Offshore Limited, 2018a). This variation arises from the use of different assessment methodologies and animal densities. For example, in the 2018 HRA the number of harbour and grey seals disturbed was determined using the Graham *et al.* (2017) dose-response function for porpoise, whilst in the PS-GS, a dose-response function from Whyte *et al.* (2020) for harbour seals was used. Additionally, the densities taken forward to the assessments are different. Based on the 2018 EIAR, the number of bottlenose dolphins predicted to experience behavioural disturbance were based on a tailored approach where the bottlenose dolphin population (195 individuals) was split between the Moray Firth (Cape Wrath to Rattray Head) and east coast (from Rattray Head south). A similar approach was applied in the PS-GS, however, using the updated size of the CES MU population of 226 individuals, distributed between the Moray Firth and the remaining area of the CES MU (from Inverallochy south). For seals, the numbers of animals disturbed presented in the 2018 HRA was based on SMRU and Marine Scotland (2017) estimated at-sea distribution maps (Inch Cape Offshore Limited, 2018b, a), whilst in the PS-GS, the more recent Carter *et al.* (2022) maps were used. Further assessment against COs is provided in section 7.2.

7.2 Assessment against COs

7.2.1 Isle of May SAC

Grey seals in the UK breed during the autumn, with a clockwise cline in the mean birth date observed across different regions (SCOS, 2023). In east Scotland, grey seals pupping season runs from September to late November with the main breeding taking place in the SAC between October to December (*pers. comms* with SMRU). There is also a probability of grey seal pups to be present within the colony throughout January. Grey seal moulting period in Scotland occurs between January and April (SCOS, 2023).

Given that piling activities are planned to take place between December and September, with a potential to run into October depending on weather conditions, the potential overlap with the WTG piling and the start and end of the grey seal breeding season (September to December) at the Isle of May SAC cannot be discounted. Temporal overlap of WTG piling and the grey seal moult season is also anticipated.

7.2.1.1 Project Alone

The Project Alone assessment of AEoI for the Isle of May SAC with respect to the grey seal COs is presented in sections 7.2.1.1.1 to 7.2.1.1.4 and conclusions are provided in section 7.2.1.1.5.

7.2.1.1.1 Grey seals are a viable component of the Isle of May SAC

The risk of auditory injury to grey seals is negligible due to the application of mitigation measures (see section 6.2). As such, WTG piling activities will not affect the maintenance of the integrity of the grey seal population within the SAC and will not lead to a permanent reduction in the grey seal population.

7.2.1.1.2 Maintain a stable or increasing trend in grey seal numbers within the SAC, taking into account the population trend for the East Scotland Management Area

Grey seals are considered to be in favourable condition at the Isle of May SAC and the trend is stable/declining (NatureScot, 2024c). In line with the advice provided in NatureScot (2024c), given that there is no site-reference population or trend for grey seals at this site, the site trend is considered in relation to the wider ES SMU. The results of the iPCoD modelling show that for grey seals within ES SMU, the impacted population is predicted to continue on an increasing trajectory, the same as the un-impacted population (see Figure 6-3). As such, no change to the increasing trend within the ES SMU is predicted as a result of WTG piling.

7.2.1.1.3 Ensure grey seal can move safely between the site and important areas of functionally linked sea outwith the site

Based on the Carter *et al.* (2022) SAC-specific distribution maps and the Whyte *et al.* (2020) dose response function, it is expected that up to 17% of the Isle of May SAC population⁵ could experience behavioural disturbance per WTG piling day (Figure 7-1); when considering the SAC-specific summer foraging distribution). It should be however noted that this value is based on the at-sea distribution of seals which haul-out in the SAC in August and may be therefore different to the number of seals that breed in the SAC during breeding period. The overlap with the grey seal breeding period at the Isle of May SAC (Sept - December) cannot be discounted. While there will be temporal overlap during the moulting period (Dec - April), it is a time when grey seals tend to spend more time hauled out and are thus less available to be disturbed at sea (this is not represented in SAC specific distribution map presented in Figure 7-1, as data used in Carter *et al.* (2022) covers summer distribution only; this does not apply to moulted pups, i.e. young-of-the-year).

⁵ See Carter *et al.* (2022) Supplementary Materials S10 Results: SAC-Specific Distribution Maps. The Isle of May SAC-specific distribution map for grey seals represents the distribution of grey seals during the main foraging season (summer) that haul out at the SAC. This is therefore not representative of grey seal distribution during the moult or breeding periods, or of young-of-the year.

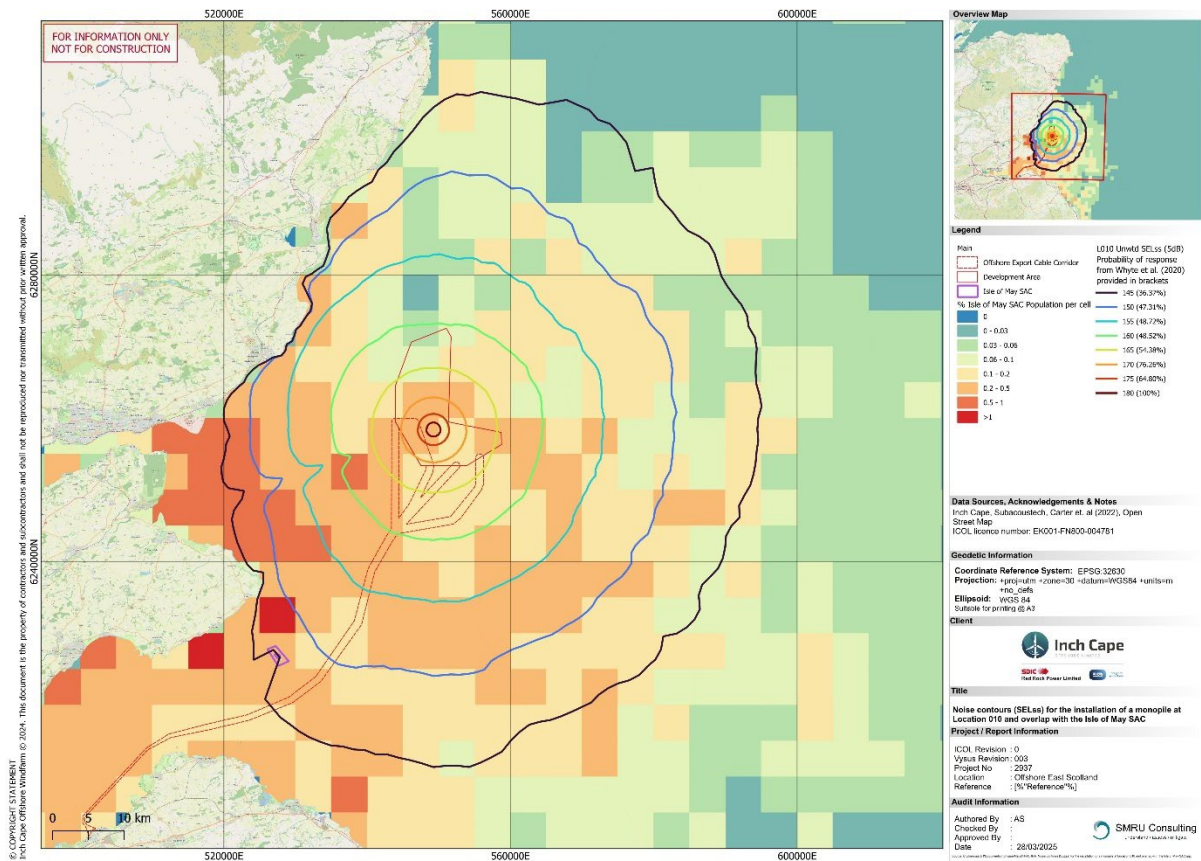


Figure 7-1: Overlap of noise disturbance contours at the modelled piling location closest to the Isle of May SAC (L010) and the mean percentage of the Isle of May SAC population estimated to be present in each grid cell at any one time in the summer foraging season (Carter et al., 2022).

It is anticipated that grey seals may be temporarily disturbed from areas outwith the SAC during WTG piling. Considering that the installation of the WTGs is going to take up to 72 days, SAC grey seals may be temporarily deterred from a portion of their summer foraging distributional range. However, it should be noted that not all seals will respond to piling to the same extent (Aarts et al., 2018). As such, it is expected that not all animals will stop using the area in the vicinity of the works. For example, at the most outer noise contour which overlaps with the Isle of May SAC, it is anticipated that at any given time approximately 36% of individuals would respond (Whyte *et al.*, 2020) (Figure 7-1). The site trend is considered in relation to the wider ES SMU; as shown by the population modelling for the East Scotland SMU (Figure 6-3), the temporary disturbance and potential temporary barrier effects are unlikely to cause a reduction in the SMU grey seal population. For instance, previous studies on harbour seal redistribution as a response to piling showed that it is likely to be temporarily limited to a duration of two hours following the cessation of pile driving activity (Russell *et al.*, 2016). Piling at WTGs will not reduce the ability of SAC grey seals to use all areas of importance within the site or the access to supporting habitats in the long-term.

7.2.1.1.4 The distribution of grey seal throughout the site is maintained by avoiding significant disturbance of grey seal

As presented in Figure 7-1, there is a potential for overlap of the outermost noise contours and the east of the Isle of May SAC. However, based on the Whyte *et al.* (2020) dose response function it is anticipated that at any given point in time, approximately 36% of individuals that haul out at the SAC in summer may respond behaviourally to this level of sound. It is not anticipated that this level of sound will limit access to shore areas or affect the ability of seals to move between the breeding colonies within the SAC (Rona, Kirkhaven (including Jetties) and Pilgrims Haven). As such, whilst temporary disturbance of SAC seals whilst at sea cannot be excluded, it is not considered to be “significant disturbance” as it is not expected to alter the distribution of grey seals such that recovery cannot be expected, or effects can be considered long term.

7.2.1.1.5 Conclusion

Based on the assessment presented above, adverse effects on the qualifying Annex II marine mammal species, grey seal, which undermine the COs of the Isle of May SAC will not occur as a result of injury or disturbance from underwater noise generated from WTG piling.

7.2.2 Berwickshire and North Northumberland Coast SAC

In east Scotland, grey seal pupping season runs from September to late November with the main breeding taking place in the SAC between October and December. Given that piling the piling window is assumed to be from December to September, with a risk of running over into October subject to weather conditions (see section 6.1), the potential overlap with the WTG piling and the end of the grey seal breeding season within east Scotland cannot be discounted.

In eastern England, breeding primarily takes place between mid-October and mid-January and pupping between early November and mid-December (SCOS, 2023). As such, temporal overlap of piling of the WTGs at the Inch Cape OWF with the breeding season in England cannot be discounted.

7.2.2.1 Project Alone

The assessment Project Alone of AEoI of the Berwickshire and North Northumberland Coast SAC with respect to grey seal COs is presented in sections 7.2.2.1.1 and conclusions are provided in section 7.2.2.1.3.

7.2.2.1.1 Maintaining or restoring the populations of qualifying species

The risk of auditory injury to grey seals is negligible due to application of mitigation measures (see section 6.2). As such, WTG piling activities will not affect the population size nor its recruitment and reproductive capability.

As presented in Figure 7-2, overlap of the noise contours with the SAC is not anticipated. However, animals outside the SAC boundaries could be exposed to disturbance. Based on the Carter *et al.* (2022) SAC-specific distribution maps and the Whyte *et al.* (2020) dose-response function, it is expected that at any given time, up to 7% of the SAC population⁶ could experience behavioural disturbance (Figure 7-2); when considering the SAC-specific summer foraging distribution). However, it should be noted that although the temporal overlap towards the end of breeding period is likely, it is a time when grey seals tend to spend more time hauled out and are thus less available to be disturbed at sea (this is not represented in SAC specific distribution map presented in Figure 7-2, as data used in Carter *et al.* (2022) covers summer distribution only; this does not apply to moulted pups, i.e. young-of-the-year).

⁶ See Carter *et al.* (2022) Supplementary Materials S10 Results: SAC-Specific Distribution Maps. The Berwickshire and North Northumberland Coast SAC-specific distribution map for grey seals represents the distribution of grey seals during the main foraging season (summer) that haul out at the SAC. It is not representative of grey seal distribution during the moult or breeding periods, or of young-of-the-year.

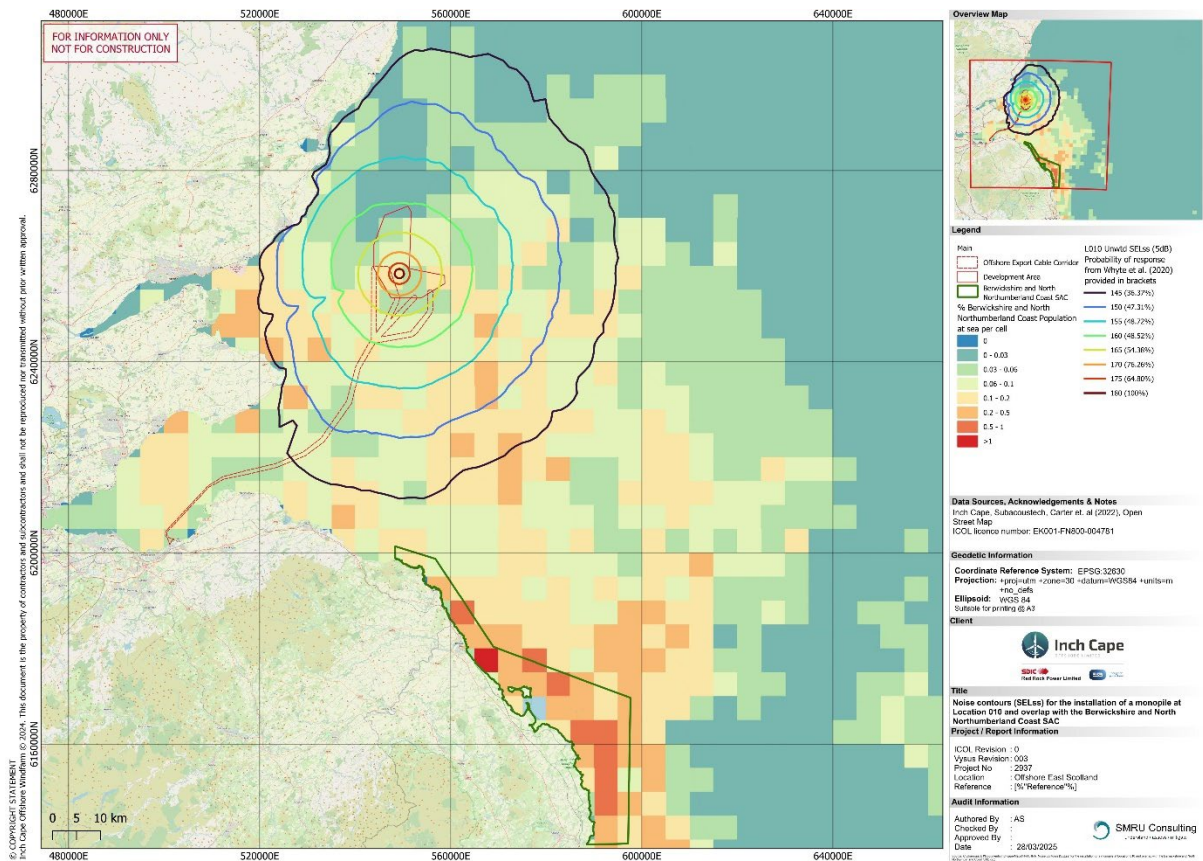


Figure 7-2: Overlap of noise disturbance contours at the modelled piling location closest to the Berwickshire and North Northumberland Coast SAC (L010) and the mean percentage of the Berwickshire and North Northumberland Coast SAC population estimated to be present in each grid cell at any one time in the summer foraging season (Carter et al., 2022).

Given that there is no site-reference population or trend for grey seals at this site, the site trend is considered in relation to the wider ES SMU⁷. The results of the iPCoD modelling show that for grey seals within ES SMU, the impacted population is predicted to continue on an increasing trajectory, the same as the un-impacted population (see Figure 6-3). As such, the SMU population of grey seal is not expected to be affected, and thus the site is expected to contribute to achieving FCS of grey seal.

7.2.2.1.2 Maintaining or restoring the distribution of qualifying species within the site

As discussed above and shown on Figure 7-2, there will be no overlap of the noise contours and the SAC. As such, piling at WTGs will not affect the presence and spatial distribution of the species or their ability to undertake key life cycle stages and behaviours within the site.

⁷ The Berwickshire & North Northumberland Coast SAC is located within two SMUs – ES and Northeast England. The number of grey seals predicted to be disturbed, incorporated into the iPCoD model has been assigned to the ES SMU, where the Inch Cape OWF is located (representing a precautionary approach as splitting the number between two SMUs would likely result in smaller impacts on each SMU).

7.2.2.1.3 Conclusions

Based on the assessment above, adverse effects on the qualifying Annex II marine mammal species, grey seal, which undermine the COs of the Berwickshire and North Northumberland Coast SAC will not occur as a result of injury or disturbance from underwater noise generated from WTG piling.

7.2.3 Firth of Tay and Eden Estuary SAC

In the UK, the harbour seal breeding period occurs between June and July, with moulting taking place from late July to mid-September. Given that the piling window extends from December to September, with a risk of running into October depending on weather conditions, temporal overlap with the WTG piling and harbour seal breeding and moulting seasons cannot be discounted.

7.2.3.1 Project Alone

The Project Alone assessment of AEoI of the Firth of Tay and Eden Estuary SAC with respect to harbour seal COs is presented in sections 7.2.3.1.1 to 7.2.3.1.3 and conclusions are provided in section 7.2.3.1.4.

7.2.3.1.1 To ensure that the qualifying features of Firth of Tay and Eden Estuary SAC are in favourable condition and make an appropriate contribution to achieving FCS

The conservation status of harbour seal at the site is currently assessed as “unfavourable – inadequate” (NatureScot, 2024b). The unfavourable status of the harbour seal population at the Firth of Tay and Eden Estuary SAC reflects an approximate 95% decline compared to population counts from the 1990s. However, this rate of decline is not consistent across the ES SMU, where the overall reduction has been less severe (NatureScot, 2024b). Research suggests that off-site factors, including predation, competition for prey, prey quality and availability, and exposure to toxins from harmful algal blooms, are the most probable drivers of the decline. In line with the advice provided in NatureScot (2024b), given that there is no site-reference population for harbour seal at this site, the site trend is considered in relation to the wider ES SMU. The iPCoD modelling shows that the level of disturbance predicted for Inch Cape OWF is not sufficient to result in any change at the SMU population level (there is no difference in the mean impacted population size from the mean un-impacted population). The impacted SMU population is predicted to decline, at exactly the same rate as the un-impacted population (Figure 6-2). Consequently, the modelled decline is unrelated to the disturbance due to WTG piling at Inch Cape OWF.

7.2.3.1.2 Harbour seal within the Firth of Tay and Eden Estuary SAC are not at significant risk from injury or mortality (ensure the harbour seal population has the ability to recover and can move safely between the site and important areas of functionally linked sea outwith the site)

The risk of injury to harbour seals is negligible due to application of mitigation measures (see section 6.2). Based on the Carter *et al.* (2022) SAC-specific distribution maps and the Whyte *et al.* (2020) dose-response function, it is expected that at any given time, up to 20% of the SAC population⁸ could experience behavioural disturbance (Figure 7-3) (when considering the SAC-specific spring foraging distribution). As discussed in section 7.2.3.1.1, the iPCoD modelling against the ES SMU showed that the population decline is unrelated to the disturbance due to WTG piling at Inch Cape OWF. Temporary impacts associated with behavioural disturbance outwith the site cannot be excluded, however, any displacement is expected to be limited to during the piling activity. For instance, previous studies on harbour seal redistribution as a response to piling showed that it is likely to be temporarily limited to a duration of two hours following the cessation of pile driving activity (Russell *et al.*, 2016). The effects associated with piling are not expected to cause further reduction of the population size or prevent the ability of harbour seal to fully recover in the long-term.

It is anticipated that some individuals may be temporarily disturbed from their foraging distributional range outwith the SAC during piling, especially those which tend to travel further from the SAC, in the areas within the noise disturbance contours. Considering that the installation of the WTGs are going to take up to 72 days, harbour seals may be temporarily displaced. However, it should be noted that not all seals will respond to piling to the same extent. As such, although for some animals underwater noise may act as a temporary barrier to access certain areas, not all animals will stop using the area in the vicinity of the works. Piling at WTGs will not reduce the ability of seals to use all areas of importance within the site or to access to supporting habitats in the long-term.

⁸ See Carter *et al.* (2022) Supplementary Materials S10 Results: SAC-Specific Distribution Maps. The Firth of Tay and Eden Estuary SAC-specific distribution map for harbour seals represents the distribution of harbour seals during the main foraging season (spring). It is not representative of harbour seal distribution during the moult or breeding periods.

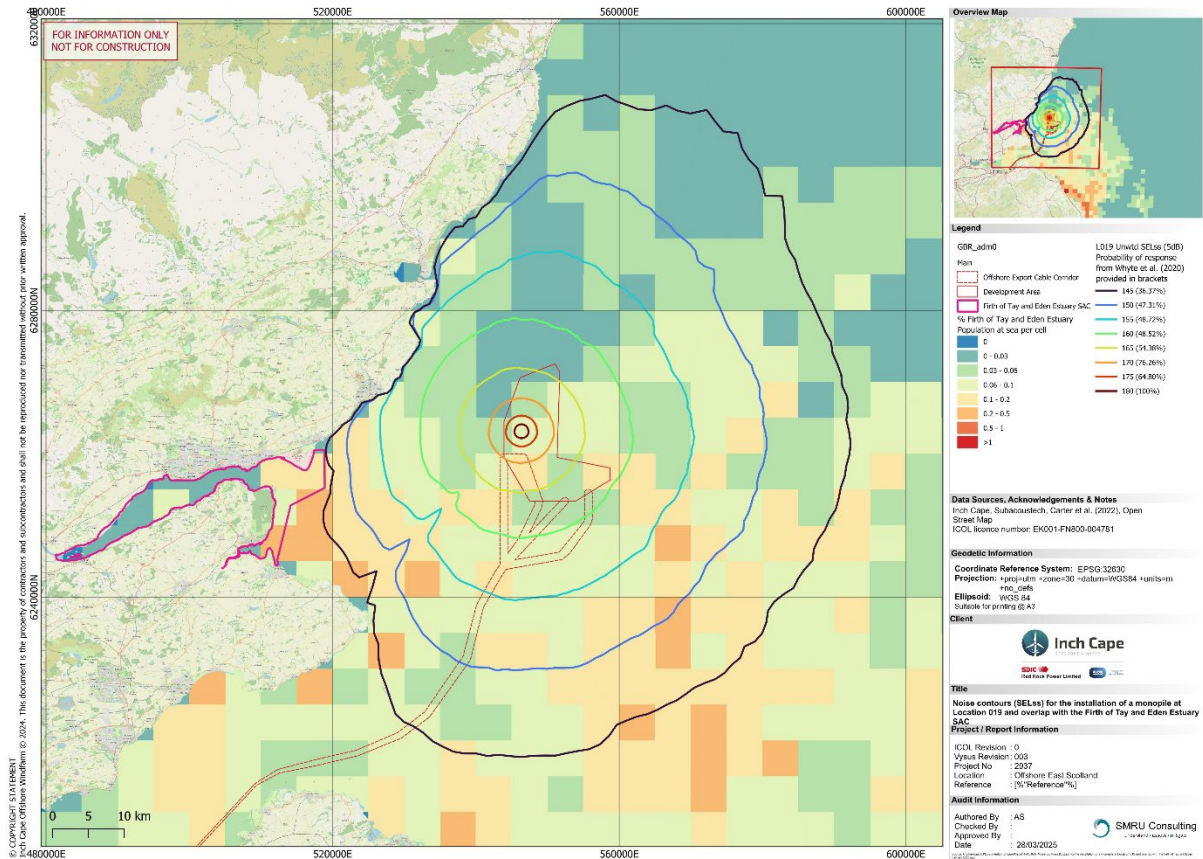


Figure 7-3: Overlap of noise disturbance contours at the modelled piling location closest to the Forth of Tay and Eden Estuary SAC (L019) and the mean percentage of the Firth of Tay and Eden Estuary SAC population estimated to be present in each grid cell at any one time in the spring foraging season (Carter et al., 2022).

7.2.3.1.3 The distribution of harbour seal throughout the site is maintained by avoiding significant disturbance (ensure harbour seal continue to have access to and can utilise all habitats suitable for haul-outs and breeding associated within the site)

It is anticipated that there will be no overlap of noise contours with the SAC (Figure 7-3). Therefore, piling is not expected to affect the ability of harbour seals to use the site nor change the distribution or behaviour of harbour seals within the SAC.

7.2.3.1.4 Conclusions

Based on the assessment above, adverse effects on the qualifying Annex II marine mammal species, harbour seal, which undermine the COs of the Firth of Tay and Eden Estuary SAC will not occur as a result of injury or disturbance from underwater noise generated from WTG piling.

7.2.4 Moray Firth SAC

Bottlenose dolphins are present within the Moray Firth SAC throughout the year, with May to September being important for breeding and calving (NatureScot, 2024a).

7.2.4.1 Project Alone

The Project Alone assessment of AEoI of the Moray Firth SAC with respect to bottlenose dolphin COs is presented in sections 7.2.4.1.1 to 7.2.4.1.2 and conclusions are provided in section 7.2.4.1.3.

7.2.4.1.1 To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving FCS.

Bottlenose dolphins are considered to be in favourable maintained condition at the Moray Firth SAC (NatureScot, 2024a). The dolphin population from the Moray Firth SAC range beyond the SAC boundaries, throughout the CES MU and beyond to English waters (Arso Civil *et al.*, 2025). Consequently, the Moray Firth SAC population is considered equivalent to that of the CES MU. The estimated abundance of this population is 226 individuals, with 95% confidence intervals of 214 to 239 (Cheney *et al.*, 2024). The results of the iPCoD modelling show that for bottlenose dolphins within the CES MU, the impacted population is predicted to continue on an increasing trajectory, the same as the un-impacted population (see Figure 6-1). As such, no change in the increasing trend within the CES MU is predicted as a result of WTG piling at the Inch Cape OWF and therefore, no change in FCS is expected. The population of bottlenose dolphin remains a viable component of the site.

The risk of auditory injury to bottlenose dolphins is negligible due to application of mitigation measures (see section 6.2). As such, it is not expected to affect the CES MU bottlenose dolphin population.

Bottlenose dolphins are a highly mobile species, and the long-term viability of the population within the SAC is inherently dependent on their ability to access and utilise habitat and prey resources in functionally connected marine areas beyond the SAC boundaries and throughout the CES MU (NatureScot, 2024a). There will be no overlap with the noise contours and the SAC boundary, however, there is a potential for overlap with the bottlenose dolphin habitat (within the 20 m depth contour and approximately 2 km of the shore (Figure 7-4). Considering the piling location closest to the bottlenose dolphin habitat, there is a potential for overlap of the 155 dB noise contour with the bottlenose dolphin habitat. Based on the Graham *et al.* (2017) dose-response function, it is anticipated that approximately 82% of individuals may respond behaviourally to this level of sound. It should be noted that the Graham *et al.* (2017) dose-response function was developed using data on harbour porpoise and various studies have shown that dolphins show comparatively less of a disturbance response from underwater noise compared with harbour porpoise (Lucke *et al.*, 2009, Tougaard *et al.*, 2009, Brandt *et al.*, 2011, Moray Offshore Renewables Limited, 2012, Niu *et al.*, 2012). Additionally, a study on bottlenose dolphins within the Moray Firth suggests that bottlenose dolphins have the ability

7.2.4.1.3 Conclusions

Based on the assessment above, adverse effects on the qualifying Annex II marine mammal species, bottlenose dolphin, which undermine the COs of the Moray Firth SAC will not occur as a result of injury or disturbance from underwater noise generated from WTG piling.

8 Conclusions

Based on the assessment presented in this report, it is predicted that WTG piling at Inch Cape will not have a negative effect on COs of four European sites: Isle of May SAC, Berwickshire and North Northumberland Coast SAC, Firth of Tay and Eden Estuary SAC and Moray Firth SAC. As such, WTG piling at Inch Cape will not adversely affect the integrity of the sites. Whilst it is unlikely that the Firth of Tay and Eden Estuary SAC will achieve favourable conservation status for harbour seals in the long term (irrespective of piling at Inch Cape), the impacts associated with the WTG pile driving are not predicted to have a bearing on this outcome.

Given that the in-combination screening did not identify any projects that could contribute to in-combination effects on protected features of the sites, the same applies to the in-combination effects.

The 2018 conclusions drawn for the Isle of May SAC, Berwickshire and North Northumberland Coast SAC, Firth of Tay and Eden Estuary SAC and Moray Firth SAC with respect to marine mammal protected features remain valid, and it can be concluded that the proposed works (pile driving works for the installation of the WTGs), alone or in combination, will not cause adverse effects on the integrity of any SAC designated for marine mammal species.

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