Department for
Business, Energy
& Industrial Strategy

OFFSHORE OIL & GAS LICENSING 31ST SEAWARD ROUND

Habitats Regulations Assessment

Appropriate Assessment: Moray Firth

April 2019

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Contents

1 Introduction

1.1 Background and purpose

The plan/programme covering this and potential future seaward licensing rounds has been subject to a Strategic Environmental Assessment (OESEA3), completed in July 2016. The SEA Environmental Report includes detailed consideration of the status of the natural environment and potential effects of the range of activities which could follow licensing, including potential effects on conservation sites. The SEA Environmental Report was subject to an 8-week public consultation period, and a post-consultation report summarising comments and factual responses was produced as an input to the decision to adopt the plan/programme. This decision has allowed the Oil & Gas Authority (OGA) to progress with further seaward oil and gas licensing rounds. As a result on 10th July 2018, the OGA invited applications for licences relating to 1,779 Blocks in a 31st Seaward Licensing Round covering mature and frontier areas of the UK Continental Shelf (UKCS). Applications were received for licences covering 164 Blocks/part Blocks.

The *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) implement the requirements of Articles 6(3) and 6(4) of the Habitats Directive with respect to oil and gas activities in UK territorial waters and on the UK Continental Shelf. The *Conservation of Offshore Marine Habitats and Species Regulations 2017* cover other relevant activities in offshore waters (i.e. excluding territorial waters). Within territorial waters, the Habitats Directive is transposed into UK law via the *Conservation of Habitats and Species Regulations 2017* in England and Wales, the *Conservation (Natural Habitats, &c.) Regulations 1994* in Scotland (for non-reserved matters), and the *Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995* (as amended) in Northern Ireland.

As the petroleum licensing aspects of the plan/programme are not directly connected with or necessary for nature conservation management of European (Natura 2000[1]) sites, to comply with its obligations under the relevant regulations, the Department for Business, Energy and Industrial Strategy[2] (BEIS) is undertaking a Habitats Regulations Assessment (HRA). To comply with obligations under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), in winter 2018, the Secretary of State undertook a screening assessment to determine whether the award of any of the Blocks offered would be likely to

[1] This includes Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and potential sites for which there is adequate information on which to base an assessment.
[2] Note that while certain licensing and regulatory functions were passed to the OGA (a government company wholly owned by the Secretary of State for BEIS) on 1 October 2016, environmental regulatory functions are retained by BEIS, and are administered by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).

have a significant effect on a relevant site, either individually or in combination[3] with other plans or projects (BEIS 2018a). In doing so, BEIS has applied the Habitats Directive test[4] (elucidated by the European Court of Justice in the case of Waddenzee (Case C-127/02)[5]) which is:

> *…any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects.*
>
> *…where a plan or project not directly connected with or necessary to the management of a site is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site. The assessment of that risk must be made in the light inter alia of the characteristics and specific environmental conditions of the site concerned by such a plan or project.*

1.2 Relevant Blocks

The screening assessment (including consultation with the statutory conservation agencies/bodies) formed the first stage of the HRA process. The assessment was undertaken in the period within which applications for Blocks were being accepted, and therefore considered all 1,779 Blocks offered. The screening identified 525 whole or part Blocks as requiring further assessment prior to decisions on whether to grant licences (BEIS 2018a). Following the closing date for 31st Seaward Round applications, and the publication of the screening document, those Blocks identified as requiring further assessment were reconsidered against the list of actual applications. It was concluded that further assessment (Appropriate Assessment, AA) was required for 41 of the Blocks applied for. Because of the wide distribution of these Blocks around the UKCS, the AAs are documented in four regional reports as follows:

- Mid North Sea High
- Moray Firth
- Irish Sea

[3] Note that "in-combination" and "cumulative" effects have similar meanings, but for the purposes of HRA, and in keeping with the wording of Article 6(3) of the Habitats Directive, "in-combination" is used to describe the potential for such effects throughout. More information on the definitions of "cumulative" and "in-combination" effects are available in MMO (2014) and Judd *et al.* (2015).

[4] See Article 6(3) of the Habitats Directive.

[5] Also see the Advocate General's Opinion in the recent 'Sweetman' case (Case C-258/11), which confirms those principles set out in the Waddenzee judgement.

- English Channel

1.2.1 Moray Firth Blocks

The Moray Firth Blocks applied for in the 31st Round and considered in this assessment are listed below in Table 1.1, and are shown in Figure 1.1.

Table 1.1: Blocks requiring further assessment

11/24c	11/23	11/25b	12/14	12/15
12/16	12/19	12/20	12/21b	17/5
18/1	18/2	18/3	18/4	18/5

1.3 Relevant Natura 2000 sites

The screening identified the relevant Natura 2000 sites and related Blocks requiring further assessment in the Moray Firth (refer to Appendix B of BEIS 2018a). Following a reconsideration of those Blocks and sites screened in against those Blocks applied for, 11 Natura 2000 sites were identified as requiring further assessment in relation to 15 Blocks (Table 1.2 and Figure 1.1). Abbreviations and species common names follow those in Appendix A of BEIS (2018a).

Table 1.2: Relevant sites requiring further assessment

Relevant site Features	Relevant Blocks applied for	Potential effects
SPAs		
Caithness and Sutherland Peatlands SPA Breeding: black-throated diver, common scoter, dunlin, golden eagle, golden plover, greenshank, hen harrier, merlin, red-throated diver, short-eared owl, wigeon, wood sandpiper	11/23, 11/24c, 11/25b, 12/16, 12/21b	Underwater noise
	11/23, 11/24c, 11/25b, 12/16	Physical disturbance and drilling
Pentland Firth pSPA Breeding: Arctic tern Breeding seabird assemblage	12/14, 12/15, 12/16, 12/19, 12/20	Underwater noise
	12/14, 12/16, 12/19	Physical disturbance and drilling
Pentland Firth Islands SPA Breeding: Arctic tern	12/14, 12/15, 12/16, 12/19, 12/20	Underwater noise
	12/14, 12/16, 12/19	Physical disturbance and drilling
North Caithness Cliffs SPA Breeding: peregrine, guillemot Breeding seabird assemblage	12/14, 12/15, 12/16, 12/19, 12/20	Underwater noise
	12/14, 12/16, 12/19	Physical disturbance and drilling
Hoy SPA Breeding: peregrine, red-throated diver, great skua Breeding seabird assemblage	12/14, 12/15, 12/16, 12/19, 12/20	Underwater noise
	12/14, 12/16, 12/19	Physical disturbance and drilling
Copinsay SPA Breeding seabird assemblage	12/14, 12/15, 12/16, 12/19, 12/20	Underwater noise
	12/14, 12/16, 12/19	Physical disturbance and drilling

Relevant site Features	Relevant Blocks applied for	Potential effects
East Caithness Cliffs SPA Breeding: guillemot, herring gull, kittiwake, peregrine, razorbill and shag Breeding seabird assemblage	11/23, 11/24c, 11/25b, 12/16, 12/21b, 17/5, 18/1, 18/2, 18/3	Underwater noise
	11/23, 11/24c, 11/25b, 12/16, 12/21b, 17/5, 18/1, 18/2, 18/3	Physical disturbance and drilling
Moray Firth pSPA Over winter: great northern diver, red-throated diver, Slavonian grebe, greater scaup, common eider, long-tailed duck, common scoter, velvet scoter, goldeneye, red-breasted merganser, shag Breeding: shag	11/23, 11/24c, 11/25b, 17/5, 18/1, 18/2, 18/3	Underwater noise
	11/23, 11/24c, 11/25b, 17/5, 18/1, 18/2, 18/3	Physical disturbance and drilling
Troup, Pennan and Lion`s Heads SPA Breeding: guillemot Breeding seabird assemblage	18/3, 18/4, 18/5	Underwater noise
SACs		
Berriedale and Langwell Waters SAC Annex II species: Atlantic salmon	11/23, 11/24c	Underwater noise
	11/23, 11/24c	Physical disturbance and drilling
Moray Firth SAC Annex I habitats: sandbanks Annex II species: bottlenose dolphin	11/23, 17/5	Underwater noise
	11/23, 17/5	Physical disturbance and drilling

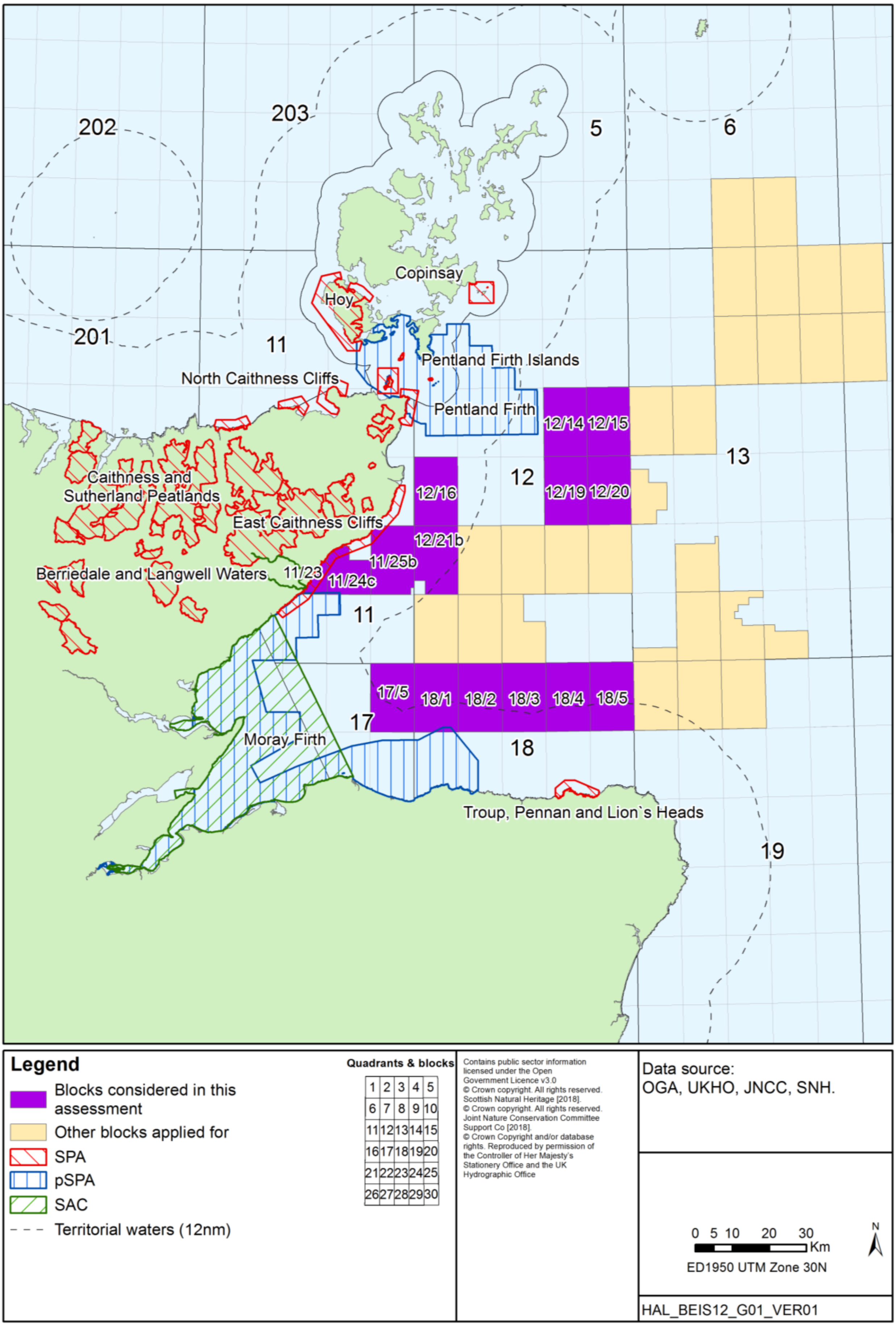
1.4 Assessment overview

This document sets out the key assumptions and approach to the AA, the evidence base underpinning the assessment and the assessment of relevant Blocks and sites. The document is organised as follows:

- Overview of the licensing process and nature of the activities that could follow including assumptions used to underpin the AA process (Section 2)
- Description of the approach to ascertaining the absence or otherwise of adverse effects on the integrity of relevant European sites (Section 3)
- Evidence base on the environmental effects of offshore oil and gas activities to inform the assessment (Section 4)
- The assessment of effects on the integrity of relevant sites, including in-combination with other plans or projects (Sections 5-8)
- Overall conclusion (Section 9)

As part of this HRA process, the AA document is being subject to consultation with appropriate nature conservation bodies and the public and will be amended as appropriate in light of comments received. The final AA document will be available via the 31st Round Appropriate Assessment webpage of the gov.uk website.

Figure 1.1: Blocks and sites relevant to this Appropriate Assessment



2 Licensing and potential activities

2.1 Licensing

The exclusive rights to search and bore for petroleum in Great Britain, the territorial sea adjacent to the United Kingdom and on the UKCS are vested in the Crown and the *Petroleum Act 1998* (as amended) gives the OGA the power to award Seaward Production Licences which grant exclusive rights to the holders "to search and bore for, and get, petroleum" in the area covered by the Licence. A Seaward Production Licence does not constitute any form of approval for activities to take place in the licensed Blocks, nor does it confer any exemption from other legal or regulatory requirements. Offshore activities that may follow licensing are subject to a range of statutory permitting and consenting requirements, including, where relevant, activity specific AA as required under Article 6(3) of the Habitats Directive (Directive 92/43/EC).

Several sub-types of Seaward Production Licence were available in previous rounds (Traditional, Frontier and Promote) which have been replaced by the single "Innovate" licence[6]. As per previous licensing structures, the Innovate licence is made up of three terms covering exploration (Initial Term), appraisal and field development planning (Second Term), and development and production (Third Term). The lengths of the first two terms are flexible, but have a maximum duration of 9 and 6 years respectively. The Third Term is granted for 18 years but may be extended if production continues beyond this period. The Innovate licence introduces three Phases to the Initial Term, covering:

- Phase A: geotechnical studies and geophysical data reprocessing (note that the acquisition of new seismic could take place in this phase for the purpose of defining a 3D survey as part of Phase B, but normally this phase will not involve activities in the field)
- Phase B: shooting of new seismic and other geophysical data
- Phase C: exploration and appraisal drilling

Applicants may propose the Phase combination in their submission to the OGA. Phase A and Phase B are optional and may not be appropriate in certain circumstances, but every application must propose a Phase C, except where the applicant does not think any exploration is needed (e.g. in the development of an existing discovery or field re-development) and proposes to go straight to development (i.e. 'straight to Second Term'). The duration of the Initial Term and the Phases within it are agreed between the OGA and the applicant. Applicants may choose to spend up to 4 years on a single Phase in the Initial Term, but cannot

[6] *The Petroleum and Offshore Gas Storage and Unloading Licensing (Amendment) Regulations 2017* amend the Model Clauses to be incorporated in Seaward Production Licences so as to implement the Innovate licences to be issued in the 31st Round.

take more than 9 years to progress to the Second Term. Failure to complete the work agreed in a Phase, or to commit to the next Phase means the licence ceases, unless the term has been extended by the OGA.

Financial viability is considered prior to licence award for applicants proposing to start at Phase A or B, but further technical and financial capacity for Phase C activities would need to be demonstrated before the licence could enter Phase C and drilling could commence. If the applicant proposes to start the licence at Phase C or go straight to the Second Term, the applicant must demonstrate that it has the technical competence to carry out the activities that would be permitted under the licence during that term, and the financial capacity to complete the work programme, before the licence is granted. It is noted that the safety and environmental capability and track record of all applicants are considered by the OGA (in consultation with the Offshore Safety Directive Regulator)[7] through written submissions before licences are awarded[8].

As part of these written submissions operators must demonstrate that they have the relevant safety and environmental capabilities to undertake the proposed work programme (e.g. company environmental policies, awareness of statutory safety and environment provisions, and has environmental management systems). Where full details cannot be provided in the written submissions at the application stage, licensees must provide supplementary submissions that address any outstanding environmental and safety requirements before approvals for specific offshore activities such as drilling can be issued. In all instances applicants must submit an environmental sensitivities assessment, demonstrating at the licence application stage that they are aware of environmental sensitivities relevant to the Blocks being applied for and the adjacent areas, and understand the potential impacts of the proposed work programme.

2.2 Activities that could follow licensing

As part of the licence application process, applicants provide the OGA with details of work programmes they propose in the Initial Term. These work programmes are considered along with a range of other factors by the OGA before arriving at a decision on whether to license the Blocks and to whom. Activities detailed in work programmes may include the purchase, reprocessing or shooting of 2D or 3D seismic data (Phases A and B) and the drilling of wells (Phase C). There are three levels of drilling commitment:

- A Firm Drilling Commitment is a commitment to the OGA to drill a well. Firm drilling commitments are preferred on the basis that, if there were no such commitment, the OGA

[7] The Offshore Safety Directive Regulator is the Competent Authority for the purposes of the Offshore Safety Directive comprising of the Department for Business, Energy and Industrial Strategy (BEIS) Offshore Petroleum Regulator for Gas Environment and Decommissioning (OPRED) and the Health and Safety Executive (HSE) working in partnership.

[8] Refer to OGA technical guidance and safety and environmental guidance (Appendix C) on applications for the 31st Round at: https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/

could not be certain that potential licensees would make full use of their licences. However, the fact that a licensee has been awarded a licence on the basis of a "firm commitment" to undertake a specific activity should not be taken as meaning that the licensee will actually be able to carry out that activity. This will depend upon the outcome of relevant activity specific environmental assessments.

- A Contingent Drilling Commitment is also a commitment to the OGA to drill a well, but it includes specific provision for the OGA to waive the commitment in light of further technical information.
- A Drill or Drop (D/D) Drilling Commitment is a conditional commitment with the proviso that the licence is relinquished if a well is not drilled.

Note that Drill or Drop and Contingent work programmes (subject to further studies by the licensees) will probably result in a well being drilled in less than 50% of the cases.

The OGA general guidance[9] makes it clear that an award of a Production Licence does not automatically allow a licensee to carry out any offshore petroleum-related activities from then on (this includes those activities outlined in initial work programmes, particularly Phases B and C). Figure 2.1 provides an overview of the plan process associated with the 31st Seaward Licensing Round and the various environmental assessments including HRA. Offshore activities such as drilling and seismic survey are subject to relevant activity specific environmental assessments by BEIS (see Figures 2.2 and 2.3), and there are other regulatory provisions exercised by the Offshore Safety Directive Regulator and bodies such as the Health and Safety Executive. It is the licensee's responsibility to be aware of, and comply with, all regulatory controls and legal requirements, and work offshore cannot proceed until the relevant consents/approvals are in place.

The proposed work programmes for the Initial Term are detailed in the licence applications. For some activities, such as seismic survey, the potential impacts associated with noise could occur some distance from the licensed Blocks and the degree of activity is not necessarily proportional to the size or number of Blocks in an area. In the case of direct physical disturbance, the Blocks being applied for are relevant.

[9] https://www.ogauthority.co.uk/media/4950/general-guidance-31st-seaward-licensing-round-july-2018.docx

Figure 2.1: Stages of plan level environmental assessment

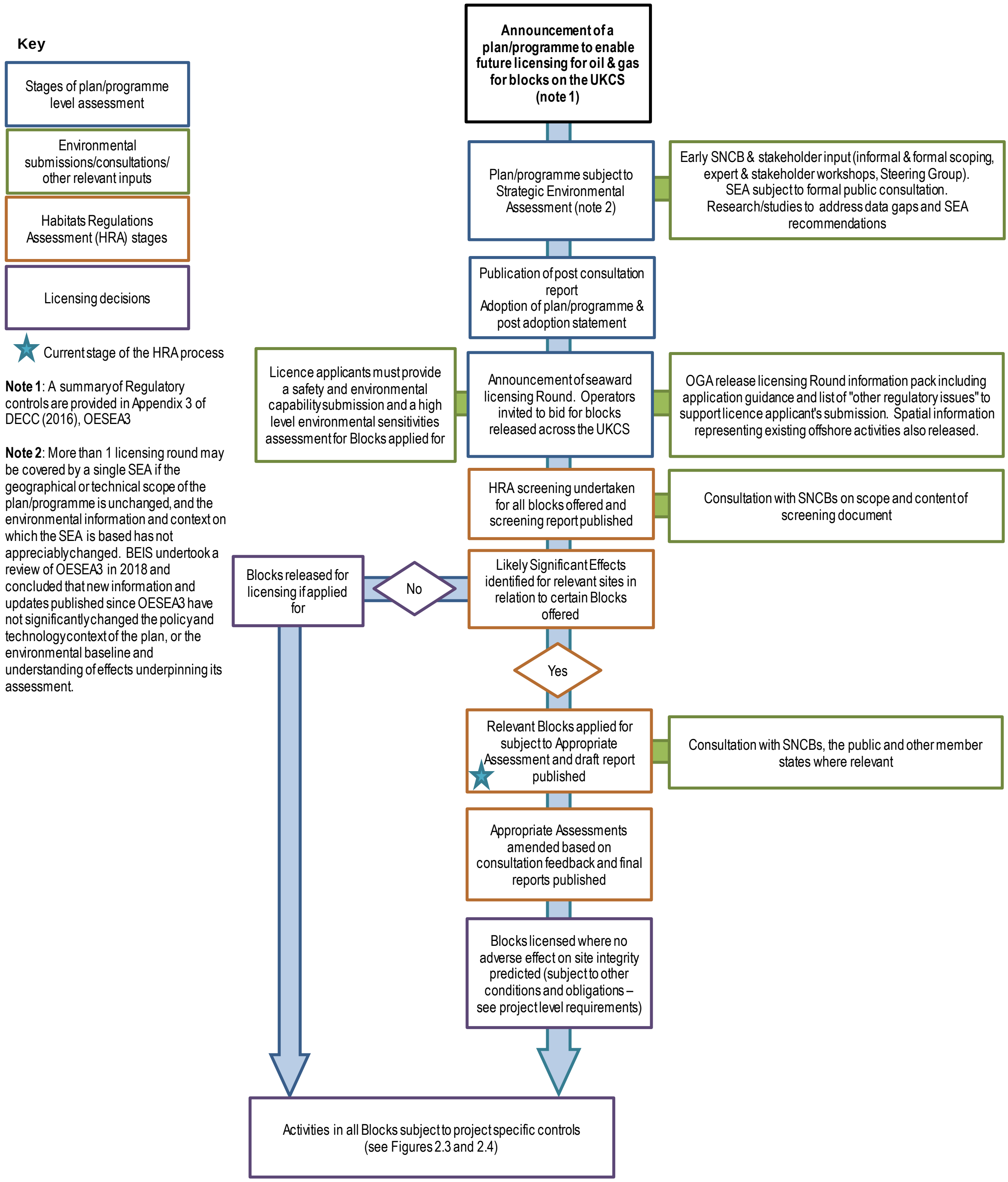
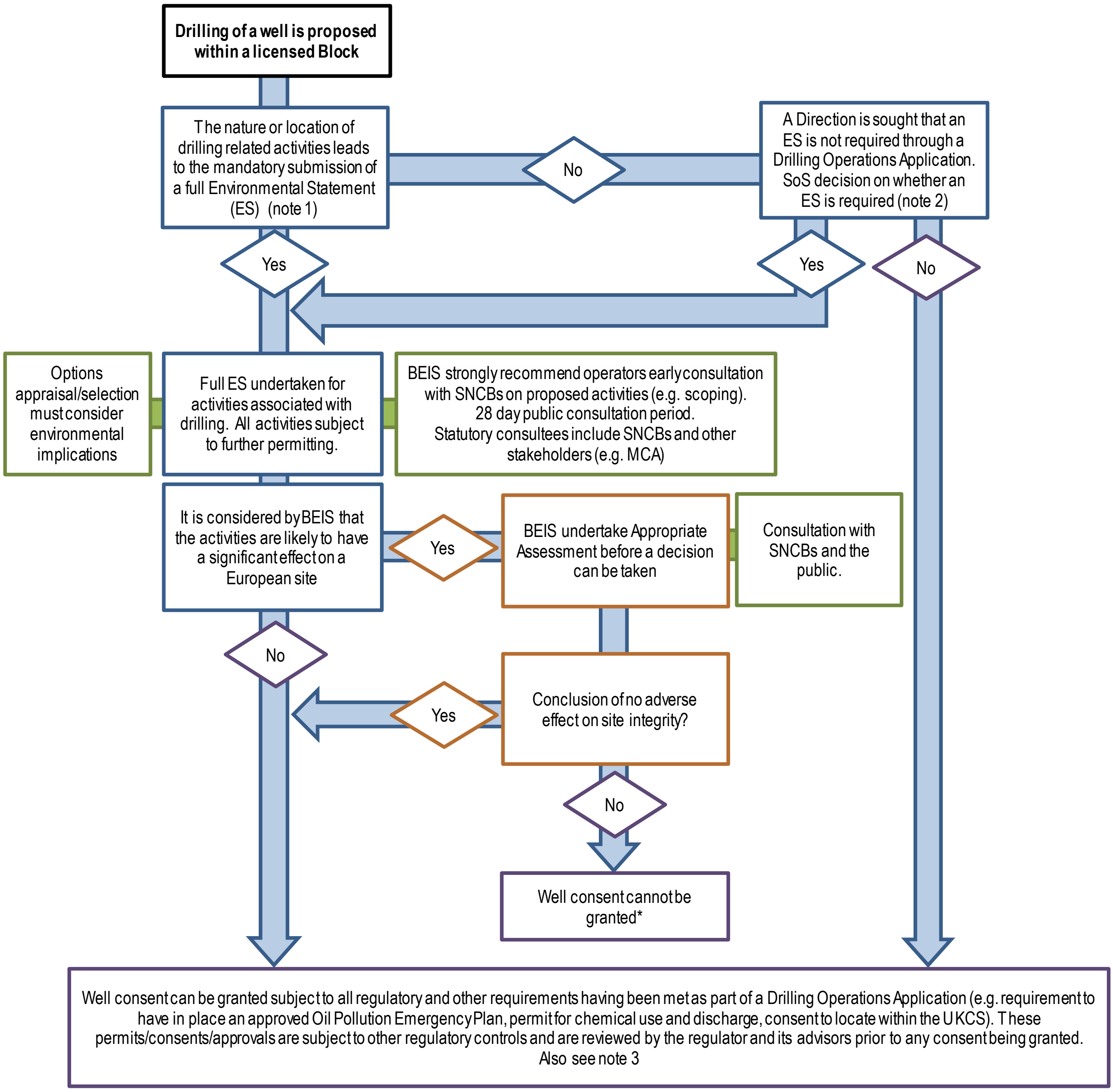
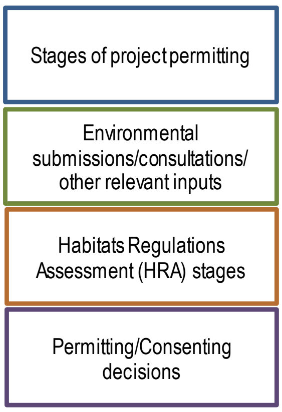


Figure 2.2: High level overview of exploration drilling environmental requirements



Key



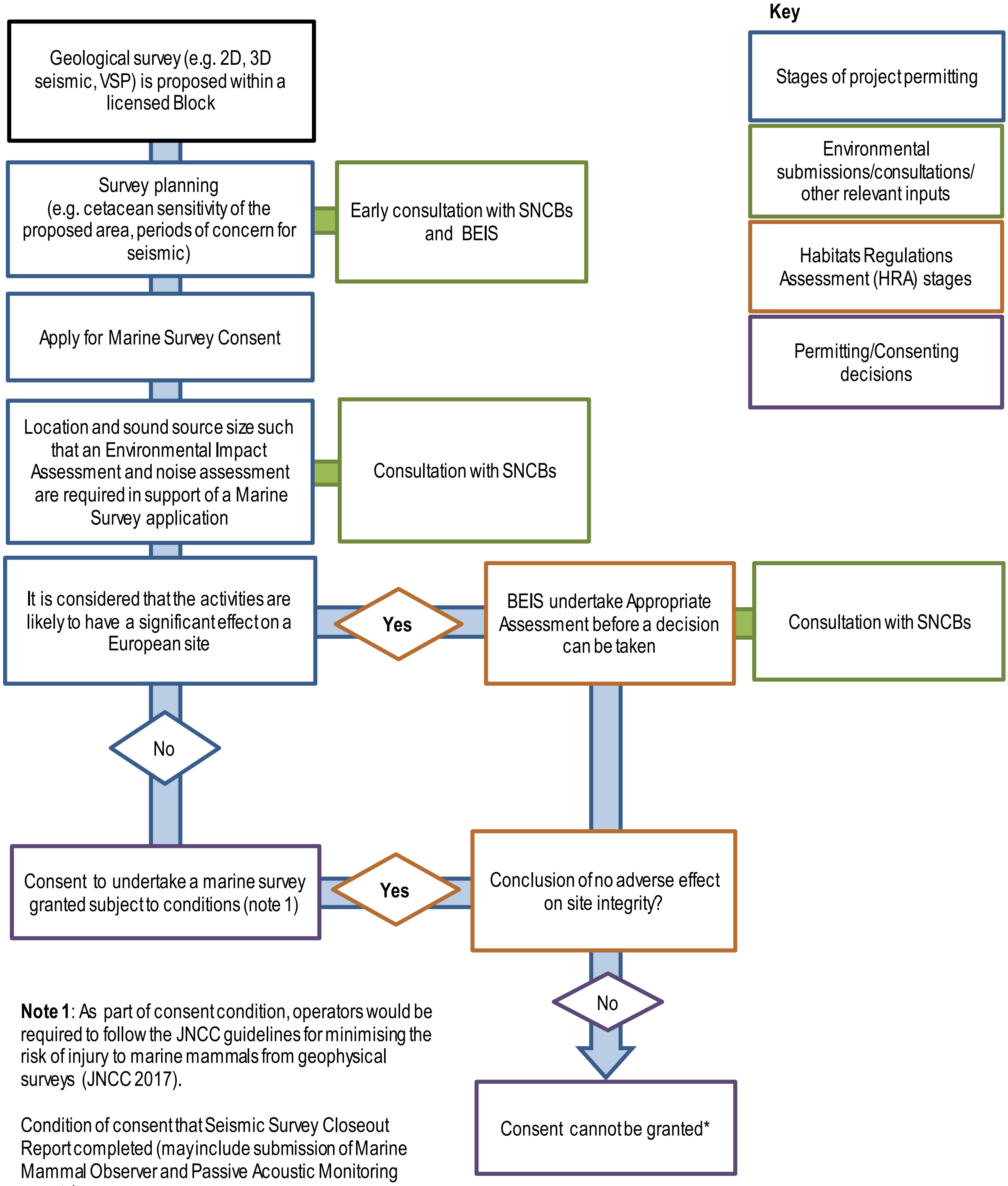
Note 1: See BEIS (2018). The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) – A Guide. The Offshore Petroleum Regulator for Environment and Decommissioning, 80pp.

Note 2: Early consultation between BEIS and licensed operators is typical to mitigate against Environmental Statement (ES) requirements being identified following the request for a direction

Note 3: In cases where an ES was initially identified as not required, or where an ES has been approved, the requirement to undertake AA may still apply (e.g. due to changes in the nature of the project or the designation of additional European sites)

* Article 6(4) of the Habitats Directive provides a derogation which would allow a plan or project to be approved in limited circumstances even though it would or may have an adverse effect on the integrity of a European site (see: Defra 2012).

Figure 2.3: High level overview of seismic survey environmental requirements



Note 1: As part of consent condition, operators would be required to follow the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC 2017).

Condition of consent that Seismic Survey Closeout Report completed (may include submission of Marine Mammal Observer and Passive Acoustic Monitoring reports)

* Article 6(4) of the Habitats Directive provides a derogation which would allow a plan or project to be approved in limited circumstances even though it would or may have an adverse effect on the integrity of a European site (see: Defra 2012).

2.2.1 Likely scale of activity

On past experience the activity that actually takes place is less than what is included in the work programmes at the licence application stage. A proportion of Blocks awarded may be relinquished without any offshore activities occurring. Activity after the Initial Term is much harder to predict, as this depends on the results of the initial phase, which is, by definition, exploratory. Typically, less than half the wells drilled reveal hydrocarbons, and of that, less than half will have a potential to progress to development. For example, the OGA analysis of exploration well outcomes from the Moray Firth & Central North Sea between 2003 and 2013 indicated an overall technical success rate of 40% with respect to 150 exploration wells and side-tracks (Mathieu 2015). Depending on the expected size of finds, there may be further drilling to appraise the hydrocarbons (appraisal wells). For context, Figure 2.4 highlights the total number of exploration and appraisal wells started on the UKCS each year since 2000 as well as the number of significant discoveries made (associated with exploration activities).

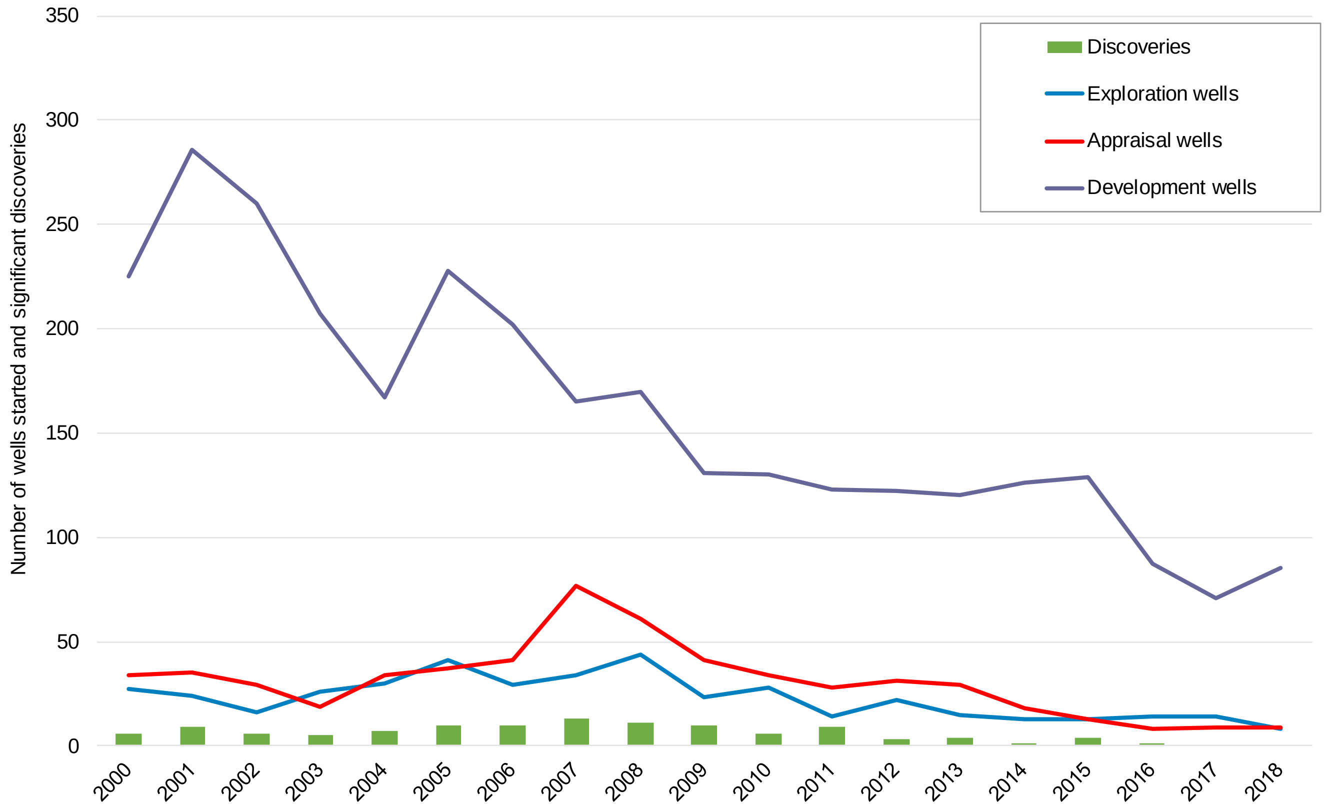
Discoveries that progress to development may require further drilling, installation of infrastructure such as wellheads, pipelines and possibly fixed platform production facilities, although recent developments are mostly tiebacks to existing production facilities rather than stand-alone developments. For example, of the 33 relevant projects identified by the OGA's Oil & Gas Pathfinder (as of 5th April 2019)[10], 18 are planned as subsea tie-backs to existing infrastructure, 6 involve new stand-alone production platforms and 5 are likely to be developed via Floating Production, Storage and Offloading facilities (FPSO). The final form of development for many of the remaining projects is not decided, with some undergoing re-evaluation of development options but some are likely to be subsea tie-backs. Figure 2.4 indicates that the number of development wells has declined over time and this pattern is likely to continue. The nature and scale of potential environmental impacts from the drilling of development wells are similar to those of exploration and appraisal wells and thus the screening criteria described in Section 4 are applicable to the potential effects of development well drilling within any of the 31st Round Blocks.

2.2.2 31st Round activities considered by the HRA

The nature, extent and timescale of development, if any, which may ultimately result from the licensing of 31st Round Blocks is uncertain, and therefore it is regarded that at this stage a meaningful assessment of development level activity (e.g. pipelay, placement of jackets, subsea templates or floating installations) cannot be made. Once project plans are in place, subsequent permitting processes relating to exploration, development and decommissioning, would require assessment including an HRA where appropriate, allowing the opportunity for further mitigation measures to be identified as necessary, and for permits to be refused if necessary.

[10] https://itportal.ogauthority.co.uk/eng/fox/path/PATH_REPORTS/pdf

Figure 2.4: UKCS Exploration, appraisal & development wells, and significant discoveries since 2000



Note: "significant" generally refers to the flow rates that were achieved (or would have been reached) in well tests (15 mmcfgd or 1000 BOPD) and does not indicate commercial potential of the discovery. Source: OGA Drilling Activity (February 2018), Significant Offshore Discoveries (October 2018)

In this way the opinion of the Advocate General in ECJ (European Court of Justice) case C-6/04, on the effects on Natura sites, "*must be assessed at every relevant stage of the procedure to the extent possible on the basis of the precision of the plan. This assessment is to be updated with increasing specificity in subsequent stages of the procedure*" is addressed. Therefore, only activities as part of the work programmes associated with the Initial Term and its associated Phases A-C will be considered in this AA (see Table 2.2).

Potential accidental events, including spills, are not considered in the AA as they are not part of the work plan. Measures to prevent accidental events, response plans and potential impacts in the receiving environment would be considered as part of the environmental impact assessment (EIA) process for specific projects that could follow licensing when the location, nature and timing of the proposed activities are available to inform a meaningful assessment of such risks. The EIA would be informed by the modelling undertaken for the Oil Pollution Emergency Plan (OPEP). The OPEP is assessed by BEIS, and a range of organisations, and other Government departments are consulted by BEIS during the OPEP determination process. The OPEP includes an assessment of spill risk, response arrangements, and details of actions, interfaces, training and exercises specific to an installation or operation[11]. A comprehensive overview of spill risk on the UKCS from offshore oil & gas activity and related potential environmental effects is provided in OESEA3 (DECC 2016).

The approach used in this assessment has been to take the proposed activity for the Block as being the maximum of any application for that Block, and to assume that all activity takes place. The estimates of work commitments for the relevant Blocks from the applications received by the OGA are shown in Table 2.1. Note, this represents a worst-case scenario since several Blocks may be included in one licence and the drill or drop well/contingent well applies to the licence, i.e. it is likely that fewer wells will be drilled than indicated in Table 2.1.

Table 2.1: Indicative work programmes relevant to Blocks considered in this assessment

Relevant Blocks	Obtain[12] and/or reprocess 2D or 3D seismic data	Shoot 3D seismic	Drill or drop well/contingent well
11/24c	-	-	✓
11/23	-	-	✓
11/25b	-	✓	✓
12/14	-	✓	✓
12/15	-	✓	✓
12/16	-	-	✓
12/19	-	✓	✓
12/20	-	✓	✓
12/21b	-	✓	✓
17/5	-	-	✓
18/1	-	-	✓
18/2	-	-	✓
18/3	-	✓	✓
18/4	-	✓	✓
18/5	-	✓	✓

Completion of the work programmes is likely to involve one or more of the activities summarised in Table 2.2. A series of assumptions has been developed on the nature and scale of activities to be assessed based on the evidence base for potential effects presented in Section 4 as well as reviews of exemplar Environmental Statements of relevant activities. Subsequent development activity is contingent on successful exploration and appraisal and may or may not result in the eventual installation of infrastructure. Where relevant, such future activities will themselves be subject to activity specific screening procedures and tests under the Habitats Directive.

[11] http://www.hse.gov.uk/osdr/assets/docs/opep-guidance-rev4-oct-2017.pdf, also see http://www.hse.gov.uk/osdr/index.htm

[12] To obtain seismic data means purchasing or otherwise getting the use of existing data and does not involve shooting new seismic.

Table 2.2: Potential activities and assessment assumptions

Potential activity	Description	Assumptions used for assessment
Initial Term Phase B: Geophysical survey		
Seismic (2D and 3D) survey	2D seismic involves a survey vessel with an airgun array and a towed hydrophone streamer (up to 12 km long), containing several hydrophones along its length. The reflections from the subsurface strata provide an image in two dimensions (horizontal and vertical). Repeated parallel lines are typically run at intervals of several kilometres (minimum *ca*. 0.5km) and a second set of lines at right angles to the first to form a grid pattern. This allows imaging and interpretation of geological structures and identification of potential hydrocarbon reservoirs. 3D seismic survey is similar but uses several hydrophone streamers towed by the survey vessel. Thus closely spaced 2D lines (typically between 25 and 75m apart) can be achieved by a single sail line.	These deep-geological surveys tend to cover large areas (300-3,000km^2) and may take from several days up to several weeks to complete. Typically, large airgun arrays are employed with 12-48 airguns and a total array volume of 3,000-8,000 in^3. From available information across the UKCS, arrays used on 2D and 3D seismic surveys produce most energy at frequencies below 200Hz, typically peaking at 100Hz, and with a peak source level of around 256dB re 1μPa @ 1m (Stone 2015). While higher frequency noise will also be produced which is considerably higher than background levels, these elements will rapidly attenuate with distance from source; it is the components < 1,000Hz which propagate most widely.
Initial Term Phase C: Drilling and well evaluation		
Rig tow out & de-mobilisation	Mobile rigs are towed to and from the well site typically by 2-3 anchor handling vessels.	The physical presence of a rig and related tugs during tow in/out is both short (a number of days depending on initial location of rig) and transient.
	Jack-up rigs are used in shallower waters (normally <120m) and jacking the rig legs to the seabed supports the drilling deck. Each of the rig legs terminates in a spud-can (base plate) to prevent excessive sinking into the seabed. Unlike semi-submersible rigs, jack-up rigs do not require anchors to maintain station and these are not typically deployed for exploration activities, with positioning achieved using several tugs, with station being maintained by contact of the rig spudcans with the seabed. Anchors may be deployed to achieve precision siting over fixed installations or manifolds at production facilities, which are not considered in this assessment.	It is assumed that jack-up rigs will be three or four-legged rigs with 20m diameter spudcans with an approximate seabed footprint of 0.001km^2 within a radius of *ca*. 50m of the rig centre. For the assessment it is assumed that direct physical disturbance effects on the seabed may occur within 500m of a jack-up rig (0.8km^2) which would take account of any additional rig stabilisation (rock placement) footprint. The Environmental Statement for a proposed well in Block 11/24b included rig stabilisation as a worst-case contingency option (up to 1000 tonnes per rig leg), although stabilisation was not required. A further short review of a number of Environmental Statements in the Moray Firth since 2006 (specifically in quadrants 11 and 12) indicated that rig stabilisation was not considered necessary. For information, a review of 18 Environmental Statements,

Potential activity	Description	Assumptions used for assessment
		which included drilling operations in the southern North Sea since 2007 (specifically in quadrants 42, 43, 44, 47, 48, 49 and 53) indicated that where figures were presented, the spatial scale of potential rock placement operations was estimated at between 0.001-0.004km^2 per rig siting.
Rig placement/ anchoring	Semi-submersible rigs are used in deeper waters (normally >120m). Mooring is achieved using either anchors (deployed and recovered by anchor handler vessels) or dynamic positioning (DP) to manoeuvre into and stay in position over the well location. Eight to 12 anchors attached to the rig by cable or chain are deployed radially from the rig; part of the anchoring hold is provided by a proportion of the cables or chains lying on the seabed (catenary).	Semi-submersible rig anchors (if used) may extend out to a radius of 1.5-1.8km in North Sea waters of the UK. An ES for an exploration well in Block 18/05 in *ca*. 90m water depth estimated that the area of seabed affected by anchoring was *ca*. 0.01km^2 (Apache North Sea Limited 2006). Given the water depths over the Blocks assessed, it has been assumed that jack-up rigs are more likely to be used although as indicated semi-submersible rigs have the potential to be deployed. As indicated above, for the purposes of assessment it has been assumed that with respect to rig siting, direct physical disturbance effects on the seabed will not exceed 0.8km^2 which is considerably larger than the area of seabed likely affected by rig anchoring.
Marine discharges	Typically around 1,000 tonnes of cuttings (primarily rock chippings) result from drilling an exploration well. Water-based mud cuttings are typically discharged at, or relatively close to sea surface during “closed drilling” (i.e. when steel casing in the well bore and a riser to the rig are in place), whereas surface hole cuttings are normally discharged at seabed during “open-hole” drilling. Use of oil based mud systems, for example in highly deviated sections or in drilling water reactive shales, would require onshore disposal or treatment offshore to the required standards prior to discharge.	The distance from source within which smothering or other effects may be considered possible is generally a few hundred metres. For the assessment it is assumed that effects may occur within 500m of the well location covering an area in the order of 0.8km^2 (refer to Section 4.2 for supporting information).
Conductor piling	Well surface holes are usually drilled “open-hole” with the conductor subsequently inserted and cemented in place to provide a stable hole through which the lower well sections are drilled. Where the nature of the seabed sediment and shallow geological formations are such that they would not support a stable open-hole (i.e. risking collapse), the conductor may be driven into the sediments. In North Sea exploration wells, the diameter of the conductor pipe is usually 26” or 30” (<1m), which is considerably smaller than the monopiles used for offshore wind farm foundations (>3.5m diameter), and	The need to pile conductors is well-specific and is not routine. It is anticipated that a conductor piling event would last between 4-6 hours, during which time impulses sound would be generated primarily in the range of 100-1,000Hz, with each impulse of a sound pressure level of approximately 150dB re 1μPa at 500m from the source.

Potential activity	Description	Assumptions used for assessment
	therefore require less hammer energy and generate noise of a considerably lower amplitude. For example, hammer energies to set conductor pipes are in the order of 90-270kJ (see: Matthews 2014, Intermoor website), compared to energies of up to 3,000kJ in the installation of piles at some southern North Sea offshore wind farm sites. Direct measurements of underwater sound generated during conductor piling are limited. Jiang *et al.* (2015) monitored conductor piling operations at a jack-up rig in the central North Sea in 48m water depth and found peak sound pressure levels (L_{pk}) not to exceed 156dB re 1 µPa at 750m (the closest measurement to source) and declining with distance. Peak frequency was around 200Hz, dropping off rapidly above 1kHz; hammering was undertaken at a stable power level of 85 ±5 kJ but the pile diameter was not specified (Jiang *et al.* 2015). MacGillivray (2018) reported underwater noise measurements during the piling of six 26" conductors at a platform, six miles offshore of southern California in 365m water depth. After initially penetrating the seabed under its own weight, each conductor was driven approximately 40m further into the seabed (silty-clay and clayey-silt) with hammer energies that increased from 31 ±7 kJ per strike at the start of driving to 59 ±7 kJ per strike. Between 2.5-3 hours of active piling was required per conductor. Sound levels were recorded by fixed hydrophones positioned at distances of 10-1,475m from the source and in water depths of 20-370m, and by a vessel-towed hydrophone. The majority of sound energy was between 100-1,000Hz, with peak sound levels around 400Hz. Broadband sound pressure levels recorded at 10m from source and 25m water depth were between 180-190dB re 1µPa (SEL = 173-176dB re 1µPa·s), reducing to 149-155dB re 1µPa at 400m from source and 20m water depth (SEL = 143-147dB re 1µPa·s).	
Rig/vessel presence and movement	On site, the rig is supported by supply and standby vessels, and helicopters are used for personnel transfer.	Supply vessels typically make 2-3 supply trips per week between rig and shore. Helicopter trips to transfer personnel to and from the rig are typically made several times a week. A review of Environmental Statements for exploratory drilling suggests that the rig could be on location for up to 10 weeks. Support and supply vessels (50-100m in length) are expected to have broadband source levels in the range 165-180dB re 1µPa@1m, with the majority of energy below 1kHz (OSPAR 2009). Additionally, the use of thrusters for dynamic positioning has been reported to result in increased sound generation (>10dB) when compared to the same vessel in transit

Potential activity	Description	Assumptions used for assessment
		(Rutenko & Ushchipovskii 2015).
Rig site survey	Rig site surveys are undertaken to identify seabed and subsurface hazards to drilling, such as wrecks and the presence of shallow gas. The surveys use a range of techniques, including multibeam and side scan sonar, sub-bottom profiler, magnetometer and high-resolution seismic involving a much smaller source (mini-gun or four airgun cluster of 160 in^3) and a much shorter hydrophone streamer. Arrays used on site surveys and some Vertical Seismic Profiling (VSP) operations (see below) typically produce frequencies predominantly up to around 250Hz, with a peak source level of around 235dB re 1µPa @ 1m (Stone 2015).	A rig site survey typically covers 2-3km^2. The rig site survey vessel may also be used to characterise seabed habitats, biota and background contamination. Survey durations are usually of the order of four or five days.
Well evaluation (e.g. Vertical Seismic Profiling)	Sometimes conducted to assist with well evaluation by linking rock strata encountered in drilling to seismic survey data. A seismic source (airgun array, typically with a source size around 500 in^3 and with a maximum of 1,200 in^3, Stone 2015) is deployed from the rig, and measurements are made using a series of geophones deployed inside the wellbore.	VSP surveys are of short duration (one or two days at most).

2.3 Existing regulatory requirements and controls

The AA assumes that the high-level controls described below are applied as standard to activities since they are legislative requirements. These are distinct from further control measures which may be identified and employed to avoid likely significant effects on relevant sites. These further control measures are identified in Sections 5.2.3 and 5.3.3 with reference to the two main sources of effect identified.

2.3.1 Physical disturbance and drilling

The routine sources of potential physical disturbance and drilling effects associated with exploration are assessed and controlled through a range of regulatory processes, such as Environmental Impact Assessment (EIA) under the *Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999* (as amended) as part of the Drilling Operations Application through the Portal Environmental Tracking System and, where relevant, HRA to inform decisions on those applications[13].

There is a mandatory requirement to have sufficient recent and relevant data to characterise the seabed in areas where activities are due to take place (e.g. rig placement)[14]. If required, survey reports must be made available to the relevant statutory bodies on submission of a relevant permit application or Environmental Statement for the proposed activity, and the identification of any potential sensitive habitats by such survey (including those under Annex I of the Habitats Directive) may influence BEIS's decision on a project-level consent.

Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades (see review in DECC 2016, and related Appendices 2 and 3). As a result, oil and other contaminant concentrations in the major streams (drilling wastes and produced water) have been substantially reduced or eliminated (e.g. the discharge of oil based muds and contaminated cuttings is effectively banned), with discharges of chemicals and oil exceeding permit conditions or any unplanned release, potentially constituting a breach of the permit conditions and an offence. Drilling chemical use and discharge is subject to strict regulatory control through permitting, monitoring and reporting (e.g. the mandatory Environmental and Emissions Monitoring System (EEMS) and annual environmental performance reports). The use and discharge of chemicals must be risk assessed as part of the permitting process (e.g. Drilling Operations Application) under the *Offshore Chemicals Regulations 2002* (as amended), and the discharge of chemicals which would be expected to have a significant negative impact would not be permitted.

At the project level, discharges would be considered in detail in project-specific EIAs, (and where necessary through HRAs) and chemical risk assessments under existing permitting procedures.

[13] https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation
[14] See BEIS (2018). The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) – A Guide.

2.3.2 Underwater noise effects

Controls are in place to cover all significant noise generating activities on the UKCS, including geophysical surveying. Seismic surveys (including VSP and high-resolution site surveys), sub-bottom profile surveys and shallow drilling activities require an application for consent under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and cannot proceed without consent. These applications are supported by an EIA, which includes a noise assessment. Applications are made through BEIS's Portal Environmental Tracking System using a standalone Master Application Template (MAT) and Geological Survey Subsidiary Application Template (SAT). Regarding noise thresholds to be used as part of any assessment, applicants are encouraged to seek the advice of relevant SNCB(s) (JNCC 2017) in addition to referring to European Protected Species (EPS) guidance (JNCC 2010). Applicants are expected to be aware of recent research development in the field of marine mammal acoustics and the publication in the US of a new set of criteria for injury (NMFS 2016, referred to as NOAA thresholds).

BEIS consults the relevant statutory consultees on the application for advice and a decision on whether to grant consent is only made after careful consideration of their comments. Statutory consultees may request additional information or risk assessment, specific additional conditions to be attached to consent (such as specify timing or other specific mitigation measures) or advise against consent.

It is a condition of consents issued under Regulation 4 of the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) for oil and gas related seismic and sub-bottom profile surveys that the JNCC Seismic Guidelines are followed. Where appropriate, EPS disturbance licences may also be required under the *Conservation of Offshore Marine Habitats and Species Regulations 2017*[15]. JNCC have recently updated their guidelines (2017) and reaffirm that adherence to these guidelines constitutes best practice and will, in most cases, reduce the risk of deliberate injury to marine mammals to negligible levels. Applicants are expected to make every effort to design a survey that minimises sound generated and consequent likely impacts, and to implement best practice measures described in the guidelines.

In addition, potential disturbance of certain qualifying species (or their prey) may be avoided by the seasonal timing of offshore activities. For example, periods of seasonal concern for individual Blocks on offer have been highlighted with respect to seismic survey and fish spawning (see Section 2 of OGA's Other Regulatory Issues[16] which accompanied the 31st Round offer) which licensees should take account of. Licensees should also be aware that it may influence BEIS's decision whether or not to approve particular activities.

[15] Disturbance of European Protected Species (EPS) (i.e. those listed in Annex IV) is a separate consideration under Article 12 of the Habitats Directive, and is not considered in this assessment.
[16] https://www.ogauthority.co.uk/media/4942/other-regulatory-issues_june-2018.docx

3 Appropriate assessment process

3.1 Process

In carrying out this AA so as to determine whether it is possible to agree to the grant of licences in accordance with Regulation 5(1) of the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), BEIS has:

- Considered, on the basis of the precautionary principle, whether it could be concluded that the integrity of relevant European Sites would not be affected. This impact prediction involved a consideration of the in-combination effects.

- Examined, in relation to elements of the plan where it was not possible to conclude that the integrity of relevant sites would not be affected, whether appropriate mitigation measures could be designed which negated or minimised any potential adverse effects identified.

- Subject to consultation on this document, drawn conclusions on whether or not it can agree to the grant of relevant licences.

In considering the above, BEIS used the clarification of the tests set out in the Habitats Directive in line with the ruling of the ECJ in the *Waddenzee* case (Case C-127/02), so that:

- Prior to the grant of any licence all activities which may be carried out following the grant of such a licence, and which by themselves or in combination with other activities can affect the site's conservation objectives, are identified in the light of the best scientific knowledge in the field.

- A licence can only be granted if BEIS has made certain that the activities to be carried out under such a licence will not adversely affect the integrity of that site (i.e. cause deterioration to a qualifying habitat or habitat of qualifying species, and/or undermine the conservation objectives of any given site). That is the case where no reasonable scientific doubt remains as to the absence of such effects.

3.2 Site integrity

The integrity of a site is defined by government policy, in the Commission's guidance and clarified by the courts (Cairngorms judicial review case[17]) as being: *'…the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat,*

[17] World Wild Life Fund & Others, Re application for judicial review of decisions relating to the protection of European Sites at Cairngorm Mountain, by Aviemore and proposals for construction of a funicular railway thereon.

complex of habitats and/or the levels of populations of the species for which it was classified[/designated].' This is consistent with the definitions of favourable conservation status in Article 1 of the Directive (JNCC 2002). As clarified by the European Commission (2000), the integrity of a site relates to the site's conservation objectives. These objectives are assigned at the time of designation to ensure that the site continues, in the long-term, to make an appropriate contribution to achieving favourable conservation status for the qualifying interest features. An adverse effect would be something that impacts the site features, either directly or indirectly, and result in altering the ecological structure and functioning of the site which affects the ability of the site to meet its conservation objectives. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only with respect to habitat types or species other than those listed in Annex I or Annex II[18]. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3) of the Habitats Directive, provided that the coherence of the network is not affected. The AA must therefore conclude whether the proposed activity adversely affects the integrity of the site, in the light of its conservation objectives.

3.3 Assessment of effects on site integrity

The assessment has been undertaken in accordance with the European Commission Guidance (EC 2000) and with reference to other guidance, reports and policy, including the Habitats Regulations Guidance Notes (English Nature 1997, Defra 2012, SEERAD 2000), SNH (2015), the National Planning Policy Framework (MHCLG 2018), the Marine Policy Statement (HM Government 2011), English Nature report No. 704 (Hoskin & Tyldesley 2006) and Natural England report NECR205 (Chapman & Tyldesley 2016).

The assessment of effects on site integrity is documented in Sections 5-8. It has been informed by an evidence base on the environmental effects of oil and gas activities on the UKCS and elsewhere (Section 4) and has utilised a number of assumptions on the nature and scale of potential activities that could follow licensing (Table 2.2), along with the characteristics and specific environmental conditions of the relevant sites. Activities which may be carried out following the grant of a licence, and which by themselves or in combination with other activities can affect the conservation objectives of relevant sites are discussed under the following broad headings:

- Physical disturbance and drilling effects
- Underwater noise effects
- In-combination effects

[18] Noting that those typical species of the protected Annex I habitat types (as defined in Article 1), and other species and habitats types to the extent that they are necessary for the conservation of Annex I habitats or Annex II species must also be considered in appropriate assessment (as clarified in ECJ Judgement on Case C-461/17 of *Holohan and others v An Bord Pleanála*).

4 Evidence base for assessment

4.1 Introduction

The AAs are informed by an evidence base on the environmental effects of oil and gas activities derived from the scientific literature, relevant Strategic Environmental Assessments (e.g. DECC 2009, 2011 and 2016) and other literature. Recent operator Environmental Statements for offshore exploration and appraisal activities on the UKCS have also been reviewed, providing for example a more specific indication of the range of spatial footprints associated with relevant drilling activities to inform the further consideration of those sites where physical disturbance and drilling effects may be considered likely.

In recent years, much work has been undertaken in the area of sensitivity assessments and activity/pressure (i.e. mechanisms of effect) matrices (e.g. Tillin *et al*. 2010, JNCC 2013, Tillin & Tyler-Walters 2014, Defra 2015, Robson *et al.* 2018, the Scottish Government Feature Activity Sensitivity Tool, FeAST, the MarESA tool, Tyler-Walters *et al*. 2018). These matrices are intended to describe the types of pressures that act on marine species and habitats from a defined set of activities and are related to benchmarks where the magnitude, extent or duration is qualified or quantified in some way and against which sensitivity may be measured – note that benchmarks have not been set for all pressures. The sensitivity of features to any pressure is based on tolerance and resilience and can be challenging to determine (e.g. see Tillin & Tyler-Walters 2014, Pérez-Domínguez *et al.* 2016, Maher *et al.* 2016), for example due to data limitations for effect responses of species making up functional groups and/or lack of consensus on expert judgements. Outputs from such sensitivity exercises can therefore be taken as indicative.

A number of pressures associated with oil and gas exploration[19] (e.g. hydrocarbon & PAH contamination, introduction of other substances (solid, liquid or gas), synthetic compound contamination (including antifoulants), transition elements & organo-metal contamination, introduction or spread of non-indigenous species, and litter) are subject to existing controls either directly in relation to oil and gas activities (as outlined in Section 2.3) or generally in relation to shipping controls (e.g. MARPOL Annex I and V controls on oil and garbage respectively, and the Ballast Water Management Convention). Whilst these matrices are informative and identify relevant pressures associated with hydrocarbon exploration, resultant impacts at a scale likely to give rise to significant effects are not inevitable consequences of activity, and they can often be mitigated through timing, siting or technology (or a combination of these). The Department expects that these options would be evaluated by the licensees and documented in the environmental assessments required as part of the activity specific consenting regime.

[19] http://jncc.defra.gov.uk/page-7650 and http://jncc.defra.gov.uk/page-7136

A review of the range of pressures identified in the JNCC pressures-activities database (PAD) was made in relation to exploration activities relevant to the 31st Round. The review concluded that the evidence base for potential effects of oil and gas exploration from successive Offshore Energy SEAs and the review of the OESEA3 Environmental Report (BEIS 2018b) covers the range of pressures identified (as summarised in Sections 4.2-4.3) and has therefore been used to underpin the assessment against site-specific information.

The following sections provide a summary of the evidence informing the site-specific assessment of effects provided in Section 5, with headings reflecting those pressures identified to be relevant to the activities being assessed. To focus the presentation of relevant information, the sections take account of the environments in which those Blocks and relevant Natura 2000 sites to be subject to further assessment are located (Figure 1.1).

4.2 Physical disturbance and drilling effects

The pressures which may result from exploration activities and cause physical disturbance and drilling effects on the relevant Natura 2000 sites assessed in Section 5.2 are described below.

4.2.1 Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion

Jack-up rigs are likely to be used in the Moray Firth Blocks due to water depths (<120m). Such rigs leave three or four seabed depressions from the feet of the rig (the spud cans) around 15-20m in diameter. The form of the footprint depends on factors such as the spudcan shape, the soil conditions, the footing penetration and methods of extraction, with the local sedimentary regime affecting the longevity of the footprint (HSE 2004). For example, side scan survey data from a 2011 pipeline route survey in the central North Sea (Blocks 30/13c and 30/14) showed spudcan depressions associated with the drilling of a previous well in 2006 (no information on the depths of the depressions was provided). The well was located in a water depth of *ca*. 70m with sediments consisting of fine to medium silty sand with gravel, cobbles and coarse sand also present (Maersk 2011[20]). Tidal currents over the central North Sea Blocks (maximum 0.1-0.26m/s) are lower than those expected over the Moray Firth Blocks (for example, over the Smith Bank, peak currents vary between 0.45-0.52m/s during a mean spring tide, Caithness Petroleum 2012). In locations with an uneven or soft seabed, material such as grout bags or rocks may be placed on the seabed to stabilise the rig feet, and recoverable mud mats may be used in soft sediment (see 4.2.4 below).

The response of benthic macrofauna to physical disturbance has been well characterised in peer-reviewed literature, with increases in abundance of small opportunistic fauna and decreases in larger more specialised fauna (Eagle & Rees 1973, Newell *et al.* 1998, van Dalfsen *et al.* 2000, Dernie *et al*. 2003).

[20] https://docplayer.net/40962474-Environmental-statement-flyndre-and-cawdor-development.html

Habitat recovery from temporary disturbance (caused by spud can placement, anchor scarring, anchor mounds) will depend primarily on re-mobilisation of sediments by current shear (as reviewed by Newell *et al*. 1998, Foden *et al.* 2009). Subsequent benthic population recovery takes place through a combination of migration, re-distribution and larval settlement. On the basis that seabed disturbance is qualitatively similar to the effects of wave action from severe storms, it is likely that in most of the shallower parts of the UKCS, sand and gravel habitat recovery from anchor scarring, anchor mounds and cable scrape is likely to be relatively rapid (1-5 years) (van Dalfsen *et al.* 2000, Newell & Woodcock 2013).

Mud habitats, by contrast, are more sensitive to physical disturbance than the coarser sediments typical of high wave- and current-energy areas. The muddy sediments of deeper or quieter waters support benthic communities often characterised by large burrowing crustaceans and pennatulid sea-pens (*Virgularia mirabilis* and *Pennatula phosphorea*). Pennatulid mortality may be high following physical disturbance, but crustaceans are probably able to restore burrow entrances following limited physical disturbance of the sediment surface (a few cm). *P. phosphorea* spawns annually and its fecundity is high (Edwards & Moore 2008), information on the reproduction of *V. mirabilis* is sparse but is likely to be similar. Gates & Jones (2012) suggest that re-establishment of pennatulids is likely to take in excess of 5 years due to their slow growth rate (based on the Arctic species *Halipteris willemoesi*).

4.2.2 Abrasion/disturbance of the substrate on the surface of the seabed and habitat structure changes – removal of substratum

The surface hole sections of exploration wells are typically drilled riserless, producing a localised (and transient) pile of surface-hole cuttings around the surface conductor. These cuttings are derived from shallow geological formations and a proportion will be similar to surficial sediments in composition and characteristics. The persistence of cuttings discharged at the seabed is largely determined by the potential for it to be redistributed by tidal and other currents. After installation of the surface casing (which will result in a small quantity of excess cement returns being deposited on the seabed), the blowout preventer (BOP) is positioned on the wellhead housing. These operations (and associated activities such as ROV operations) may result in physical disturbance of the immediate vicinity (a few metres) of the wellhead. When an exploration well is abandoned, the conductor and casing are plugged with cement and cut below the mudline (seabed sediment surface) using a mechanical cutting tool deployed from the rig and the wellhead assembly is removed. The seabed "footprint" of the well is therefore removed although post-well sediments may vary in the immediate vicinity of the well compared to the surrounding seabed (see for example, Jones *et al*. (2012)).

The extent and potential impact of drilling discharges have been reviewed in successive SEAs, OESEA, OESEA2 and OESEA3 (DECC 2009, 2011 and 2016, respectively, also see BEIS 2018b).

Relevant information on the recovery of benthic habitats to smothering mainly comes from studies of dredge disposal areas (see Newell *at al.* 1998). Recovery following disposal occurs through a mixture of vertical migration of buried fauna, together with sideways migration into the area from the edges, and settlement of new larvae from the plankton. The community recolonising a disturbed area is likely to differ from that which existed prior to construction.

Opportunistic species will tend to dominate initially and on occasion, introduced and invasive species may then exploit the disturbed site (Bulleri & Chapman 2010). Harvey *et al.* (1998) suggest that it may take more than two years for a community to return to a closer resemblance of its original state (although if long lived species were present this could be much longer). Shallow water (<20m) habitats in wave or current exposed regimes, with unconsolidated fine grained sediments have a high rate of natural disturbance and the characteristic benthic species are adapted to this. Species tend to be short lived and rapid reproducers and it is generally accepted that they recover from disturbance within months. By contrast a stable sand and gravel habitat in deeper water is believed to take years to recover (see Newell *et al.* 1998, Foden *et al*. 2009).

4.2.3 Physical change to another seabed type

As noted, there may be a requirement for jack-up rig stabilisation (e.g. rock placement or use of mud mats) depending on local seabed conditions although an ES for an exploration well in Block 11/24b indicated that rig stabilisation was unlikely to be required due to the time of year of drilling operations (September), the water depth (*ca*. 50m) and local hydrographic regime (Caithness Petroleum 2012). In soft sediments, rock deposits may cover existing sediments resulting in a physical change of seabed type. The introduction of rock into an area with a seabed of sand and/or gravel can in theory provide "stepping stones" which might facilitate biological colonisation including by non-indigenous species by allowing species with short lived larvae to spread to areas where previously they were effectively excluded. On the UK continental shelf natural "stepping stones" are already widespread and numerous for example in the form of rock outcrops, glacial dropstones and moraines, relicts of periglacial water flows, accumulations of large mollusc shells, carbonate cemented rock etc., and these are often revealed in rig site and other (e.g. pipeline route) surveys. The potential for man-made structures to act as stepping stones in the North Sea and the impact of their removal during decommissioning is being investigated as part of the INSITE[21] programme. Phase 1 projects (2015-2017) are now complete; those of relevance suggest that man-made structures may influence benthic community structure and function but only on a limited spatial scale. Modelling indicates the potential for biological connectivity between structures in the North Sea but this has not been validated by empirical data (ISAB 2018). BEIS are supporting Phase 2 of INSITE research.

4.2.4 Contamination[22]

The past discharge to sea of drill cuttings contaminated with oil based drill mud (OBM) resulted in well documented acute and chronic effects at the seabed (e.g. Davies *et al.* 1989, Olsgard & Gray 1995, Daan & Mulder 1996). These effects resulted from the interplay of a variety of factors of which direct toxicity (when diesel based muds were used) or secondary toxicity as a consequence of organic enrichment (from hydrogen sulphide produced by bacteria under anaerobic conditions) were probably the most important. Through OSPAR and other actions,

[21] https://www.insitenorthsea.org/

[22] Including contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas).

the discharge of oil based and other organic phase fluid contaminated material is now effectively banned. The "legacy" effects of contaminated sediments on the UKCS resulting from OBM discharges have been the subject of joint industry work (UKOOA 2002) and reporting to OSPAR.

The UK Government/Industry Environmental Monitoring Committee has reviewed UK offshore oil and gas monitoring requirements and developed a monitoring strategy which aims to ensure that adequate data is available on the environmental quality status in areas of operations for permitting assurance and to meet the UK's international commitments to report on UK oil industry effects. This strategy has been implemented since 2004 and has included regional studies in various parts of the North Sea, and surveys around specific single and multi-well sites.

Overall, there are positive indications of recovery of sediments and communities in both the Fladen Ground and East Shetland Basin from the historic effects of oil-based mud discharges. The total PAH and total n-alkane concentrations in Fladen Ground sediments were all lower in 2001 than in 1989 and are now at levels which are considered below 'background'. The results of the most recent Fladen Ground survey confirm this general pattern of recovery.

In contrast to historic oil based mud discharges[23], effects on seabed fauna resulting from the discharge of cuttings drilled with water based muds (WBM) and of the excess and spent mud itself are usually subtle or undetectable (e.g. Cranmer 1988, Neff *et al*. 1989, Hyland *et al*. 1994, Daan & Mulder 1996, Currie & Isaacs 2005, OSPAR 2009, Bakke *et al.* 2013, DeBlois *et al.* 2014). Considerable data has been gathered from the North Sea and other production areas, indicating that localised physical effects are the dominant mechanism of ecological disturbance where water-based mud and cuttings are discharged. Modelling of WBM cutting discharges has indicated that deposition of material is generally thin and quickly reduces away from the well.

OSPAR (2009) concluded that the discharge of water-based muds and drill cuttings may cause some smothering in the near vicinity of the well location. The impacts from such discharges are localised and transient but may be of concern in areas with sensitive benthic fauna, for example corals and sponges. Field experiments on the effects of water-based drill cuttings on benthos by Trannum *et al*. (2011) found after 6 months only minor differences in faunal composition between the controls and those treated with drill cuttings. This corresponds with the results of field studies where complete recovery was recorded within 1-2 years after deposition of water-based drill cuttings (Daan & Mulder 1996, Currie & Isaacs 2005).

Finer particles may be dispersed over greater distances than coarser particles although exposure to WBM cuttings in suspension will in most cases be short-term (Bakke *et al.* 2013). Chemically inert, suspended barite has been shown under laboratory conditions to potentially

[23] OSPAR Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings came into effect in January 2001 and effectively eliminated the discharge of cuttings contaminated with oil based fluids (OBF) greater than 1% by weight on dry cuttings.

have a detrimental effect on suspension feeding bivalves. Standard grade barite, the most commonly used weighting agent in WBMs, was found to alter the filtration rates of four bivalve species (*Modiolus modiolus, Dosinia exoleta, Venerupis senegalensis* and *Chlamys varia*) and to damage the gill structure when exposed to 0.5mm, 1.0mm and 2.0mm daily depth equivalent doses (Strachan 2010, Strachan & Kingston 2012). All three barite treatments altered the filtration rates leading to 100% mortality. The horse mussel (*M. modiolus*) was the most tolerant to standard barite with the scallop (*C. varia*) the least tolerant. Fine barite, at a 2mm daily depth equivalent, also altered the filtration rates of all species, but only affected the mortality of *V. senegalensis*, with 60% survival at 28 days. The bulk of WBM constituents (by weight and volume) are on the OSPAR list of substances used and discharged offshore which are considered to Pose Little or No Risk to the Environment (PLONOR). Barite and bentonite are the materials typically used in the greatest quantities in WBMs and are of negligible toxicity. Field studies undertaken by Strachan (2010) showed that the presence of standard grade barite was not acutely toxic to seabed fauna but did alter benthic community structure. When the suspended barite levels used in laboratory studies are translated to field conditions (i.e. distances from the point of discharge) it is clear that any effects will be very local to a particular installation (in the case of oil and gas facilities, well within 500m).

4.2.5 Introduction or spread of non-indigenous species

Through the transport and discharge of vessel ballast waters (and associated sediment), and to a lesser extent fouling organisms on vessel/rig hulls, non-native species may be introduced to the marine environment. Should these introduced species survive and form established breeding populations, they can result in negative effects on the environment. These include: displacing native species by preying on them or out-competing them for resources; irreversible genetic pollution through hybridisation with native species, and increased occurrence of harmful algal blooms (as reviewed in Nentwig 2007). The economic repercussions of these ecological effects can also be significant (see IPIECA & OGP 2010, Lush *et al*. 2015, Nentwig 2007). In response to these risks, a number of technical measures have been proposed such as the use of ultraviolet radiation to treat ballast water or procedural measures such as a mid-ocean exchange of ballast water (the most common mitigation against introductions of non-native species). Management of ballast waters is addressed by the International Maritime Organisation (IMO) through the International Convention for the Control and Management of Ships Ballast Water & Sediments, which entered into force in 2017[24]. The Convention includes Regulations with specified technical standards and requirements (IMO Globallast website[25]). Further oil and gas activity is unlikely to change the risk of the introduction of non-native species as the vessels typically operate in a geographically localised area (e.g. rigs may move between the Irish Sea and North Sea), and the risk from hull fouling is low, given the geographical working region and scraping of hulls for regular inspection.

[24] http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx
[25] http://archive.iwlearn.net/globallast.imo.org/the-bwmc-and-its-guidelines/index.html

4.2.6 Visual disturbance and above water noise

Blocks may support important numbers of birds at certain times of the year including overwintering birds and those foraging from coastal SPAs. Therefore, the presence and/or movement of vessels and aircraft from and within Blocks during exploration and appraisal activities could temporarily disturb birds from relevant SPA sites. In areas where helicopter transits are regular, a degree of habituation to disturbance amongst some birds has been reported (see Smit & Visser 1993). The anticipated level of helicopter traffic associated with Block activity (2-3 trips per week, see Table 2.2) is likely to be insignificant in the context of existing helicopter, military and civilian aircraft activity levels. Helicopter traffic associated with Block activity is also unlikely to deviate from established main routes (e.g. over the Moray Firth[26] and central and northern North Sea[27]), which will reduce the potential of causing temporary disturbance of birds not previously exposed to this pressure.

Physical disturbance of seaduck and other waterbird flocks by vessel and aircraft traffic associated with hydrocarbon exploration and appraisal is possible, particularly in SPAs established for shy species (e.g. common scoter). Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. For example, large flocks of common scoter were observed being put to flight at a distance of 2km from a 35m vessel, though smaller flocks were less sensitive and put to flight at a distance of 1km (Kaiser 2002, also see Schwemmer *et al.* 2011). Larger vessels would be expected to have an even greater disturbance distance (Kaiser *et al.* 2006). Mendel *et al.* (2019) further note behavioural response in red-throated diver within 5km of ships. With respect to the disturbance and subsequent displacement of seabirds in relation to offshore wind farm (OWF) developments, the Joint SNCB interim displacement advice[28] recommends for most species a standard displacement buffer of 2km with the exception of the species groups of divers and sea ducks. Divers and sea ducks have been assessed as being the most sensitive species groups to offshore development and associated boat and helicopter traffic. Therefore, for divers and sea ducks a 4km displacement buffer is recommended. Whilst displacement effects for divers have been detected at greater distances (e.g. 5-7km, Webb 2016; significant changes noted at 10-16.5km, Mendel *et al.* 2019), this relates to the construction and operation of offshore wind farms which have a much larger spatial and temporal footprint than oil and gas exploration activities.

4.2.7 Introduction of light

A significant number of various bird species migrate across the North Sea region twice a year or use the area for feeding and resting (OSPAR 2015). Some species crossing or using the area may become attracted to offshore light sources, especially in poor weather conditions with restricted visibility (e.g. low clouds, mist, drizzle, Wiese *et al*. 2001), and this attraction can potentially result in mortality through collision (OSPAR 2015). As part of navigation and worker safety, and in accordance with international requirements, drilling rigs and associated vessels

[26] https://www.aurora.nats.co.uk/htmlAIP/Publications/2019-01-31-AIRAC/graphics/41008.pdf
[27] https://www.aurora.nats.co.uk/htmlAIP/Publications/2019-01-31-AIRAC/graphics/41001.pdf
[28] http://jncc.defra.gov.uk/pdf/Joint_SNCB_Interim_Displacement_AdviceNote_2017.pdf

are lit at night and the lights will be visible at distance (some 10-12nm in good visibility). Guidelines (applicable to both existing and new offshore installations) aimed at reducing the impact of offshore installations lighting on birds in the OSPAR maritime area are available (OSPAR 2015). Exploration drilling activities are temporary so a drilling rig will be present at a location for a relatively short period (e.g. up to 10 weeks), limiting the potential for significant interaction with migratory bird populations. Given the seasonal nature of the sensitivity, where relevant it is more appropriate to consider this in project-level assessment (e.g. EIA and HRA where necessary), when the location and timing of activities are known.

4.2.8 Collisions above or below water with static or moving objects

Worldwide, collisions with vessels are a potential source of mortality to marine mammals, primarily cetaceans. Whales are occasionally reported to be struck and killed, especially by fast-moving ferries but smaller cetacean species and seals can also be impacted by propeller strikes from smaller vessels. In the UK certain areas experience very high densities of commercial and recreational shipping traffic, some of which may also be frequented by large numbers of marine mammals; despite this, relatively few deaths are recorded as results of collisions (Hammond *et al.* 2008). Between 2000 and 2009, only 11 out of 1,100 post-mortems on harbour porpoises and common dolphins identified collision as the cause of death (UKMMAS 2010).

4.3 Underwater noise effects[29]

The current level of understanding of sources, measurement, propagation, ecological effects and potential mitigation of underwater noise associated with hydrocarbon exploration and production have been extensively reviewed, assessed and updated in each of the successive offshore energy SEAs (see DECC 2009, 2011, 2016). The following description of noise sources and potential effects builds on these previous publications, augmented with more recent literature sources.

4.3.1 Noise sources and propagation

Of those oil and gas activities that generate underwater sound, deep geological seismic survey (2D and 3D) is of primary concern due to the high amplitude, low frequency and impulsive nature of the sound generated over a relatively wide area. Typical 2D and 3D seismic surveys consist of a vessel towing a large airgun array, made up of sub-arrays or single strings of multiple airguns, along with towed hydrophone streamers. Total energy source volumes vary between surveys, most commonly between 1,000 and 8,000 inches^3, with typical broadband source levels of 248-259 dB re 1μPa (OGP 2011). Most of the energy produced by airguns is low frequency: below 200Hz and typically peaking around 100Hz; source levels at higher frequencies are low relative to that at the peak frequency but are still loud in absolute terms and relative to background levels. As detailed in Section 2.2.1 some work programmes

[29] Note that all underwater noise effects fall within the “underwater noise change” and “vibration” pressure definitions.

relating to the Blocks applied for in the 31st Round include the intention to conduct a 3D seismic survey.

In addition to seismic surveys, relevant sources of impulsive sound are restricted to the smaller volume air-guns and sub-bottom profilers used in site surveys and well evaluation (i.e. Vertical Seismic Profiling, VSP), and also from occasional pile-driving of conductors during drilling. Compared to deep geological survey, these smaller volume sources tend to generate sound of lower amplitude, are typically complete within several hours on a single day, are conducted from either a fixed point (VSP) or cover a small area (site surveys) and, in the case of some sub-bottom profilers, operate at a higher frequency than air guns[30]. Consequently, the overall magnitude and area of risk from sound effects is considerably smaller than in the case of deep geological seismic surveys.

Drilling operations and support vessel traffic are sources of continuous noise (non-impulsive), of a comparable amplitude, dominated by low frequencies and of a lower amplitude than deep geological seismic survey. Sound pressure levels of between 120dB re 1µPa in the frequency range 2-1,400Hz (Todd & White 2012) are probably typical of drilling from a jack-up rig, with slightly higher source levels likely from semi-submersible rigs due to greater rig surface area contact with the water column. In general, support and supply vessels (50-100m) are expected to have broadband source levels in the range 165-180dB re 1µPa@1m, with the majority of energy below 1kHz (OSPAR 2009). Additionally, the use of thrusters for dynamic positioning has been reported to result in increased sound generation (>10dB) when compared to the same vessel in transit (Rutenko & Ushchipovskii 2015).

For all sources, there is now a reasonable body of evidence to quantify sound levels associated with these activities and to understand the likely propagation of these sounds within the marine environment, even in more complex coastal locations (DECC 2016).

4.3.2 Potential ecological effects

Potential effects of anthropogenic noise on receptor organisms range widely, from masking of biological communication and small behavioural reactions, to chronic disturbance, physiological injury and mortality. While generally the severity of effects tends to increase with increasing exposure to noise, it is important to draw a distinction between effects from physical (including auditory) injury and those from behavioural disturbance. In addition to direct effects, indirect effects may also occur, for example via effects on prey species, complicating the overall assessment of significant effects. Marine mammals, and in particular the harbour porpoise, are regarded as particularly sensitive to underwater noise effects therefore it is considered appropriate to focus on marine mammals when assessing risk from underwater noise; however, high amplitude impulsive noise also potentially presents a risk to fish and diving birds.

[30] It should be noted that airgun (including VSP) and sub-bottom profiling site surveys undertaken in relation to licences issued under the *Petroleum Act 1998* require consent under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), but side-scan sonar and multibeam echosounder surveys only require to be notified to the Regulator (JNCC 2017).

Marine mammals

The risk of physical injury (hearing loss) from an activity can be assessed by modelling the propagation of sound from an activity and using threshold criteria corresponding to the sound levels at which permanent hearing loss (permanent threshold shift, PTS) would be expected to occur. For marine mammals, the latest SEA (DECC 2016) reflects the injury thresholds criteria developed by Southall *et al.* (2007), including the subsequent update for harbour porpoises in Lepper *et al*. (2014), based on the work by Lucke *et al.* (2009). Since then, NOAA has further updated the acoustic thresholds, including alternative frequency-weighting functions (NMFS 2016). It is recognised that geophysical surveys (primarily 2D and 3D seismic) have the potential to generate sound that exceeds thresholds of injury, but only within a limited range from source (tens to hundreds of metres); for site surveys and VSP, the range from source over which injury may occur will be even smaller. Within this zone, JNCC (2017) provide guidelines which are thought sufficient in minimising the risk of injury to marine mammals to negligible levels.

With respect to disturbance, it has proved much more difficult to establish broadly applicable threshold criteria based on exposure alone; this is largely due to the inherent complexity of animal behaviour where the same sound level is likely to elicit different responses depending on an individual's behavioural context and exposure history. For compliance with the Habitat Directive, the guidance for the protection of marine European Protected Species from injury and disturbance (JNCC 2010) recommends that 'disturbance' is interpreted as sustained or chronic disruption of behaviour scoring five or more in the Southall *et al*. (2007) behavioural response severity scale[31]. This is to highlight that a disturbance offence is unlikely to occur from sporadic changes in behaviour with negligible consequences on vital rates and population effects (i.e. trivial disturbance). While it is possible to envisage how some behavioural effects may ultimately influence vital rates, evidence is currently limited. The focus of field studies has been on measuring displacement and changes in vocalisation with the assumption that these may influence vital rates mainly via a reduction in foraging opportunities.

Evidence on the effects of seismic surveys on odontocetes and pinnipeds is limited but of note are studies in the Moray Firth observing harbour porpoise responses to a 10 day 2D seismic survey (Thompson *et al.* 2013a). The 2D seismic survey took place in September 2011 and exposed a 200km^2 area to noise; peak-to-peak source levels generated by the 470 cubic inch airgun array were estimated to be 242-253 dB re 1 µPa at 1m and are therefore representative of the volume of a typical array used in VSP, and larger than that used in rig-site survey. Within 5-10km from the source, received peak-to-peak SPLs were estimated to be between 165 and 172 dB re 1 µPa, with SELs for a single pulse between 145 and 151 dB re 1 µPa^{2}s. A relative decrease in the density of harbour porpoises within 10km of the survey vessel and a relative increase in numbers at distances greater than 10km was reported; however, these effects were short-lived, with porpoise returning to affected areas within 19 hours after cessation of activities. Overall, it was concluded that while short-term disturbance was induced, the survey did not lead to long-term or broad-scale displacement (Thompson *et al*.

[31] See Table 4 (p450) of Southall *et al.* (2007) for a full description of response scores.

2013a). Further acoustic analyses revealed that for those animals which stayed in proximity to the survey, there was a 15% reduction in buzzing activity associated with foraging or social activity; however, a high level of natural variability in the detection of buzzes was noted prior to survey (Pirotta *et al*. 2014). Passive acoustic monitoring provided evidence of short-term behavioural responses also for bottlenose dolphins, but no measurable effect on the number of dolphins using the Moray Forth SAC could be identified (Thompson *et al*. 2013b).

As concluded in OESEA3 (DECC 2016), a conservative assessment of the potential for marine mammal disturbance of seismic surveys will assume that firing of airguns will affect individuals within 10km of the source, resulting in changes in distribution and a reduction of foraging activity but the effect is short-lived. The precautionary criterion applied during initial Block screening (15km from relevant sites) is maintained here to identify the Blocks applied for to be considered with respect to likely significant effects in this assessment (see Section 5.3); this is to reflect the degree of uncertainty and the limited direct evidence available and to allow for a greater potential for disturbance when large array sizes are used.

Recent evidence on harbour porpoise responses to impact piling during wind-farm construction is also relevant since the impulsive character of the sound generated during piling is comparable with that from seismic airguns and for assessing in-combination effects with wind farms currently planned or under construction across the North Sea. Empirical studies during the construction of OWFs in the North and Baltic Seas (Carstensen *et al*. 2006, Tougaard *et al*. 2009, Brandt *et al*. 2011, 2018, Dähne *et al.* 2013) have all observed displacement of harbour porpoises in response to pile-driving. The magnitude of the effect (spatial extent and duration) varied between studies as a function of the many factors including exposure level, duration of piling and ecological importance of the area. Nonetheless, from the available evidence it has been concluded that impact piling will displace individual harbour porpoises within an area of approximately 20km radius; however, once piling ceases, harbour porpoises are expected to return readily (hours to days) (DECC 2016). Current SNCB advice assumes a distance of 26km as the zone of disturbance for pile-driving (Joint SNCB response to 29th Round draft AA, February 2017). At Horns Rev wind farm, off the Danish North Sea coast, a study using satellite telemetry showed that harbour seals were still transiting the site during periods of piling, but no conclusive results could be obtained from analysis of habitat use with regard to a change in response to piling (Tougaard *et al*. 2006). Evidence of a response was obtained by Edrén *et al.* (2010) at a haul-out site 4km away from the Danish Nysted windfarm; during piling, numbers hauling out were reduced by 10-60% but the effect was only of short duration since the overall number of seals increased slightly during the whole construction phase. Russell *et al*. (2016) used telemetry data from 23 harbour seals to investigate potential avoidance of seals to the construction of the Lincs wind farm in The Wash off the east coast of England, including pile-driving of mono-pile foundations. While there was no significant displacement during construction as a whole, seal abundance during piling was significantly reduced up to 25km from the piling activity, with a 19-83% (95% confidence intervals) reduction in usage compared to breaks in piling activity. This displacement was shown to be temporary, with seals returning to their non-piling distribution within two hours of the cessation of piling.

Information on the potential effects of other geophysical surveys (e.g. sub-bottom profilers) is currently very limited and the most recent OESEA (DECC 2016) concluded that effects are negligible but with a high level of uncertainty. Laboratory and field measurements on similar equipment are part of a US project. Outputs from these studies will be considered in due course to reduce uncertainty in assessments. With regard to conductor piling, the low hammer energy, narrow diameter of pipes and short duration of piling, combined with field measurements of sound propagation from this activity (Jiang *et al*. 2015, MacGillivray 2018), suggest a very low potential for significant disturbance of marine mammals.

The presence and/or movement of vessels from and within Blocks during exploration and appraisal activities could also potentially disturb marine mammals foraging within or close to designated or potential SACs for which they are a qualifying feature. Reported responses include avoidance, changes in swimming speed, direction and surfacing patterns, alteration of the intensity and frequency of calls and increases in stress-related hormones (Rolland *et al.* 2012, Dyndo *et al.* 2015, Veirs *et al.* 2016). Harbour porpoises, white-sided dolphins and minke whales have been shown to respond to survey vessels by moving away from them, while white-beaked dolphins have shown attraction (Palka & Hammond 2001). A study on captive harbour porpoises in a semi-natural net-pen complex in a Danish canal, recorded their behaviour while simultaneously measuring underwater noise of vessels passing the enclosure; reaction to noise was defined to occur when a highly stereotyped ‘porpoising’ behaviour was observed. Porpoising occurred in response to almost 30% of vessel passages. Statistical analyses showed that higher levels of medium- to high-frequency components of vessel noise (250Hz to 63 kHz octave bands) significantly increase the probability of porpoising. By contrast, there was no significant relationship between porpoising behaviour and low-frequency components of vessel noise (3.51 to 125Hz) or the presence of pulses from echo-sounders on the vessels (Dyndo *et al*. 2015). A tagging study of porpoises in Danish coastal waters estimated that porpoises encountered vessel noise 17–89% of the time (from evaluation of the wideband sound and movement tag recordings). Occasional high levels of noise (coinciding with a fast ferry) were associated with vigorous fluking, bottom diving, interrupted foraging and even cessation of echolocation, leading to significantly fewer prey capture attempts at received levels greater than 96 dB re 1 µPa (16 kHz third-octave band, Wisniewska *et al.* 2018).

More evidence is available on bottlenose dolphins, especially for coastal populations. Monitoring of the effects of boat activity on bottlenose dolphin behaviour off the US South Carolina coast, indicated that slow moving, large vessels, like ships or ferries, appeared to cause little to no obvious response in bottlenose dolphin groups (Mattson *et al*. 2005). Pirotta *et al*. (2015) used passive acoustic techniques to quantify how boat disturbance affected bottlenose dolphin foraging activity in the inner Moray Firth. The presence of moving motorised boats appeared to affect buzzing activity (foraging vocalisations), with boat passages corresponding to a reduction by almost half in the probability of recording a buzz. The boat effect was limited to the time when a boat was physically present in the sampled area and visual observations indicated that the effect increased for increasing numbers of boats in the area (Pirotta *et al.* 2013). Dolphins appeared to temporarily interrupt their activity when disturbed, staying in the area and quickly resuming foraging as the boat moved away.

Of primary concern for this HRA is whether vessels linked to potential operations result in a significant increase to overall local traffic. New *et al*. (2013) developed a mathematical model simulating the complex social, spatial, behavioural and motivational interactions of coastal bottlenose dolphins in the Moray Firth to assess the biological significance of increased rate of behavioural disruptions caused by vessel traffic. A scenario was explored in which vessel traffic increased from 70 to 470 vessels a year but despite the more than six fold increase traffic, the dolphins' behavioural time budget, spatial distribution, motivations and social structure remained unchanged. While harbour porpoises appear to be more sensitive to potential disturbance than bottlenose dolphins, the increase in vessel traffic linked to the proposed plan is expected to be negligible (see Table 2.2). In UK waters, a modelling study indicated a negative relationship between the number of ships and the presence and abundance of harbour porpoises when shipping intensity exceeded a suggested threshold of approximately 50 ships per day (within any of the model's 5km grid cells) in the Celtic Sea/Irish Sea and 80 ships per day in the North Sea (Heinänen & Skov 2015).

Fish

Many species of fish are highly sensitive to sound and vibration and broadly applicable sound exposure criteria have recently been published (Popper *et al.* 2014). Studies investigating fish mortality and organ damage from noise generated during seismic surveys are very limited and results are highly variable, from no effect to long-term auditory damage (reviewed in Popper *et al.* 2014). Behavioural responses and effects on fishing success ("catchability") have been reported following seismic surveys (Pearson *et al.* 1992, Skalski *et al.* 1992, Engås *et al.* 1996, Wardle *et al*. 2001). Potential effects on migratory diadromous fish is an area of significant interest for which empirical evidence is still limited, especially as salmonids and eels are sensitive to particle motion (not sound pressure) (Gill & Bartlett 2010). Atlantic salmon *Salmo salar* have been shown through physiological studies to respond to low frequency sounds (below 380Hz), with best hearing at 160Hz (threshold 95 dB re 1 μPa). More recently, Harding *et al.* (2016) note a lower sensitivity at 100Hz than previously reported (by Hawkins & Johnstone 1978), and greater sensitivity at frequencies of >200Hz, with evidence of some response at 400-800Hz. However, the authors qualify their results with differences in methodological approach, and the use of fish maintained in tanks receiving low frequency ambient sound within the greatest range of sensitivity (<300Hz) for some time in advance of the experiments taking place. The ability of salmon to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity relative to other fish species (Hawkins & Johnstone 1978, cited by Gill & Bartlett 2010, Harding *et al.* 2016).

In addition to considering direct effects on fish as qualifying features of Natura 2000 sites, fish are important prey items of seabird, marine mammal and fish qualifying features. Fish species of known importance to diving seabirds and marine mammals in the North Sea include sandeels, pelagic species such as herring and sprat, and young gadoids. Sandeels lack a swim bladder, which is considered to be responsible for their observed low sensitivity to underwater noise (Suga *et al*. 2005) and minor, short-term responses to seismic survey noise (Hassel *et al*. 2004), although data are limited. Herring are considered hearing specialists and detect a broader frequency range than many species. Sprat are assumed to have similar sensitivities to herring due to their comparable morphology, although studies on this species are lacking. Observed responses of herring to underwater noise vary. For example, Peña *et al*. (2013) did not observe any changes in swimming speed, direction, or school size as a 3D seismic vessel slowly approached schools of feeding herring from a distance of 27km to 2km; conversely, Slotte *et al*. (2004) observed herring and other mesopelagic fish to be distributed at greater depth during periods of seismic shooting than non-shooting, and a reduced density within the survey area. Evidence for and against avoidance of approaching vessels by herring has been reported (e.g. Skaret *et al*. 2005, Vabø *et al*. 2002), with the nature of responses believed to be related to the activity of the school at the time.

Following a review of relevant studies, MMS (2004) consider that the "consensus is that seismic airgun shooting can result in reduced trawl and longline catch of several species when the animals receive levels as low as 160dB". These reduced catches are temporary in nature and likely reflect temporary displacement and/or altered feeding behaviour. No associations of lower-intensity, continuous drilling noise and fishing success have been demonstrated, and large numbers of fish are typically observed around producing installations in the North Sea (e.g. Løkkeborg *et al*. 2002, Fujii 2015) and elsewhere (e.g. Stanley & Wilson 1991).

Diving birds

Direct effects from seismic exploration noise on diving birds could potentially occur through physical damage, or through disturbance of normal behaviour, although evidence for such effects is very limited. Deeper-diving species which spend longer periods of time underwater (e.g. auks) may be most at risk of exposure to high-intensity noise from seismic survey and consequent injury or disturbance, but all species which routinely submerge in pursuit of pelagic or benthic prey (i.e. excluding shallow plunge feeders) may be exposed to anthropogenic noise. A full list of relevant species occurring in the UK is provided in Box 4.1, all of which are qualifying species of one or more relevant sites considered in this HRA (see Appendix A).

Very high amplitude low frequency underwater noise may result in acute trauma to diving seabirds, with several studies reporting mortality of diving birds in close proximity (i.e. tens of metres) to underwater explosions (Yelverton *et al*. 1973, Cooper 1982, Stemp 1985, Danil & St Leger 2011). However, mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere. While seabird responses to approaching vessels are highly variable, flushing disturbance would be expected to displace most diving seabirds from close proximity to seismic airgun arrays, particularly among species more sensitive to visual disturbance such as scoter, divers and cormorant (Garthe & Hüppop 2004). Therefore, the potential for acute trauma to diving birds from seismic survey is considered to be very low.

Data relating to the potential behavioural disturbance of diving birds due to underwater noise are very limited. The reported in-air hearing sensitivity for a range of diving duck species, red-throated diver and gannet have been tested for tone bursts between frequencies of 0.5-5.7kHz; results revealed a common region of greatest sensitivity from 1-3kHz, with a sharp reduction in sensitivity >4kHz (Crowell e*t al.* 2015). Similar results were observed for African penguin; tests of in-air hearing showed a region of best sensitivity of 0.6-4kHz, consistent with the vocalisations of this species (Wever *et al*. 1969). Testing on the long-tailed duck underwater showed reliable responses to high intensity stimuli (> 117 dB re 1μPa) from 0.5-2.9kHz

(Crowell 2014). An underwater hearing threshold for cormorant of 70-75 dB re 1µPa rms for tones at tested frequencies of 1-4kHz has been suggested (Hansen *et al*. 2017). The authors argue that this underwater hearing sensitivity, which is broadly comparable to that of seals and small odontocetes at 1-4kHz, is suggestive of the use of auditory cues for foraging and/or orientation and that cormorant, and possibly other species which perform long dives, are sensitive to underwater sound. The use of acoustic pingers mounted on the corkline of a gillnet in a salmon fishery, emitting regular impulses of sound at *ca.* 2kHz, was associated with a significant reduction in entanglements of guillemot, but not rhinoceros auklet (Melvin *et al*. 1999). In a playback experiment on wild African penguins, birds showed strong avoidance behaviour (interpreted as an antipredator response) when exposed to killer whale vocalisations and sweep frequency pulses, both focussed between 0.5-3kHz (Frost *et al*. 1975).

McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic noise in some species (e.g. penguins, a possible proxy for auk species) would be high, hence individuals might be adversely affected only in close proximity to the source. A study investigated seabird abundance in Hudson Strait (Atlantic seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of fulmar, kittiwake and thick-billed murre (Brünnich’s guillemot). More recently, Pichegru *et al*. (2017) used telemetry data from breeding African penguins to document a shift in foraging distribution during a 2D seismic survey off South Africa. Pre/post shooting, areas of highest use (indicated by the 50% kernel density distribution) bordered the closest boundary of the seismic survey; during shooting, their distribution shifted away from the survey area, with areas of higher use at least 15km from the closest survey line. However, insufficient information was provided on the spatio-temporal distribution of seismic shooting or penguin distribution to determine an accurate displacement distance. The penguins quickly reverted to normal foraging behaviour after cessation of seismic activities, suggesting a relatively short-term influence of seismic activity on these birds’ behaviour and/or that of their prey (Pichegru *et al*. 2017).

The data are limited, but the observed regions of greatest hearing sensitivity for cormorants in water and other diving birds in air are above the low frequencies (i.e. <500Hz) which dominate and propagate most widely from geological survey. While there is some evidence of noise-induced changes in the distribution and behaviour of diving birds in response to impulsive underwater noise, these have been temporary and may be a direct disturbance or reflect a change in prey distribution during that period (possibly as a result of seismic activities).

Box 4.1: Migratory and/or Annex I diving bird species occurring in the UK considered potentially vulnerable to underwater noise effects

Divers and grebes	Diving ducks
Great northern diver *Gavia immer* **Red-throated diver *Gavia stellata*** Black-throated diver *Gavia arctica* Little grebe *Tachybaptus ruficollis* Great crested grebe *Podiceps cristatus* **Slavonian grebe *Podiceps auritus*** **Seabirds** Manx shearwater *Puffinus puffinus* Gannet *Morus bassanus* **Cormorant *Phalacrocorax carbo carbo*** **Shag *Phalacrocorax aristotelis*** **Guillemot *Uria aalge*** **Razorbill *Alca torda*** **Puffin *Fratercula arctica***	Pochard *Aythya ferina* Tufted duck *Aythya fuligula* **Scaup *Aythya marila*** **Eider *Somateria mollissima*** **Long-tailed duck *Clangula hyemalis*** **Common scoter *Melanitta nigra*** **Velvet scoter *Melanitta fusca*** **Goldeneye *Bucephala clangula*** **Red-breasted merganser *Mergus serrator*** Goosander *Mergus merganser*

Note: Includes species which are known to engage in pursuit diving or benthic feeding in marine, coastal and estuarine waters at least during part of the year. Species in ***bold*** *are those of relevance to the sites and Blocks considered within this AA.*

5 Assessment

The screening process (BEIS 2018a) identified a number of sites in the Moray Firth where there was the potential for likely significant effects associated with proposed activities that could follow licensing of Blocks offered in the 31st Round. The further assessment of 11 sites in relation to 15 Blocks applied for in the Moray Firth is given below. This assessment has been informed by the evidence base on the environmental effects of relevant oil and gas activities (Section 4) and the assumed nature and scale of potential activities (Table 2.2).

5.1 Relevant sites

A description of the each of the relevant sites is provided below based on the site citation and site selection information, which has been augmented by additional information from grey and primary sources relevant to site qualifying features. The assessment of these sites in relation to the 31st Round Moray Firth Blocks is documented in Sections 5.2-5.4.

Caithness and Sutherland Peatlands SPA

The Caithness and Sutherland Peatlands SPA contain the largest and most intact area of blanket bog in Britain. A range of structurally diverse peatland and freshwater habitats supports a wide variety of breeding birds including internationally important populations of raptors, waders and wildfowl including breeding red- and black-throated divers, and common scoter (all assessed as *favourable maintained* except common scoter which is *unfavourable declining*[32]). During the breeding season, black-throated diver normally undertake all feeding activities on freshwater lochs, with estuarine and marine habitats rarely used outside passage and wintering periods[33]; based on their habitat use elsewhere in their breeding range (e.g. Norway, Russia), common scoter are believed to be similarly reliant upon freshwater habitats while breeding in the UK. In contrast, during the chick-rearing period (July and August), red-throated divers make particularly intensive use of inshore marine areas close to the site (Black *et al.* 2015), while those breeding inland will mainly feed in large, valley-bottom lochs. In a review of foraging ranges for breeding seabirds occurring in the UK, Thaxter *et al*. (2012) list the mean and maximum reported foraging range for red-throated diver as 4.5km and 9km, respectively, from direct information, and a maximum of 12km from speculative sources. Approximately 30% of the site area lies within 9km of the coast. Black *et al*. (2015) indicated that the spread-out nature of nests within the site meant there was a low likelihood of finding aggregations of breeding red-throated divers at sea.

[32] https://www.environment.gov.scot/data/data-analysis/protected-nature-sites/?pagenumber=1&resetmap=true&siteid=8476
[33] http://jncc.defra.gov.uk/pdf/UKSPA/UKSPA-A6-2.pdf

Pentland Firth pSPA and Pentland Firth Islands SPA

The Pentland Firth pSPA includes waters within the Pentland Firth between the north coast of Caithness and the south of Orkney Mainland and a contiguous area of the North Sea to the southeast. The Pentland Firth is characterised by very strong tidal flows, with spring tide peaks of 4.5ms^{-1} in the Outer Sound between Swona and Stroma. Depths in the main channel are typically 60-80m but exceed 90m in places with shallower waters extending around Stroma and in the vicinity of Swona and the Pentland Skerries. The pSPA boundary encompasses the key foraging habitat of the largest population of breeding Arctic tern in Scotland, which nest on Swona, Muckle Skerry and other skerries designated as the adjoining **Pentland Firth Islands SPA** (where they are assessed as *unfavourable declining*[34]). During the breeding season (May-June), the site also supports a large aggregation of guillemots (34,410 birds, 2.0% of the GB population, Mitchell *et al*. 2004) primarily originating from the colony SPAs of North Caithness Cliffs, Hoy and Copinsay, which congregate at densities up to *ca*. 44 birds/km^2 towards the north-eastern tip of Caithness at the mouth of the Pentland Firth. Some birds also occur there later in the year but in much lower numbers. Arctic terns influence the northern and western boundaries of the site, while guillemot influence the southern and eastern extent, closer to the relevant Blocks. While not influencing the site boundaries, Arctic skua are also present in qualifying numbers in the breeding season, with birds breeding at the overlapping Hoy SPA and other locations in Orkney and Caithness. The pSPA encompasses spawning/nursery grounds for sandeels (Ellis *et al.* 2012), which provide important prey to the qualifying seabird features. Common guillemots in Orkney, Shetland and eastern Scotland breed in dense cliff colonies in the summer months, dispersing east and south across the North Sea in winter. They are pursuit divers, capable of reaching depths well in excess of 100m in search of fish, including sandeels and fish of the herring family, on which they principally feed[35].

North Caithness Cliffs SPA

The North Caithness Cliffs SPA comprises most of the sea cliff areas between Red Point and Duncansby Head on the north mainland coast, and the western cliffs on the island of Stroma. Cliff ledges, stacks and geos provide ideal nesting sites for important populations of seabirds, especially guillemots, as well as other auks and gulls (all *favourable maintained* except razorbill, *favourable recovered*, and kittiwake, *unfavourable declining*[36]). The seabirds nesting on the North Caithness Cliffs feed outside the SPA in the surrounding waters of the Pentland Firth (note guillemot are also a qualifying feature (breeding season) of the Pentland Firth pSPA), as well as further afield. The site includes a 2km seaward extension designated in 2009 to protect the adjacent marine habitat[37].

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[34] https://www.environment.gov.scot/data/data-analysis/protected-nature-sites/?pagenumber=1&resetmap=true&siteid=8566
[35] https://www.nature.scot/sites/default/files/2017-12/Marine%20Protected%20Area%20%28Proposed%29%20-%20Site%20selection%20document%20%20-%20Pentland%20Firth.pdf
[36] https://www.environment.gov.scot/data/data-analysis/protected-nature-sites/?pagenumber=1&resetmap=true&siteid=8554
[37] https://apps.snh.gov.uk/sitelink-api/v1/sites/8554/documents/16

Hoy SPA

The island of Hoy lies at the south-western end of the Orkney archipelago; the SPA covers the northern and western two-thirds of the island, including a diverse mixture of mire, heath woodland and alpine vegetation habitats, along with adjacent coastal waters to approximately 2km offshore. The upland areas and high sea cliffs at the coast support important assemblages of moorland breeding birds and breeding seabirds. The site is over 30km from the nearest block considered in this assessment, but is included here due to its qualifying species of breeding guillemot (assessed as *unfavourable no change*) and Arctic skua (*favourable maintained*) foraging further south and east where they are present as qualifying species of the Pentland Firth pSPA (above).

Copinsay SPA

Copinsay SPA lies 4km off the east coast of Orkney Mainland and consists of the island of Copinsay and three islets (Corn Holm, Ward Holm and Black Holm) and extends into waters approximately 2km from shore. The three holms are vegetated and a storm beach connects them to Copinsay at low water. Copinsay is formed of Old Red Sandstone with the largely horizontal bedding planes providing breeding ledges for seabirds (auks and kittiwake), especially on the sheer cliffs of the southeast of Copinsay. The site is over 40km from the nearest block considered in this assessment, but is included here due to its qualifying species of breeding guillemot (assessed as *unfavourable no change*) foraging further south in large numbers where they are present as qualifying species of the Pentland Firth pSPA (above). The site includes a 2km seaward extension designated in 2009 to protect the adjacent marine habitat.

East Caithness Cliffs SPA

The East Caithness Cliffs SPA comprises most of the sea cliff areas between Wick and Helmsdale, including a 2km seaward extension designated in 2009 to protect the adjacent marine habitat[38]. The cliff ledges, stacks and geos provide ideal nesting sites for several species of seabird: guillemot, razorbill, herring gull and kittiwake are present in qualifying numbers (all assessed as in *favourable maintained* condition except herring gull as *unfavourable no change*), with a qualifying assemblage also including puffin, great black-backed gull, cormorant, fulmar and shag (*favourable maintained* except great black-backed gull and shag as *unfavourable no change* and cormorant as *unfavourable declining*). Shag largely forage within inshore waters throughout the year, within the site boundary and along the adjacent coast. This includes an area of the Moray Firth pSPA (where they are listed as a qualifying feature) which overlaps with the southwest of the site. The other qualifying seabird species nesting within this site feed outside the SPA in inshore waters, as well as further away.

Digital aerial surveys in support of the wind farm development in the outer Moray Firth collected data on the distribution and abundance of seabirds from May-July 2011 across a large area of the Moray Firth, including waters extending offshore of the east Caithness coast

(Natural Power 2012). Surveys revealed the highest densities of birds to occur within the site boundaries. Models based on ESAS data show similar patterns during the breeding season, and also reveal relatively high densities of guillemot across much of the Moray Firth post-breeding (Aug to Sep) and in winter (Kober *et al*. 2010). Models of breeding season habitat use based on tagging data confirm the reliance of shags on inshore waters within a few kilometres of the coast at east Caithness, with razorbills showing greater use of waters offshore of the site boundary and guillemot and kittiwake showing the greatest use of waters in the outer Moray Firth beyond the site boundaries (Cleasby *et al*. 2018).

Moray Firth pSPA

The Moray Firth pSPA is an extensive site stretching seaward from Buckie in the south to Helmsdale in the north and encompassing several different geographically discrete water bodies; the Beauly Firth, the Inner Moray Firth, the Cromarty Firth, Dornoch Firth, and Loch Fleet (Figure 5.1). Most of the site is shallow water (less than 20m) over a sandy substrate, apart from a 50m deep channel running east-west through muddy substrate in the inner Firth. Tidal flows are relatively weak with a maximum tidal range of 3m and the Firth is relatively sheltered. While there are 11 qualifying species, red-throated and great northern diver are the predominate species influencing the eastern extent and central core of the site; aerial surveys during the period 2001/02-2006/07 showed the highest densities of the species combined (>1.2 birds/km^2) to be in waters off the mouth of the Dornoch Firth and Loch Fleet (approximately between Tarbet Ness and Brora), off the coast of Tarbet Ness southwest to Inverness (including the inner Moray Firth), and between Lossiemouth and Portsoy to 10-15km off the coast. The mean peak population estimate within the pSPA over the 5 years of survey was 144 (great northern diver) and 324 (red-throated diver) birds with relatively few birds outside of the site. Of the qualifying species, shag have been observed in the greatest numbers in the north of the site, where they influence the northern boundary closest to the relevant Blocks. During the winter the site regularly supports a total of at least 6,462 shags during the period of October to February, with at least 3,179 birds (1.6% of the biogeographic population & 2.9% of the GB population) regularly occurring on the north coast (at a density of 19.4 birds/km^2) and a further 1,967 birds regularly occurring on the south coast (the densest concentration being 57.9 birds/km^2). During the breeding season of March to September the site regularly supports a total of at least 5,494 birds on the north coast of the firth (in some locations aggregated at a density of 28.8 birds/km^2)[39]. Divers, mergansers and shags feed on a wide variety of fish that are associated with a range of seabed substrates. The diet of divers and merganser includes haddock, cod, herring, sprats and gurnard along with smaller species such as sandeels. Sandeels are favoured by shags during the breeding season, but adult birds take a wide variety of species. Slavonian grebe feed on small fish species but their diet also includes small amphipods and other crustaceans. Great northern divers also feed opportunistically on small crustaceans. Common eider, velvet scoter, common scoter, and long-tailed duck feed almost exclusively on molluscs and small crustaceans, diving from the surface to pluck their prey from the seabed. Common goldeneye and greater scaup feed

[39] https://www.nature.scot/sites/default/files/2017-11/Marine%20Protected%20Area%20%28Poposed%29%20-%20Site%20selection%20document%20-%20Moray%20Firth.pdf

mainly on a variety of invertebrates such as molluscs, worms, aquatic insects and crustaceans but will take also small fish. Diving activity varies among species but average foraging dive depths for most are shallower than 15m. However, substantially greater maximum dive depths have been recorded for some species, particularly shag (30m) and great northern diver (55m). The numerous firths, inlets and sandy bays provide sheltered areas where birds can moult, roost, rest and feed[40].

Troup, Pennan and Lion's Heads SPA

Troup, Pennan and Lion's head SPA is a 9km stretch of sea cliffs on the south coast of the outer Moray Firth including adjacent cliff-top grassland and heath and waters to approximately 2km offshore. The cliffs provide nesting sites for several species of seabird, with guillemot present in qualifying numbers along with a qualifying assemblage of guillemot, razorbill, kittiwake, herring gull and fulmar. The condition of all species was most recently assessed as *unfavourable declining*, with the exception of fulmar and kittiwake as *unfavourable no change*. During the breeding season, these species feed and rest within the marine areas of the SPA, as well as foraging further afield in the outer Moray Firth and wider North Sea. Digital aerial surveys in support of the wind farm development in the outer Moray Firth collected data on the distribution and abundance of seabirds from May-July 2011 across a large area of the Moray Firth, including Troup, Pennan and Lion's Heads SPA, several kilometres of the adjacent coastline and waters extending offshore (Natural Power 2012). Surveys revealed the highest densities of guillemot, razorbill, kittiwake and fulmar to occur within the site boundaries and nearshore waters of the neighbouring coast, particularly to the east. The density of these species reduced to < 5 birds per km^2 within a few kilometres offshore of the site. Models based on ESAS data show similar patterns during the breeding season, and also reveal relatively high densities of guillemot across much of the Moray Firth post-breeding (Aug to Sep) and in winter (Kober *et al*. 2010). Models of breeding season habitat use based on tagging data show guillemot, razorbill and kittiwake to be focussed on waters close to the colony with a pattern of decreasing use at greater distances from the site (Cleasby *et al*. 2018). Of those species, guillemot appear to range the furthest, with core areas of use (top 10% utilisation distribution) extending up to 12km offshore of the site boundary (Cleasby *et al*. 2018).

Berriedale and Langwell Waters SAC

The Berriedale and Langwell Waters SAC on the north-east coast of Scotland supports small, but high quality Atlantic salmon (*Salmo salar*) populations (assessed as *favourable maintained*[41]). The rivers have two separate catchments, but share a short length of river just before they meet the sea. Both rivers are oligotrophic, draining the southern edge of the Caithness and Sutherland peatlands, and show only limited ecological variation along their length. Whilst they are comparatively small rivers and support only a small proportion of the

[40] https://www.nature.scot/sites/default/files/2017-11/Marine%20Protected%20Area%20%28Propsoed%29%20-%20Advice%20to%20support%20management%20-%20Moray%20Firth.pdf
[41] https://www.environment.gov.scot/data/data-analysis/protected-nature-sites/?pagenumber=1&resetmap=true&siteid=8206

Scottish salmon resource, their long history of low management intervention means that they score highly for naturalness. Recent records indicate that the full range of Atlantic salmon life-history types return to the river, with grilse, spring and summer salmon all being caught.

Moray Firth SAC

The Moray Firth SAC is designated for bottlenose dolphins (*Tursiops truncatus*) and sandbanks which are slightly covered by sea water all the time. The site extends from the inner firths to Helmsdale on the north coast and Lossiemouth on the south coast, and includes areas that are regularly used by the population of bottlenose dolphins occurring along the east coast of Scotland. The most recent site condition monitoring of the dolphin population (Cheney *et al.* 2018), estimated that 103 (95% CI: 93-115) different bottlenose dolphins used the SAC during the period May to September 2016. Using 16 years of data, results indicated inter-annual variability in the number of dolphins in the SAC, but no significant trend in abundance. With respect to estimates of overall abundance for the east coast of Scotland bottlenose dolphin population, estimates varied from 129 (95% HPDI 104-155) in 2001 to 189 (95% HPDI 155-216) in 2015. Results suggest that between 2001 and 2016 there was a slight decrease in the proportion of the total population using the SAC, but this seems to be driven by an increase in overall population size rather than a reduction in the number of dolphins using the SAC. Despite this reduction, results suggest that the SAC is still used by the majority of this bottlenose dolphin population, but that it is marginally less important to the population as a whole in 2016 than it was in 2001.

Passive acoustic monitoring data from three sample sites within the SAC (Sutors, Chanonry and Lossiemouth) between 2011 and 2016 showed dolphins were detected in all months at all sites (Cheney *et al.* 2018). At an annual scale, the two sites within the inner waters of the Moray Firth (Sutors and Chanonry) showed the highest frequency of detections, with dolphins detected on 95-100% of monitored days in each year for an annual median of 7-9 hours per day at Sutors and 4-8 at Chanonry. At Lossiemouth, on the southern coast of the Moray Firth at the eastern boundary of the SAC, dolphins were detected on 68-88% of monitored days in each year for an annual median of 1-2 hours per day. However, inter-annual and seasonal patterns of occurrence varied between sites. There was a slight decrease in the amount of time dolphins were detected in each day around the Sutors in 2015 and 2016, although dolphins were still detected on >99% of days in these years. At Chanonry, dolphins were detected for slightly longer each day in 2013 and 2014 compared to the other years, although again they were detected on most days every year. Overall, dolphins were detected for fewer hours per day and on fewer days at Lossiemouth compared to the Sutors and Chanonry. Although dolphin detections peaked during the summer months at all three sites, the data suggest that dolphins may use certain areas of the SAC outside the summer months more than previously thought. For example, at Sutors, dolphins were detected on >90% of monitored days from April through to December. Cheney *et al*. (2018) concluded that whilst the east coast of Scotland bottlenose dolphin population remains small and potentially vulnerable, based on the monitoring data, they recommended that no change be made to the *favourable maintained* condition status.

The range of this population extends well beyond the boundaries of the SAC as animals utilise waters off the southern Moray Firth, Grampian and Fife coasts (Cheney *et al*. 2013). Quick *et al*. (2014) showed that individual dolphins range up and down the Grampian and Fife coasts, where they were most frequently encountered in waters less than 20m deep and within 2km of the coast in and around the Tay Estuary as well as along the coast between Montrose and Aberdeen. Boat-based surveys conducted along the southern shore of the outer Moray Firth between Lossiemouth and Fraserburgh during summer and autumn months since 2001 show inshore waters of this area to be frequented by bottlenose dolphins, with most sightings between the mouth of the River Spey and Rosehearty (Robinson *et al*. 2007). Population estimates suggest that approximately 60 to 130 individuals use these waters each year over the period May-September/October (Culloch & Robinson 2008, Filan 2015), representing up to two thirds of the *ca*. 200 individuals of the total Scottish east coast population (Cheney *et al.* 2013, 2018). These inshore waters of the southern outer Moray Firth will be used by bottlenose dolphins transiting between the SAC and other areas of preferred habitat further south off the east coast; however, based on the regular sighting of animals in these nearshore waters, including a high proportion of females with calves, it is likely that they support ecological functions for the Scottish east coast population beyond a corridor to other areas (Culloch & Robinson 2008).

Less survey effort has been conducted off the east Caithness coast and in offshore waters of the outer Moray Firth compared to within the SAC and southern coast; however, the low number of sightings of bottlenose dolphins suggests only limited use of these areas. For example, in aerial surveys conducted in summer 2010 by the University of Aberdeen along the Moray Firth coast and two offshore blocks, all bottlenose dolphins encountered were located in the inner Moray Firth or within 10km of the southern Moray Firth coast (Thompson & Brookes 2011). Furthermore, a review of historic data from the outer Moray Firth found that all previous reported sightings of dolphins around proposed wind farms in the northern outer Moray Firth were of species other than bottlenose dolphins (Thompson *et al*. 2010).

The sublittoral sediments within the Moray Firth SAC range from muddy sands and sandy sediments in the more sheltered parts of the site with coarser sand and gravel-based sediments in the outer, more coastal reaches of the Firth. These contrasting habitat conditions support a variety of distinctive algal and invertebrate species. The sandbank habitats may be spawning grounds and nursery areas for juvenile fish species and may support large populations of sandeels. This productivity in turn becomes an important food source for marine mammals and seabirds (SNH 2018). The subtidal sandbanks were judged to be in a favourable maintained condition in 2004 (last assessment)[42].

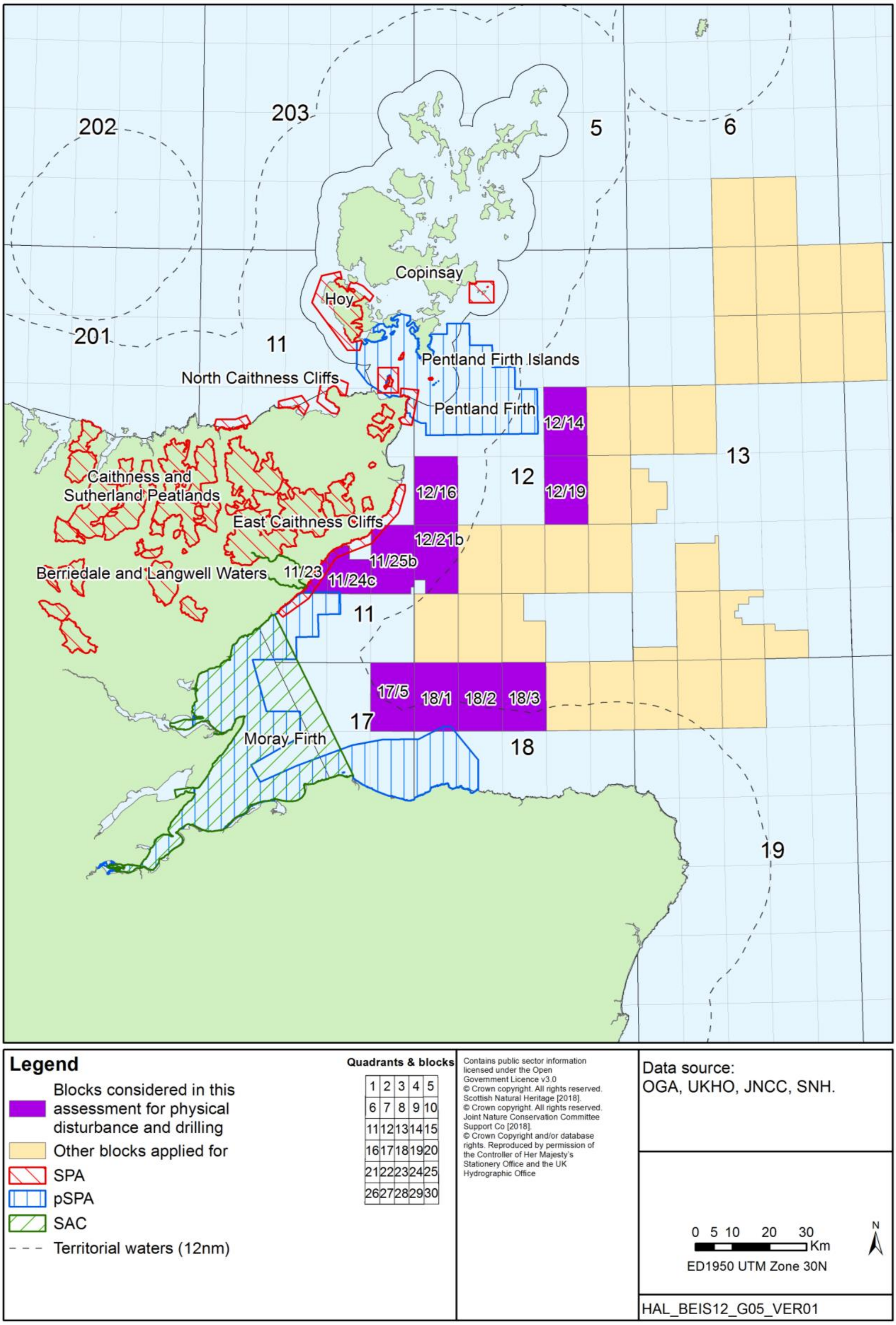
[42] https://www.environment.gov.scot/data/data-analysis/protected-nature-sites/?pagenumber=1&resetmap=true&siteid=8327

5.2 Assessment of physical disturbance and drilling effects

5.2.1 Blocks and sites to be assessed

The nature and extent of potential physical disturbance and drilling effects are summarised in Section 4.2. On the basis of this information, in conjunction with the locations of the Moray Firth Blocks applied for in the 31st Round and the sites with relevant qualifying features, potential likely significant effects are considered to remain for 11 Blocks (or part Blocks), in respect of 10 sites (Figure 5.1). These are assessed in Section 5.2.2.

Figure 5.1: Sites and Blocks in the Moray Firth to be subject to further assessment for physical disturbance and drilling effects



5.2.2 Implications for site integrity of relevant sites

The conservation objectives of relevant sites and other relevant information relating to site selection and advice on operations has been considered against the work programmes for the Blocks applied for to determine whether they could adversely affect site integrity. The results are given in Table 5.1 below. All mandatory control requirements (as given in Section 2.3.1) are assumed to be in place as a standard for all activities assessed here.

Table 5.1: Consideration of potential physical disturbance and drilling effects and relevant site conservation objectives

Caithness and Sutherland Peatlands SPA
Site information
Area (ha): 145,313 **Relevant qualifying features**: Breeding black-throated diver, common scoter, dunlin, golden eagle, golden plover, greenshank, hen harrier, merlin, red-throated diver, short-eared owl, wigeon, wood sandpiper. See Natura 2000 standard data form for details of qualifying features[43]. **Conservation objectives**: To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species Relevant qualifying features (red-throated diver) likely to be present in inshore waters during the breeding season (July-August).
Relevant Blocks for physical disturbance and drilling effects
11/23, 11/24c, 11/25b, 12/16
Assessment of effects on site integrity
Rig siting *(**Relevant pressures:** none)* The site does not contain any coastal or marine habitats so there is no pathway for direct or indirect physical disturbance effects to habitats supporting the qualifying species from rig siting activities in the Blocks. No adverse effect on site integrity. **Drilling discharges** *(**Relevant pressures:** none)* The site does not contain any coastal or marine habitats so there is no pathway for direct or indirect physical disturbance effects from drilling discharges to habitats supporting the qualifying species. No adverse effect on site integrity. **Other effects** *(**Relevant pressures:** Visual disturbance, above water noise)* The Caithness and Sutherland Peatlands SPA encompasses multiple discrete areas, some of which support breeding red-throated diver and those individuals nesting near the coast will forage in inshore waters (primarily during July and August). Approximately 30% of the site is within 9km (mean maximum foraging range of red-throated diver, Thaxter *et al.* 2012) of the coast and, therefore, some individuals of the ~90 pairs nesting within the

[43] http://jncc.defra.gov.uk/pdf/SPA/UK9001151.pdf

site may use inshore waters within Blocks 11/23, 11/24c and 11/25b (all abutting the coast) and potentially Block 12/16, which lies 10km from the nearest site boundary. Shipping densities over the Blocks are very low or no data is available[44]. Whilst the temporary and localised nature of drilling activities and limited number of associated supply vessel and helicopter trips (see Table 2.2) are unlikely to represent a significant increase in disturbance of the sensitive qualifying features, further mitigation measures are available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity.

In-combination effects

There is no pathway for physical disturbance effects from activities in the Blocks and visual disturbance of sensitive qualifying species (divers and common scoter) is not expected as the qualifying species do not appear to make significant use of the marine area. In-combination effects are not expected.

Pentland Firth pSPA

Site information

Area (ha): 97,325

Relevant qualifying features: Breeding Arctic tern; breeding seabird assemblage (including guillemot, Arctic skua).

Conservation objectives:

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long-term and it continues to make an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species.

This contribution will be achieved through delivering the following objectives for each of the site's qualifying features:

a) Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term;
b) To maintain the habitats and food resources of the qualifying features in favourable condition.

Significant numbers of relevant qualifying features are present during the breeding season (May-July). Further relevant information on seasonality is provided below.

Relevant Blocks for physical disturbance and drilling effects

12/14, 12/16, 12/19

Assessment of effects on site integrity

Rig siting

*(**Relevant pressures:** penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion; physical change (to another seabed type), introduction or spread of non-indigenous species)*

Blocks 12/14, 12/16 and 12/19 are between 1.5 and 7km from the Pentland Firth pSPA boundary. Advice to support the management of the pSPA[45] indicates that all qualifying features are considered indirectly sensitive to abrasion (primarily from benthic trawls) that could reduce the extent of or damage supporting habitats for prey species. Given that the site encompasses the main areas of usage by the qualifying species and that all relevant Blocks have significant areas outside the site in which rig siting would be possible, the potential to reduce the extent of or damage supporting habitats is limited. The maximum spatial footprint of sub-surface abrasion/penetration pressure associated with jack-up rig siting is small (0.8km^2, see Table 2.2) and given the strong tidal currents in the area, recovery of any supporting habitats which are impacted is likely to be relatively rapid, allowing the conclusion that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by the specific timing and location of the rig.

There may be a requirement for rig stabilisation depending on local seabed conditions although the exposed nature of the relevant Blocks and coarse nature of seabed sediments would suggest that rig stabilisation will not be required. The potential for interaction with habitats and food resources of the qualifying features (as defined by

[44] https://www.ogauthority.co.uk/media/1419/29r_shipping_density_table.pdf, https://data.gov.uk/dataset/vessel-density-grid-2015

[45] https://www.nature.scot/sites/default/files/2017-12/Marine%20Protected%20Area%20%28Protected%29%20-%20Advice%20to%20support%20management%20-%20Pentland%20Firth.pdf

the site boundaries which encompass the main areas of usage of the features) is limited given that all Blocks are outside the site. However, it is assumed that rock placement (if required) would be within the immediate vicinity of the rig and cover an estimated area of 0.001-0.004km^2 per rig siting, (Table 2.2). The potential loss of habitat is therefore small compared to the extent of similar habitat types across the site and the wider Moray Firth region. It is concluded that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by specific rig siting information

As noted in Section 4.2.3, management of the spread of non-native species from vessels and rigs is being progressed through international measures, and the risk is limited by the operational range of rigs on the UKCS.

Drilling discharges
*(**Relevant pressures:** abrasion/disturbance of the substrate on the surface of the seabed; habitat structure changes – removal of substratum; contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas))*

Relevant management advice indicates that both guillemot and Arctic tern are considered indirectly sensitive to pressures that could reduce the extent of or damage to supporting habitat for prey species, in particular sandeel, and therefore have the potential to reduce the availability of important food resources. Given that the site encompasses the main areas of usage by the qualifying species and that all relevant Blocks are outside the pSPA boundaries, the potential for drilling discharges to reduce the extent of or damage to supporting habitats is limited. The maximum spatial footprint of abrasion/disturbance of the seabed surface (smothering) by drilling discharges and the associated habitat structure changes is small (0.8km^2, see Table 2.2), and given the strong tidal currents in the area, recovery of any supporting habitats which are impacted is likely to be relatively rapid, allowing the conclusion that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. The small scale and temporary nature of drilling discharges and the mandatory mitigation requirements with respect to drilling chemical use and discharge (Section 2.3.1) will ensure that site conservation objectives are not undermined.

Other effects
*(**Relevant pressures:** visual disturbance, above water noise)*

Of the qualifying features, guillemot (May-June) is moderately sensitive to disturbance by ship and helicopter traffic with Arctic tern (May-July) and Arctic skua (May-June[46]) of low sensitivity (Garthe & Hüppop 2004, Furness *et al.* 2013). As all of the Blocks are outside of the site boundaries, the potential for visual disturbance or above water noise to cause significant disturbance of the qualifying features is primarily associated with the movement of supply vessels and helicopters to drilling rigs. Shipping densities over the Blocks are low (12/16) to moderate (12/14, 12/19)[47]. Whilst the temporary and localised nature of drilling activities and limited number of associated supply vessel and helicopter trips (see Table 2.2) are unlikely to represent a significant increase in disturbance of the qualifying features, further control measures are available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity.

In-combination effects
No intra-plan in-combination effects are likely with respect to the spatial footprints associated with rig siting and drilling discharges given that all of the Blocks are outside of the site boundaries in which rig siting and drilling discharges would be possible. Therefore the likelihood of in-combination footprint effects is low. There is the potential for in-combination effects associated with the presence and movement of supply vessels to rigs within each of the Blocks. However, given the low to moderate densities of existing vessel traffic, and the limited and temporary vessel and helicopter traffic likely as part of Block activities (see Table 2.2), intra-plan effects are not considered likely for the three Blocks. Further control measures are also available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

[46] Seasonal presence of Arctic skua defined by analysis of relevant NBN atlas records: https://records.nbnatlas.org/#tab_simpleSearch
[47] https://www.ogauthority.co.uk/media/1419/29r_shipping_density_table.pdf, https://data.gov.uk/dataset/vessel-density-grid-2015

Pentland Firth Islands SPA
Site information
Area (ha): 170 **Relevant qualifying features**: Breeding Arctic tern. See Natura 2000 standard data form for details of qualifying features[48]. **Conservation objectives**: To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species
Relevant Blocks for physical disturbance and drilling effects
12/14, 12/16, 12/19
Assessment of effects on site integrity
Block 12/16 is closest to the site boundary (21km) with Blocks 12/14 and 12/19 between 30 and 37km from the site boundary. The site and Blocks were screened in for appropriate assessment due to the proximity of the Blocks (1.5 and 7km respectively) to the Pentland Firth pSPA, which includes an important foraging area used by Arctic tern, falling within foraging range of the breeding colonies at Pentland Firth Islands SPA (as well as 12 other colonies including Burray Haas and Glimps Holm). The assessment of effects with respect to the Pentland Firth Islands SPA and relevant Blocks is therefore covered by the Pentland Firth pSPA consideration above.
North Caithness Cliffs SPA
Site information
Area (ha): 14,629 **Relevant qualifying features**: Breeding guillemot and peregrine; breeding seabird assemblage (including fulmar, kittiwake, puffin, razorbill). See Natura 2000 standard data form for details of qualifying features[49]. **Conservation objectives**: To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species Significant numbers of relevant qualifying features are present during the breeding season (April-June). Further relevant information on seasonality is provided below.
Relevant Blocks for physical disturbance and drilling effects
12/14, 12/16, 12/19
Assessment of effects on site integrity
Rig siting *(**Relevant pressures:** penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion; physical change (to another seabed type), introduction or spread of non-indigenous species)* Block 12/16 is closest to the site boundary (8km) with Blocks 12/14 and 12/19 between 33 and 37km from the site. Blocks 12/14 and 12/19 were screened in as they are within 1.5 and 7km of the Pentland Firth pSPA respectively (considered separately above), and the North Caithness Cliffs SPA breeding guillemot feature is a

48 http://jncc.defra.gov.uk/pdf/SPA/UK9001131.pdf
49 http://jncc.defra.gov.uk/pdf/SPA/UK9001181.pdf

source colony of the guillemot assemblage feature of the pSPA. Given that the Pentland Firth pSPA likely encompasses the main aggregation of breeding guillemots from the North Caithness Cliffs SPA and that all relevant Blocks are outside the SPA and pSPA boundaries, the potential for interaction with respect to rig siting for this feature is limited. Peregrine use the site cliffs for nesting, and it is not considered that there is a pathway for effect from Block activities that could undermine the conservation objectives in relation to this qualifying feature. While the foraging range of species within the seabird assemblage (including fulmar, kittiwake, razorbill and puffin) could bring features within those Blocks applied for, the maximum spatial footprint of sub-surface abrasion/penetration pressure associated with jack-up rig siting is small (0.8km^2, see Table 2.2) and given the strong tidal currents in the area, recovery of any supporting habitats which are impacted is likely to be relatively rapid, allowing the conclusion that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by the specific timing and location of the rig.

There may be a requirement for rig stabilisation depending on local seabed conditions. The exposed nature of the relevant Blocks and coarse nature of seabed sediments would suggest that rig stabilisation will not be required. However, it is assumed that rock placement (if required) would be within the immediate vicinity of the rig and cover an estimated area of 0.001-0.004km^2 per rig siting (Table 2.2). Noting that all of the Blocks are at least 8km from the site boundary, the potential loss of extent of any supporting habitat relevant to the site would be small compared to the extent of the habitat types across the Blocks and the wider Moray Firth region. It is concluded that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by specific rig siting information.

As noted in Section 4.2.3, management of the spread of non-native species from vessels and rigs is being progressed through international measures, and the risk is limited by the operational range of rigs on the UKCS.

Drilling discharges
*(**Relevant pressures:** abrasion/disturbance of the substrate on the surface of the seabed; habitat structure changes – removal of substratum; contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas))*

Given that the Pentland Firth pSPA likely encompasses the main aggregation of breeding guillemots from the North Caithness Cliffs SPA and that all relevant Blocks are well outside the pSPA boundaries, the potential for interaction with drilling discharges for this feature is limited. While the foraging ranges of species within the seabird assemblage (including fulmar, kittiwake, razorbill and puffin) may extend to the Blocks applied for, the maximum spatial footprint of abrasion/disturbance of the seabed surface (smothering) by drilling discharges and the associated habitat structure changes is small (0.8km^2, see Table 2.2). Given the strong tidal currents in the area, recovery of any supporting habitats affected is likely to be relatively rapid, allowing the conclusion that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. The small scale and temporary nature of drilling discharges and the mandatory controls on drilling chemical use and discharge (Section 2.3.1) will ensure that site conservation objectives are not undermined.

Other effects
*(**Relevant pressures:** visual disturbance, above water noise)*

Of the qualifying features, breeding guillemot (May-June) is moderately sensitive to disturbance by ship and helicopter traffic with other species of the seabird assemblage having moderate (razorbill (April-June), puffin (May-June)[50]) or low (fulmar, kittiwake) sensitivity (Garthe & Hüppop 2004, Furness *et al.* 2013). There is no foreseeable interaction with the peregrine feature given it's restricted coastal habitat use and distance to the nearest Block (8km). Given that all of the Blocks are outside of both the North Caithness Cliffs SPA and the Pentland Firth pSPA site boundaries, the potential for visual disturbance or above water noise to impact the distribution of qualifying features within the site (and the pSPA) is primarily associated with the movement of supply vessels and helicopters to drilling rigs. Shipping densities over the Blocks are low (12/16) to moderate (12/14, 12/19)[51]. Whilst the temporary and localised nature of drilling activities and limited number of associated

[50] Seasonal presence of razorbill and puffin defined by analysis of relevant NBN atlas records: https://records.nbnatlas.org/#tab_simpleSearch
[51] https://www.ogauthority.co.uk/media/1419/29r_shipping_density_table.pdf, https://data.gov.uk/dataset/vessel-density-grid-2015

supply vessel and helicopter trips (see Table 2.2) are unlikely to represent a significant increase in disturbance of the qualifying features, further mitigation measures are available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity.

In-combination effects

No intra-plan in-combination effects are likely with respect to the spatial footprints associated with rig siting and drilling discharges given that all of the Blocks are outside of the site boundaries. Therefore the likelihood of in-combination footprint effects is low. There is the potential for in-combination effects associated with the presence and movement of supply vessels to rigs within each of the Blocks. However, given the low to moderate densities of existing vessel traffic, and the limited and temporary vessel and helicopter traffic likely as part of Block activities (see Table 2.2), intra-plan effects are not considered likely for the three Blocks. Further mitigation measures are also available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Hoy SPA

Site information

Area (ha): 18,124

Relevant qualifying features: Breeding peregrine, red-throated diver and great skua; breeding seabird assemblage (including Arctic skua, fulmar, great black-backed gull, guillemot, kittiwake, puffin). See Natura 2000 standard data form for details of qualifying features[52].

Conservation objectives:

To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

Relevant Blocks for physical disturbance and drilling effects

12/14, 12/16, 12/19

Assessment of effects on site integrity

Hoy SPA is 33km from the Block 12/16 and over 50km from Blocks 12/14 and 12/19. The site and Blocks were screened in for appropriate assessment as some of its qualifying assemblage species (breeding guillemot and Arctic skua) forage further south and east where they are present as qualifying species of the Pentland Firth pSPA which is within 1.5 and 7km of the Blocks. The assessment of effects with respect to the Hoy SPA and relevant Blocks is therefore covered by the Pentland Firth pSPA consideration above.

Copinsay SPA

Site information

Area (ha): 3,608

Relevant qualifying features: Breeding seabird assemblage (including fulmar, great black-backed gull, guillemot, kittiwake). See Natura 2000 standard data form for details of qualifying features[53].

Conservation objectives:

To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species

[52] http://jncc.defra.gov.uk/pdf/SPA/UK9002141.pdf
[53] http://jncc.defra.gov.uk/pdf/SPA/UK9002151.pdf

- No significant disturbance of the species

Relevant Blocks for physical disturbance and drilling effects

12/14, 12/16, 12/19

Assessment of effects on site integrity

Copinsay SPA is between 27 and 42km from the relevant Blocks. The site and Blocks were screened in for appropriate assessment as its breeding guillemot assemblage feature forage to the south where they are present as qualifying species of the Pentland Firth pSPA which is within 1.5 and 7km of the Blocks. The assessment of effects with respect to the Copinsay SPA and relevant Blocks is therefore covered by the Pentland Firth pSPA consideration above.

East Caithness Cliffs SPA

Site information

Area (ha): 11,696
Relevant qualifying features: Breeding guillemot, herring gull, kittiwake, peregrine, razorbill and shag; breeding seabird assemblage (including cormorant, fulmar, great back-backed gull). See Natura 2000 standard data form for details of qualifying features[54].

Conservation objectives:
To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

Significant numbers of relevant qualifying features are present during the breeding season (April-June). Further relevant information on seasonality is provided below.

Relevant Blocks for physical disturbance and drilling effects

11/23, 11/24c, 11/25b, 12/16, 12/21b, 17/5, 18/1, 18/2, 18/3

Assessment of effects on site integrity

Rig siting
*(**Relevant pressures:** penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion; physical change (to another seabed type), introduction or spread of non-indigenous species)*

Blocks 11/23, 11/24c and 11/25b are partly within the site with Blocks 12/16 and 12/21b between *ca*. 2.5 and 6km from the site boundary. Blocks 17/5, 8/1, 18/2 and 18/3 are ≥33km distant from East Caithness Cliffs SPA, but were screened in for potential physical disturbance and drilling effects due to being <10km from the boundary of the Moray Firth pSPA, which through the qualifying feature of breeding and non-breeding shag has connectivity to the East Caithness Cliffs SPA. Data analysis to support the pSPA designation confirm high densities of shags during the breeding and non-breeding seasons adjacent to and just west of the East Caithness Cliffs, approximately between Brora and Helmsdale. On the Morayshire coast non-breeding shag distribution overlaps with that of red-throated diver and great northern diver.

Advice to support the management of the pSPA[55] indicates that shag (as well as the other qualifying features) are considered indirectly sensitive to abrasion which could reduce the extent of or damage supporting habitats for prey species. All of the relevant Blocks have areas outside of the site boundaries within which rig siting would be possible although given their relative proximity to the site and the mean maximum foraging range of the qualifying species (Thaxter *et al*. 2012), all of the Blocks could theoretically contain supporting habitats for the East Caithness Cliffs SPA qualifying species. While the highest densities of guillemot, razorbill and puffin will occur within a few kilometres of the breeding colony, these wide-ranging species will forage up to many tens of kilometres from the colony and so some individuals can be expected to forage within the relevant Blocks, albeit in

[54] http://jncc.defra.gov.uk/pdf/SPA/UK9001182.pdf
[55] https://www.nature.scot/sites/default/files/2017-11/Marine%20Protected%20Area%20%28Propsoed%29%20-%20Advice%20to%20support%20management%20-%20Moray%20Firth.pdf

lower densities. These auk species will also be present throughout relevant Blocks when dispersing from the colony during the post-breeding season moult. Relevant EUNIS habitats across the Blocks include deep circalittoral sand (EUNIS code A5.27), deep circalittoral coarse sediment (A5.15) and circalittoral fine sands and muddy sand[56] (A5.25 or A5.26). MarLIN's Marine Evidence-based Sensitivity Assessment (MarESA) tool[57] indicates that relevant examples of these habitats are of low to medium sensitivity to penetration and/or disturbance of the substrate below the surface of the seabed pressure (evidence primarily associated with trawling studies). Therefore given the maximum spatial footprint of sub-surface abrasion/penetration pressure associated with jack-up rig siting is small (0.8km^2, or up to 0.7% of the site should a rig be located within the site boundary, see Table 2.2) and temporary, and that potentially supporting habitats within the Blocks are also extensive across the Moray Firth region and of low to medium sensitivity to the pressure, the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. The peregrine feature uses the site cliffs for nesting and significant effects are not considered to be likely from rig siting activities. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by the specific timing and location of the rig.

There may be a requirement for rig stabilisation depending on local seabed conditions although a recent exploration well drilled in Block 11/24b did not require stabilisation. The related ES assessed the potential to deposit stabilisation material but considered this unlikely to be required given the water depths (*ca*. 50m) and local hydrographic regime (Caithness Petroleum 2012[58]). In soft sediments, deposited rock may cover existing sediments resulting in a physical change (to another seabed type), and examples of the EUNIS habitats described above are considered highly sensitive to this pressure, which assumes a permanent change of habitat (MarESA). However, it is assumed that rock placement (if required) would be within the immediate vicinity of the rig and cover an estimated area of 0.001-0.004km^2 per rig siting (Table 2.2). Hence, the potential loss of supporting habitat is small compared to the extent of the habitat types across the Blocks and the wider Moray Firth region. It is concluded that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by specific rig siting information

As noted in Section 4.2.3, management of the spread of non-native species from vessels and rigs is being progressed through international measures, and the risk is limited by the operational range of rigs on the UKCS.

Drilling discharges

*(**Relevant pressures:** abrasion/disturbance of the substrate on the surface of the seabed; habitat structure changes – removal of substratum; contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas))*

As indicated above, all of the relevant Blocks could theoretically contain supporting habitats for the East Caithness Cliffs SPA qualifying species. The peregrine feature uses the site cliffs for nesting and significant effects are not considered to be likely from drilling discharges. The MarESA tool indicates that relevant examples of the EUNIS habitats described above are of low to medium sensitivity to abrasion/disturbance of the surface seabed (evidence primarily associated with bottom trawling) and habitat structure changes – removal of substratum (evidence primarily associated with aggregate extraction) pressures. Therefore given the maximum spatial footprint of abrasion/disturbance of the seabed surface (smothering) by drilling discharges and the associated habitat structure changes is small (0.8km^2, or 0.7% of the site should a rig be located within the site boundary, see Table 2.2), and temporary, and the potentially supporting habitats within the Blocks are extensive across the Moray Firth region and of low to medium sensitivity to the pressures, the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. The small scale and temporary nature of drilling discharges and the mandatory mitigation requirements with respect to drilling chemical use and discharge (Section 2.3.1) will ensure that any chemical discharge does not undermine site conservation objectives.

Other effects

*(**Relevant pressures:** visual disturbance, above water noise)*

As indicated above, all of the Blocks are likely to contain supporting habitats for the qualifying seabird species

[56] https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/
[57] https://www.marlin.ac.uk/habitats/eunis
[58] http://www.caithnesspetroleum.com/~/media/files/c/caithness-petroleum/pdf/environmental-statement.pdf

given their relative proximity to the site and the mean maximum foraging range of these qualifying features. Of the qualifying features, cormorant (March-September) is the most sensitive to disturbance by ship and helicopter traffic with guillemot (May-June), razorbill (April-June) and shag (March-September), moderately sensitive (Garthe & Hüppop 2004, Furness *et al.* 2013). The other qualifying species are of low sensitivity to the pressure. Both cormorant and shag are primarily coastal species with mean maximum foraging ranges of 14-25km (Thaxter *et al.* 2012, Bogdanova *et al*. 2014) and have been assessed as being in an unfavourable condition although no negative pressures were identified[59]. The northern boundary of the Moray Firth pSPA (see below) is defined by the large aggregations of breeding and non-breeding shag and is directly south of Blocks 11/23 and 11/24c. Relevant management advice for the Moray Firth pSPA indicates that shag are considered to have a medium sensitivity to visual disturbance created by vessel movement. Most of the Blocks have significant areas outside of both the SPA and the pSPA site boundaries (with 11/23 less so but still with space to site beyond site boundaries, see Figure 5.1), as such the potential for visual disturbance or above water noise to impact the distribution of qualifying features within the site is primarily associated with the movement of supply vessels and helicopters to drilling rigs (that may be located outside of the site). Shipping densities over the Blocks are very low to low (or no data)[60]. Whilst the temporary and localised nature of drilling activities and limited number of associated supply vessel and helicopter trips (see Table 2.2) are unlikely to represent a significant increase in disturbance of the sensitive qualifying features, further mitigation measures are available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity.

In-combination effects

No intra-plan in-combination effects are likely with respect to the spatial footprints associated with rig siting and drilling discharges given that all of the Blocks have significant areas outside of the site boundaries in which rig siting and drilling discharges would be possible. Therefore the likelihood of in-combination footprint effects is low. There is the potential for in-combination effects associated with the presence and movement of supply vessels to rigs within each of the Blocks. However, given the very low densities of existing vessel traffic, and the limited and temporary vessel and helicopter traffic likely as part of Block activities (see Table 2.2), intra-plan effects are not considered likely for the nine Blocks. Further mitigation measures are also available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Moray Firth pSPA

Site information

Area (ha): 176,234

Relevant qualifying features: Overwintering great northern diver, red-throated diver, Slavonian grebe, greater scaup, common eider, long-tailed duck, common scoter, velvet scoter, goldeneye, red-breasted merganser; breeding and non-breeding shag.

Conservation objectives:

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long-term and it continues to make an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species.

This contribution will be achieved through delivering the following objectives for each of the site's qualifying features:

a) Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term;
b) To maintain the habitats and food resources of the qualifying features in favourable condition.

Significant numbers of breeding (March-September) and overwintering (October-February) qualifying features indicate year round presence of qualifying interests. Further relevant information on seasonality is provided below.

Relevant Blocks for physical disturbance and drilling effects

11/23, 11/24c, 11/25b, 17/5, 18/1, 18/2, 18/3

[59] https://sitelink.nature.scot/site/8492

[60] https://www.ogauthority.co.uk/media/1419/29r_shipping_density_table.pdf, https://data.gov.uk/dataset/vessel-density-grid-2015

Assessment of effects on site integrity
Rig siting (*__Relevant pressures:__ penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion; physical change (to another seabed type), introduction or spread of non-indigenous species)* Blocks 11/23 and 11/24c abut the northern boundary of the proposed site with a small section of the southern boundary of the site within Block 18/1 and running close to Blocks 18/2 (1km) and 17/5 (2km). As indicated above, the northern boundary of the site is defined by the large aggregations of breeding (10.2% of the Great Britain population) and non-breeding (5.9% of the Great Britain population) shag that have been recorded in this area. The distribution of over-wintering red-throated and great northern divers is the predominant influence on defining the boundary of the rest of the site including in the vicinity of the Blocks off the south coast although densities here are relatively low (0.2-0.8 birds/km^2)[61], with few birds outside of the site. On the Morayshire coast non-breeding shag distribution overlaps with that of red-throated diver and great northern diver. Advice to support the management of the pSPA[62] indicates that shag and divers (as well as the other qualifying features) are considered indirectly sensitive to abrasion (primarily from benthic trawls) which could reduce the extent of or damage supporting habitats for prey species. Given that the site encompasses the main areas of usage by the qualifying species in the Moray Firth and that the relevant Blocks are either located outside of the site boundary (11/25b, 17/5, 18/2, 18/3) or have significant areas outside of the site (11/23, 11/24, 18/4) in which rig siting would be possible, the potential to reduce the extent of or damage supporting habitats is limited. It is concluded that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by the specific timing and location of the rig. There may be a requirement for rig stabilisation depending on local seabed conditions although a recent exploration well drilled in Block 11/24b did not require stabilisation. The related ES assessed the potential to deposit stabilisation material but considered this unlikely to be required given the water depths (*ca*. 50m) and local hydrographic regime (Caithness Petroleum 2012[63]). As above, the potential for interaction with habitats and food resources of the qualifying features (as defined by the site boundaries which encompass the main areas of usage of the features) is limited given that Blocks are either located outside of the site boundary or have significant areas outside the site where rig siting could occur. Also, in the event that a rig was located within the site, the potential loss of habitat is small (0.001-0.004km^2 per rig siting, Table 2.2) compared to the extent of similar habitat types across the site. Moreover, further control measures are available which include use of removable mud mats or anti-scour mats as an alternative to rock placement (Section 5.2.3). It is concluded that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by specific rig siting information. As noted in Section 4.2.3, management of the spread of non-native species from vessels and rigs is being progressed through international measures, and the risk is limited by the operational range of rigs on the UKCS. **Drilling discharges** (*__Relevant pressures:__ abrasion/disturbance of the substrate on the surface of the seabed; habitat structure changes – removal of substratum; contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas))* Given that the site encompasses the main areas of usage by the qualifying species in the Moray Firth and that all relevant Blocks have significant areas outside of the site in which rig siting would be possible, the potential for interaction with respect to drilling discharges is limited. The maximum spatial footprint of abrasion/disturbance of the seabed surface (smothering) by drilling discharges and the associated habitat structure changes is small (0.8km^2, see Table 2.2), compared to the extent of similar habitat types across the site, allowing the conclusion that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. The small scale and temporary nature of drilling discharges and the mandatory control requirements with respect to drilling chemical use and discharge (Section 2.3.1) will ensure that site conservation objectives are not

[61] https://www.nature.scot/sites/default/files/2017-11/Marine%20Protected%20Area%20%28Poposed%29%20-%20Site%20selection%20document%20-%20Moray%20Firth.pdf
[62] https://www.nature.scot/sites/default/files/2017-11/Marine%20Protected%20Area%20%28Propsoed%29%20-%20Advice%20to%20support%20management%20-%20Moray%20Firth.pdf
[63] http://www.caithnesspetroleum.com/~/media/files/c/caithness-petroleum/pdf/environmental-statement.pdf

undermined.

Other effects
(***Relevant pressures:*** *visual disturbance, above water noise)*

Of the qualifying features most relevant to the Blocks, red-throated and great northern divers (October-February, seasonal presence of both defined by analysis of relevant NBN atlas records) are very sensitive to disturbance by ship and helicopter traffic with shag moderately sensitive (all year, Garthe & Hüppop 2004, Furness *et al.* 2013). Other sensitive species that are qualifying features include overwintering common and velvet scoter, scaup and goldeneye although these have a more coastal distribution. Relevant management advice for the pSPA also highlights the sensitivity of most of the qualifying features to disturbance associated with vessel movements. Given that all of the Blocks have significant areas outside of the site boundaries, the potential for visual disturbance or above water noise to impact the distribution of sensitive qualifying features within the site is primarily associated with the movement of supply vessels and helicopters to drilling rigs (that may be located outside of the site). Shipping densities over the Blocks are very low to low (or no data)[64]. Whilst the temporary and localised nature of drilling activities and limited number of associated supply vessel and helicopter trips (see Table 2.2) are unlikely to represent a significant increase in disturbance of the sensitive qualifying features, further mitigation measures are available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity.

In-combination effects
No intra-plan in-combination effects are likely with respect to the spatial footprints associated with rig siting and drilling discharges given that all of the Blocks have significant areas outside of the site boundaries in which rig siting and drilling discharges would be possible. Therefore the likelihood of in-combination footprint effects is low. There is the potential for in-combination effects associated with the presence and movement of supply vessels to rigs within each of the Blocks. However, given the very low densities of existing vessel traffic, and the limited and temporary vessel and helicopter traffic likely as part of Block activities (see Table 2.2), intra-plan effects are not considered likely for the seven Blocks. Further mitigation measures are also available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Berriedale and Langwell Waters SAC

Site information

Area (ha): 58.25
Relevant qualifying features: Atlantic salmon

Conservation objectives:
To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species, including range of genetic types for salmon, as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

With respect to the seasonal presence of the qualifying feature, the core period is between May and October. Further relevant information on seasonality is provided below.

Relevant Blocks for physical disturbance and drilling effects

11/23, 11/24c

Assessment of effects on site integrity

Rig siting
(***Relevant pressures:*** *penetration and/or disturbance of the substrate below the surface of the seabed, including*

[64] https://www.ogauthority.co.uk/media/1419/29r_shipping_density_table.pdf, https://data.gov.uk/dataset/vessel-density-grid-2015

abrasion; physical change (to another seabed type), introduction or spread of non-indigenous species)

The site does not contain any coastal or marine habitats[65] so there is no pathway for direct physical disturbance effects to supporting habitats within the site from rig siting activities in the Blocks. Given the proximity of the Blocks to the site, the Blocks may contain supporting habitats during the migration of the qualifying feature to and from the site. Juveniles migrate from river to sea in the spring with the peak in the Moray Firth considered to be between April and May. Adults may migrate back to their natal rivers at any time of year. The core period in the Moray Firth is between May and October (SNH 2018). Given the maximum spatial footprint of sub-surface abrasion/penetration pressure associated with jack-up rig siting is small (0.8km^2, see Table 2.2) and temporary, and the potentially supporting habitats within the Blocks are extensive across the Moray Firth region, the site conservation objectives will not be undermined and there will be no adverse effect on site integrity.

There may be a requirement for rig stabilisation depending on local seabed conditions although an ES for a recent exploration well in Block 11/24b indicated that rig stabilisation was unlikely to be required given the water depths (*ca*. 50m) and local hydrographic regime (Caithness Petroleum 2012[66]). In soft sediments, deposited rock may cover existing sediments resulting in a physical change (to another seabed type). It is assumed that rock placement (if required) would be within a spatial footprint of 0.8km^2 (500m of a rig, Table 2.2). Hence, the potential loss of supporting habitat is small compared to the extent of the habitat types across the Blocks and the general Moray Firth region, allowing the conclusion that the site conservation objectives will not be undermined and there will be no adverse effect on site integrity.

As noted in Section 4.2.3, management of the spread of non-native species from vessels and rigs is being progressed through international measures, and the risk is limited by the operational range of rigs on the UKCS.

Drilling discharges
*(**Relevant pressures:** abrasion/disturbance of the substrate on the surface of the seabed; habitat structure changes – removal of substratum; contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas))*

The site does not contain any coastal or marine habitats so there is no pathway for direct physical disturbance effects to supporting habitats within the site from drilling discharges in the Blocks. As indicated above, the Blocks may contain supporting habitats during the migration of the qualifying feature to and from the site. Given the maximum spatial footprint of abrasion/disturbance of the seabed surface (smothering) by drilling discharges and the associated habitat structure changes is small (0.8km^2, see Table 2.2) and temporary, and the potentially supporting habitats within the Blocks are extensive across the Moray Firth region, the site conservation objectives will not be undermined and there will be no adverse effect on site integrity. The small scale and temporary nature of drilling discharges and the mandatory control requirements with respect to drilling chemical use and discharge (Section 2.3.1) will ensure that site conservation objectives are not undermined.

Other effects
None

In-combination effects
No intra-plan in-combination effects are likely with respect to the spatial footprints associated with rig siting and drilling discharges given that both Blocks are outside of the site boundaries. Therefore the likelihood of in-combination footprint effects is low. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Moray Firth SAC
Site information
Area (ha): 151,274 **Relevant qualifying features**: Sandbanks, bottlenose dolphin **Conservation objectives**: To avoid deterioration of the qualifying habitat (listed above) thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each

[65] http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030088.pdf
[66] http://www.caithnesspetroleum.com/~/media/files/c/caithness-petroleum/pdf/environmental-statement.pdf

of the qualifying features; and to ensure for the qualifying habitat that the following are maintained in the long term:

- Extent of the habitat on site
- Distribution of the habitat within site
- Structure and function of the habitat
- Processes supporting the habitat
- Distribution of typical species of the habitat
- Viability of typical species as components of the habitat
- No significant disturbance of typical species of the habitat

To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and to ensure for the qualifying species that the following are established then maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

With respect to seasonal presence, the bottlenose dolphin qualifying feature is present all year with numbers peaking over the summer months. Further relevant information on seasonality is provided below.

Relevant Blocks for physical disturbance and drilling effects

11/23, 17/5

Assessment of effects on site integrity

Rig siting

(***Relevant pressures:*** *penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion; physical change (to another seabed type), introduction or spread of non-indigenous species)*

Blocks 11/23 and 17/5 are both *ca*. 9km from the Moray Firth SAC boundary. With respect to the sandbank qualifying feature, the maximum spatial footprint of sub-surface abrasion/penetration pressure associated with jack-up rig siting is small (0.8km^2, see Table 2.2) and temporary. Both Blocks are well outside the site boundary and the potential for rig siting to impact the extent or distribution of the sandbank feature within the site is limited, therefore the site conservation objectives will not be undermined. Low numbers of bottlenose dolphin sightings off the east Caithness coast suggest only limited use of this area and therefore the potential for rig siting in Block 11/23 to impact the distribution and extent of supporting habitats through subsurface abrasion is limited. Boat-based surveys conducted along the southern shore of the outer Moray Firth between Lossiemouth and Fraserburgh during summer and autumn months since 2001 show inshore waters to be frequented by bottlenose dolphins. Population estimates suggest that approximately 60 to 130 individuals use these waters each year over the period May-September/October (Culloch & Robinson 2008, Filan 2015), representing up to two thirds of the *ca*. 200 individuals of the total Scottish east coast population (Cheney *et al.* 2013, 2018). Aerial surveys conducted in summer 2010 indicated that all bottlenose dolphins were encountered within 10km of the southern Moray Firth coast (Thompson & Brookes 2011). Block 17/5 is 13km from this coast at its nearest point and it is likely that dolphins would be present less frequently (if at all) than closer to the coast. Given the small and temporary spatial footprint associated with rig siting, the site conservation objectives will not be undermined and there will be no adverse effect on site integrity and therefore the site conservation objectives will not be undermined. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by specific rig siting information.

There may be a requirement for rig stabilisation depending on local seabed conditions although a recent exploration well drilled in Block 11/24b did not require stabilisation. The related ES assessed the potential to deposit stabilisation material but considered this unlikely to be required given the water depths (*ca*. 50m) and local hydrographic regime (Caithness Petroleum 2012[67]). In soft sediments, deposited rock may cover existing sediments resulting in a physical change (to another seabed type). It is assumed that rock placement (if required) would be within the immediate vicinity of the rig and cover an estimated area of 0.001-0.004km^2 per rig siting

[67] http://www.caithnesspetroleum.com/~/media/files/c/caithness-petroleum/pdf/environmental-statement.pdf

(Table 2.2). Both Blocks are well outside the site boundary and the potential for rig stabilisation to impact the sandbank feature within the site is limited, therefore the site conservation objectives will not be undermined. Blocks 11/23 and 17/5 do not appear to contain important areas of supporting habitat for the bottlenose dolphin feature and given the small spatial footprint associated with rig stabilisation, the site conservation objectives will not be undermined. No adverse effect on site integrity. Further assessment, including HRA where appropriate, would be undertaken at the project level, at which stage the assessment would be informed by specific rig siting information.

As noted in Section 4.2.3, management of the spread of non-native species from vessels and rigs is being progressed through international measures, and the risk is limited by the operational range of rigs on the UKCS.

Drilling discharges
*(**Relevant pressures:** abrasion/disturbance of the substrate on the surface of the seabed; habitat structure changes – removal of substratum; contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas))*

The maximum spatial footprint of abrasion/disturbance of the seabed surface (smothering) by drilling discharges and the associated habitat structure changes is small (0.8km^2, see Table 2.2) and temporary. Both Blocks are well outside the site boundary and the potential for drilling discharges to impact the extent or distribution of the sandbank feature within the site is limited. Similarly, Blocks 11/23 and 17/5 do not appear to contain important areas of supporting habitat for the bottlenose dolphin feature. Given the small and temporary spatial footprint associated with drilling discharges, the site conservation objectives will not be undermined, and there will be no adverse effect on site integrity. The small scale and temporary nature of drilling discharges and the mandatory control requirements with respect to drilling chemical use and discharge (Section 2.3.1) will ensure that site conservation objectives are not undermined.

Other effects
None

In-combination effects
No intra-plan in-combination effects are likely with respect to the spatial footprints associated with rig siting and drilling discharges given that both Blocks are well outside of the site boundaries and do not appear to represent important supporting habitat for the bottlenose dolphin feature. Therefore the likelihood of in-combination footprint effects is low. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

5.2.3 Further mitigation measures

Further mitigation measures are available which would be identified through the EIA process and operator's environmental management system and the BEIS permitting processes. These considerations are informed by specific project plans and the nature of the sensitivities identified from detailed seabed information collected in advance of field activities taking place. Site surveys are required to be undertaken before drilling rig placement (for safety and environmental reasons) and the results of such surveys (survey reports) allow for the identification of further mitigation including the siting of activities (e.g. rig leg positions) to ensure sensitive seabed surface or hazardous subsurface features (such as shallow gas accumulations) are avoided and potential rig stabilisation issues (e.g. from scouring around spud cans, or soft sediment conditions) are minimised.

It is not typical for rig stabilisation to be required, but this will be informed by site-specific survey and project specific plans which are not currently available. Where rig stabilisation is required, BEIS will expect operators to provide adequate justification for the stabilisation option proposed (including for rig siting beyond site boundaries if practical), and consider use of systems (e.g. anti-scour mats, mud mats) that can be removed following drilling. Where rock placement is required for rig stabilisation, BEIS will expect operators to minimise the volume of rock deposited. Survey reports are used to underpin operator environmental submissions (e.g.

EIAs) and where requested, survey reports are made available to nature conservation bodies during the consultation phases of these assessments[68].

For those Blocks where proposed activities could result in the physical disturbance of sensitive qualifying features by vessels and aircraft traffic, available mitigation measures include, as far as possible, strict use of existing shipping and aircraft routes, and timing controls on temporary activities to avoid sensitive periods (these are identified in Table 5.1 above). Operators must demonstrate awareness of relevant seasonal sensitivities, and that these have been taken into account in the planning of their operations to avoid highly sensitive periods (see BEIS 2019). In areas of high sensitivity, BEIS expect operators to liaise with relevant SNCBs on the timing of their intended activities to minimise or avoid effects on seasonally sensitive qualifying interests.

In all instances, consent for project-level activities will not be granted unless the operator can demonstrate that the proposed exploration activities will not have an adverse effect on the integrity of relevant sites. The information provided by operators in their applications must be detailed enough for BEIS (and its advisors) to make a decision on whether the activities could lead to a likely significant effect.

5.2.4 Conclusions

Likely significant effects identified with regards to physical damage to the seabed, drilling discharges and other effects (see Section 5.2.2) when considered along with project-level mitigation (Section 5.2.3) and relevant activity permitting (see Sections 2.3), will not have an adverse effect on the integrity of the Natura 2000 sites considered in this assessment. There is a legal framework through the implementation of the EIA Regulations[69] and the Habitats Directive, to ensure that there are no adverse effects on the integrity of Natura 2000 sites. These would be applied at the project level, at which point there will be sufficient definition to make an assessment of likely significant effects, and for applicants to propose project specific mitigation measures.

Taking into account the information presented above, it is concluded that activities arising from the licensing of the Blocks listed in Table 5.1, in so far as they may generate physical disturbance and drilling effects, will not cause an adverse effect on the integrity of the relevant sites identified. Consent for activities will not be granted unless the operator can demonstrate that the proposed activities which may include the drilling of a number of wells and any related activity including the placement of a drilling rig, will not have an adverse effect on the integrity of relevant sites.

[68] Whether within or outside an SAC, rig site survey typically includes a consideration of the presence of, amongst other sensitivities, Annex I habitats.

[69] The *Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended)*

5.3 Assessment of underwater noise effects

5.3.1 Blocks and sites to be assessed

The nature and extent of potential underwater noise effects are summarised in Section 4.3. On the basis of this information, in conjunction with the location of Moray Firth Blocks applied for in the 31st Round and the sites with relevant qualifying features, potential likely significant effects are considered to remain for 15 Blocks (or part Blocks), in respect of 11 sites (Figure 5.2). These are assessed in Section 5.3.2.

5.3.2 Implications for site integrity of relevant sites

The site conservation objectives and other relevant information relating to site selection and advice on operations has been considered against indicative Block work programmes (see Section 2.2.1) to determine whether they could adversely affect site integrity, i.e. impacts the site features, either directly or indirectly, and result in altering the ecological structure and functioning of the site and/or affects the ability of the site to meet its conservation objectives. The results are given in Table 5.2 below. All mandatory control requirements (as given in Section 2.3.2) are assumed to be in place as a standard for all activities assessed at this stage.

Figure 5.2: Sites and Blocks in the Moray Firth to be subject to further assessment for underwater noise effects

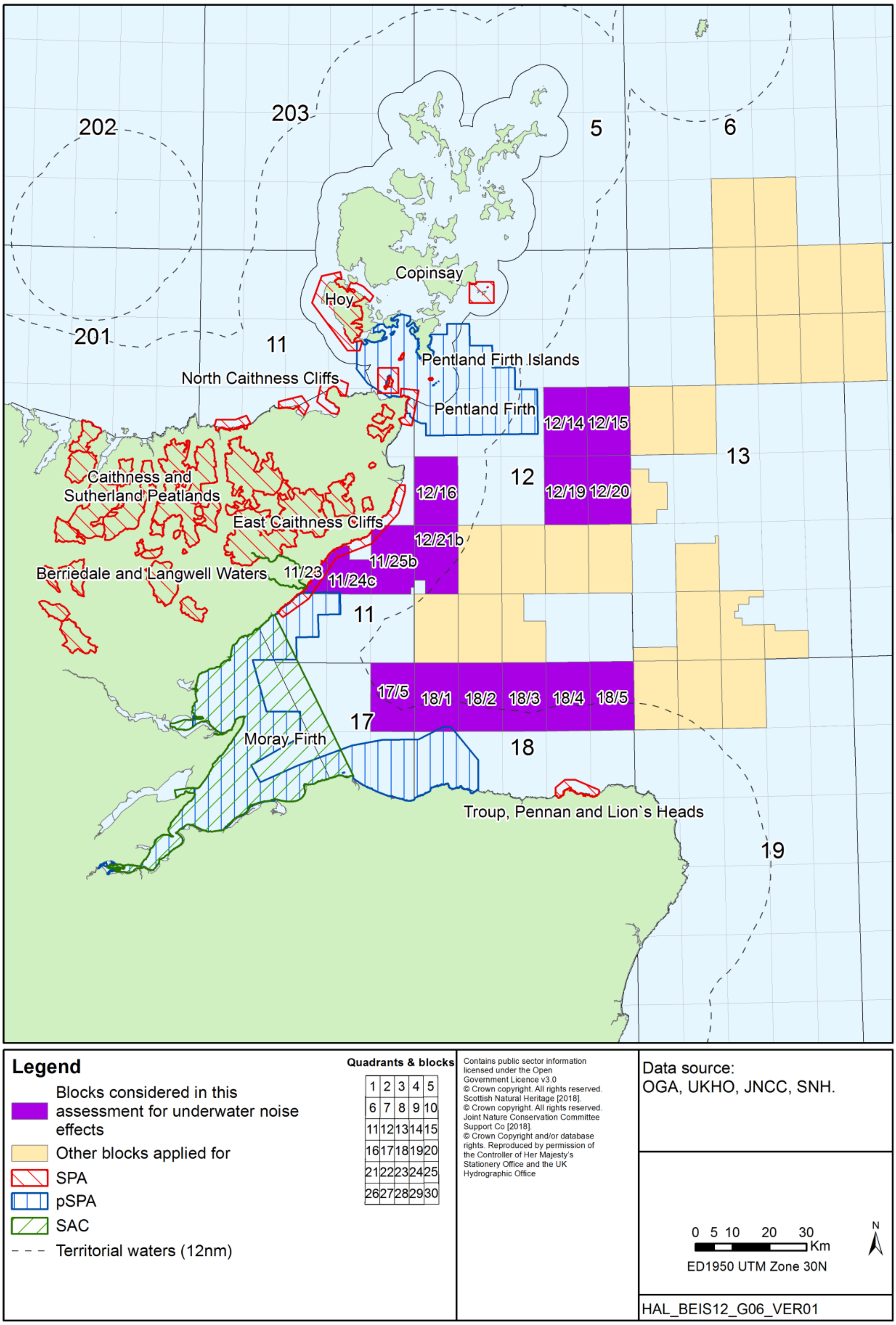


Table 5.2: Consideration of potential underwater noise effects and relevant site conservation objectives

Caithness and Sutherland Peatlands SPA
Site information
Area (ha): 145,313 **Relevant qualifying features (diving species listed only):** Breeding red-throated diver. (Black-throated diver and common scoter are also qualifying features but are not believed to use marine habitats during the breeding season). See Natura 2000 standard data form for full details of qualifying features[70]. **Conservation objectives**: See Table 5.1 above. Relevant qualifying features (red-throated diver) may be present in inshore waters during the breeding season (July-August).
Relevant Blocks for underwater noise effects
Direct: 11/23, 11/24c, 11/25b, 12/16 **Indirect:** none.
Assessment of effects on site integrity
The Caithness and Sutherland Peatlands SPA encompasses multiple discrete areas, some of which support breeding red-throated diver and those individuals nesting near the coast will forage in inshore waters. Approximately 30% of the site is within 9km of the coast and, therefore, some individuals of the ~90 pairs nesting within the site may use inshore waters within Blocks 11/23, 11/24c and 11/25b (all abutting the coast) and potentially Block 12/16, which lies 10km from the nearest site boundary. **Impulsive noise (3D seismic survey, rig site survey, VSP, conductor piling)** *(**Relevant pressures:** underwater noise change, vibration)* Of the relevant Blocks, Blocks 11/23, 11/24c and 11/25b have proposed work programmes of their licence application(s) which include shooting new 3D seismic survey. Given the likely limited presence of red-throated diver within the relevant Blocks, few individuals will be likely to come into close proximity to seismic survey activities. Furthermore, red-throated divers are known to display a large avoidance radius of vessels and surface infrastructure (up to several kilometres – see Section 4.2.6 and 5.2.2); this behaviour is expected to further reduce the potential for diving birds to be exposed to noise levels which may result in potential behavioural disturbance. There is however, very little evidence for such effects and, should they occur, they would be expected to be short-term and temporary. Considering the evidence (albeit limited) of low hearing sensitivity and a lack of reported injury or disturbance effects to diving birds, combined with the likely avoidance of the physical presence of survey vessel(s), the risk of significant mortality, injury or disturbance to red-throated diver from 3D seismic survey is considered to be very low. Considering the seasonal nature of the sensitivity, where necessary, control of timing of offshore activities allows for mitigation, which would be identified once project plans are known. Negative indirect effects of seismic survey activities on qualifying features may arise through effects on prey species, if these species are subject to injury or disturbance which reduces their availability to qualifying seabirds within their foraging range. While there is evidence that a reduction in fish catches can be associated with seismic survey activity, these are temporary in nature, and the disturbance of sensitive spawning periods will be considered through the activity consenting process. Therefore, any underwater noise effects on fish associated with licensing the relevant Blocks are not anticipated to result in significant effects on the food resources of red-throated diver. Considering the above, it is concluded that underwater noise from 3D seismic survey associated with the licensing of Blocks 11/23, 11/24c or 11/25b will not represent an adverse effect on the integrity of the site. Considering the limited potential for effects of 3D seismic survey on diving birds identified above and in Section 4.3.2, and the lower amplitude, shorter duration and smaller geographic footprint associated with other impulsive

[70] http://jncc.defra.gov.uk/pdf/SPA/UK9001151.pdf

noise such as VSP, rig site survey and conductor piling, it is concluded that these activities, in any relevant Blocks, will not result in an adverse effect on site integrity

Continuous noise (drilling, vessel & rig movements)
*(**Relevant pressures:** underwater noise change, vibration)*

No significant effects on red-throated diver are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance.

In-combination effects
Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above, in particular the limited likely overlap between the qualifying features while foraging outside of the site and relevant or neighbouring Blocks. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

North Caithness Cliffs SPA

Site information

Area (ha): 14,629
Relevant qualifying features (diving species listed only): Breeding guillemot; breeding seabird assemblage (including guillemot, puffin, razorbill). See Natura 2000 standard data form for full details of qualifying features[71].

Conservation objectives: See Table 5.1 above.

Significant numbers of relevant qualifying features are present during the breeding season (April-June).

Relevant Blocks for underwater noise effects

Direct: 12/16
Indirect: 12/14, 12/15, 12/19, 12/20 due to proximity to Pentland Firth pSPA, which has connectivity for breeding guillemot.

Assessment of effects on site integrity

At 8km from the site boundary, 12/16 is the only relevant Block falling within the 15km screening criteria (BEIS 2018a) for underwater noise effects against the North Caithness Cliffs SPA. All other relevant Blocks relate to potential effects on the breeding guillemot qualifying feature when foraging within the Pentland Firth pSPA, and these are considered against that site separately below. The assessment presented below relates only to Block 12/6, the licence application for which does not propose any new 3D seismic survey.

Impulsive noise (rig site survey, VSP, conductor piling) *(**Relevant pressures:** underwater noise change, vibration)*

Considering the limited potential for effects of 3D seismic survey on diving birds identified in Section 4.3.2, and the lower amplitude, shorter duration and smaller geographic footprint associated with other impulsive noise such as VSP, rig site survey and conductor piling, it is concluded that these activities will not result in an adverse effect on site integrity.

Continuous noise (drilling, vessel & rig movements)
*(**Relevant pressures:** underwater noise change, vibration)*

No significant effects on guillemots are anticipated from continuous underwater noise from drilling and vessel movements due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance.

In-combination effects
Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above, the lack of Block-site overlap, and that the greatest potential for effects come from a single cluster of four neighbouring Blocks to the east of the site. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

[71] http://jncc.defra.gov.uk/pdf/SPA/UK9001181.pdf

Pentland Firth pSPA
Site information
Area (ha): 97,325 **Relevant qualifying features (diving species listed only):** Breeding seabird assemblage (including guillemot). **Conservation objectives**: See Table 5.1 above. Significant numbers of relevant qualifying features are present during the breeding season (May-July). Further relevant information on seasonality is provided below.
Relevant Blocks for underwater noise effects
Direct: 12/14, 12/15, 12/16, 12/19, 12/20 **Indirect:** none.
Assessment of effects on site integrity
Impulsive noise (3D seismic survey, rig site survey, VSP, conductor piling) *(**Relevant pressures:** underwater noise change, vibration)* Of the Blocks relevant to the Pentland Firth pSPA, the four adjoining Blocks 12/14, 12/15, 12/19 and 12/20 have proposed work programmes of their licence application(s) which include shooting new 3D seismic survey. The Pentland Firth pSPA has been proposed for designation due to the large aggregation of guillemots present around the eastern approaches to the Pentland Firth during the breeding season, comprising foraging animals breeding at surrounding colonies, including Hoy SPA, Copinsay SPA and the North Caithness Cliffs SPA where they are listed as qualifying features. A major concentration of guillemots to the east of the Pentland Firth defines the eastern boundary of the site. No relevant Blocks overlap the site; Block 12/14 lies 1.6km to the east, Block 12/19 is 6km to the southeast, and Blocks 12/15 and 11/20 are ≥ 13km east and southeast respectively. The distribution of the qualifying features within the site will vary, and it is likely that some birds associated with this aggregation will occasionally be present and forage within the relevant Blocks; however, given the lack of Block-site overlap, the majority of individuals will be unlikely to come into close proximity to seismic survey activities. The dispersal of individuals after breeding period is such that low densities of qualifying features may also be present in the Blocks during this time. In addition to this limited likelihood of close exposure to high intensity underwater noise, the evidence (albeit limited) of low hearing sensitivity and a lack of reported injury or disturbance effects to diving birds, combined with the likely avoidance of the physical presence of survey vessel(s) suggests that the risk of significant mortality, injury or disturbance is very low. Considering the seasonal nature of the sensitivity, where necessary, control of timing of offshore activities allows for mitigation, which would be identified once project plans are known. Negative indirect effects of seismic survey activities on qualifying features may arise through effects on prey species, primarily sandeels and other small fish, if these species are subject to injury or disturbance which reduces their availability to qualifying seabirds. It is noted that the Pentland Firth pSPA supports important spawning and nursery areas for sandeels and there is evidence that a reduction in fish catches can be associated with seismic survey activity; however, these are temporary in nature, and the disturbance of sensitive spawning periods will be considered through the activity consenting process. Furthermore, studies specifically on sandeels have shown a low sensitivity to underwater noise (Hassel *et al*. 2004, Suga *et al*. 2005). Therefore, any underwater noise effects on fish associated with licensing the relevant Blocks are not anticipated to result in significant effects on the food resources of the qualifying seabird features. Considering the above, it is concluded that underwater noise effects from 3D seismic survey associated with the licensing of Blocks 12/14, 12/15, 12/19 and 12/20 will not represent an adverse effect on the integrity of either the Pentland Firth pSPA, or the source colony sites of Hoy SPA, North Caithness Cliffs SPA and Copinsay SPA. Considering the limited potential for effects of 3D seismic survey on diving birds identified above and in Section 4.3.2, and the lower amplitude, shorter duration and smaller geographic footprint associated with other impulsive noise such as VSP, rig site survey and conductor piling, it is concluded that these activities, in any relevant Blocks, will not result in an adverse effect on the integrity of the site or its source colony sites. **Continuous noise (drilling, vessel & rig movements)** *(**Relevant pressures:** underwater noise change, vibration)* No significant effects on guillemot are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute

trauma and no evidence of significant disturbance. **In-combination effects** Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above, that there are no overlapping Blocks, and that the Blocks for with the greatest potential for underwater noise emissions (3D seismic survey) are all within a single cluster of four Blocks to the east of the site. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.
Hoy SPA
Site information
Area (ha): 18,124 **Relevant qualifying features (diving species listed only):** Breeding seabird assemblage (including guillemot). (There are no Blocks within 9km of Hoy (all are ≥ 35km), which is the maximum reported foraging range of red-throated diver, and therefore this qualifying species is not considered here.) See Natura 2000 standard data form for full details of qualifying features[72]. **Conservation objectives**: See Table 5.1 above.
Relevant Blocks for underwater noise effects
Direct: none. **Indirect:** 12/14, 12/15, 12/16, 12/19, 12/20 due to proximity to Pentland Firth pSPA, which has connectivity for breeding guillemot.
Assessment of effects on site integrity
There are no Blocks directly relevant to Hoy SPA (i.e. within the 15km screening criteria for underwater noise effects), and the consideration of this site relates to potential effects on the qualifying feature of breeding guillemot when foraging within the Pentland Firth pSPA. Consequently, the assessment of the effects on site integrity for this feature is provided within the Table 5.2 entry for the Pentland Firth pSPA. It is noted that those guillemot breeding on Hoy will be present in high densities within a few kilometres of the site, and will forage further afield at multiple locations within the region, with those birds occurring in the Pentland Firth pSPA representing a subset of the breeding population at Hoy SPA.
Copinsay SPA
Site information
Area (ha): 3,608 **Relevant qualifying features (diving species listed only):** Breeding guillemot. See Natura 2000 standard data form for full details of qualifying features[73]. **Conservation objectives**: See Table 5.1 above.
Relevant Blocks for underwater noise effects
Direct: none. **Indirect:** 12/14, 12/15, 12/16, 12/19, 12/20 due to proximity to Pentland Firth pSPA, which has connectivity for breeding guillemot.
Assessment of effects on site integrity
There are no Blocks directly relevant to Copinsay SPA (i.e. within the 15km screening criteria for underwater noise effects), and the consideration of this site relates to potential effects on the qualifying feature of breeding guillemot when foraging within the Pentland Firth pSPA. Consequently, the assessment of the effects on site integrity for this feature is provided within the Table 5.2 entry for the Pentland Firth pSPA. It is noted that those guillemot breeding on Copinsay will be present in high densities within a few kilometres of the site, and will forage further afield at multiple locations within the region, with those birds occurring in the Pentland Firth pSPA representing a subset of the breeding population at Copinsay SPA.
East Caithness Cliffs SPA
Site information
Area (ha): 11,696

72 http://jncc.defra.gov.uk/pdf/SPA/UK9002141.pdf
73 http://jncc.defra.gov.uk/pdf/SPA/UK9002151.pdf

Relevant qualifying features (diving species listed only): Breeding guillemot, razorbill; breeding seabird assemblage (including puffin, cormorant, shag). See Natura 2000 standard data form for full details of qualifying features[74]. **Conservation objectives**: See Table 5.1 above. Significant numbers of relevant qualifying features are present during the breeding season (April-June). Further relevant information on seasonality is provided below.
Relevant Blocks for underwater noise effects
Direct: 11/23, 11/24c, 11/25b, 12/16, 12/21b, 17/5 **Indirect:** 18/1, 18/2, 18/3 due to proximity to Moray Firth pSPA, which has connectivity for breeding shag.
Assessment of effects on site integrity
Blocks 18/1, 18/2 and 18/3 are ≥ 33km distant to East Caithness Cliffs SPA, but were screened-in for potential underwater noise effects due to being ≤ 15km from the boundary of the Moray Firth pSPA, which through the qualifying feature of breeding shag has connectivity to the East Caithness Cliffs SPA. However, only the north-eastern boundary of the Moray Firth pSPA, which largely overlaps with the East Caithness Cliffs SPA and is > 23km from the three Blocks, is influenced by the distribution of shags during the breeding season. Data analysis to support the pSPA designation confirm high densities of foraging birds during the breeding season adjacent to and just west of the East Caithness Cliffs, approximately between Brora and Helmsdale, but no other breeding season 'hotspots' elsewhere in the pSPA. Consequently, likely significant effects on breeding shag from licensing Blocks 18/1, 18/2 and 18/3 are discounted. **Impulsive noise (3D seismic survey, rig site survey, VSP, conductor piling)** *(**Relevant pressures:** underwater noise change, vibration)* Of the Blocks relevant to the East Caithness Cliffs SPA, 11/25b and 12/21b have the shooting of new seismic within the proposed work programme of their licence application(s)[75]. A small proportion of Block 11/25b overlaps with the site, corresponding to approximately 8% of the site's total area, while Block 12/21b lies 5km offshore of the site boundary. The site boundary extends approximately 2km offshore to include those inshore waters adjacent to the colony which support the highest densities of birds during the breeding season. Shag largely remain in nearshore waters; they occur in high densities to the southwest of the site where they are a qualifying feature of the overlapping Moray Firth pSPA, but are otherwise unlikely to spend significant time offshore of the site boundaries. Breeding cormorant venture further offshore but the greatest densities are recorded in inshore waters, particularly towards the inner reaches of the Moray Firth (Kober *et al*. 2010). While the highest densities of guillemot, razorbill and puffin will occur within a few kilometres of the breeding colony, these wide-ranging species will forage up to many tens of kilometres from the colony and so some individuals can be expected to forage within the relevant Blocks, albeit in lower densities. These auk species will also be present throughout relevant Blocks when dispersing from the colony during the post-breeding season moult. As detailed in Section 4.3.2, there is little information on the potential impact of underwater noise on diving birds, including underwater noise from seismic survey. Mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere, and flushing disturbance associated with the physical presence of the survey vessel would be expected to displace most diving seabirds from close proximity to seismic airgun arrays where sound pressure may be at sufficient levels to cause physical injury. While the qualifying features have the potential to come into close proximity to seismic survey activities, the evidence (albeit limited) of low hearing sensitivity and a lack of reported injury or disturbance effects, combined with the likely avoidance of the physical presence of survey vessel(s) suggests that the risk of significant mortality, injury or disturbance is very low. Considering the seasonal nature of the sensitivity, where necessary, control of timing of offshore activities allows for mitigation, which would be identified once project plans are known. Negative indirect effects of seismic survey activities on qualifying features may arise through effects on prey species, primarily sandeels and other small fish, if these species are subject to injury or disturbance which reduces their availability to qualifying seabirds. While there is evidence that a reduction in fish catches can be

[74] http://jncc.defra.gov.uk/pdf/SPA/UK9001182.pdf
[75] Block 18/3 also includes new seismic survey in the proposed work programme, but this is not considered relevant for the qualifying feature of breeding shag at East Caithness Cliffs SPA or Moray Firth pSPA due to the distribution of this feature within the two sites.

associated with seismic survey activity, these are temporary in nature, and the disturbance of sensitive spawning periods will be considered through the activity consenting process (Jan-Jun and Nov-Dec are identified as periods of concern for seismic surveys for fish spawning in each of the three relevant Blocks). Furthermore, studies specifically on sandeels have shown a low sensitivity to underwater noise (Hassel *et al*. 2004, Suga *et al*. 2005). Therefore, any underwater noise effects on fish associated with licensing the relevant Blocks are not anticipated to result in significant effects on the food resources of the qualifying seabird features of East Caithness Cliffs SPA.

Considering the above, it is concluded that underwater noise effects from 3D seismic survey associated with the licensing of Blocks 11/25b and 12/21b will not represent an adverse effect on the integrity of the site.

Considering the limited potential for effects of 3D seismic survey on diving birds identified above, and the lower amplitude, shorter duration and smaller geographic footprint associated with other impulsive noise such as VSP, rig site survey and conductor piling, it is concluded that these activities, in any relevant Blocks, will not result in an adverse effect on site integrity.

Continuous noise (drilling, vessel & rig movements)
*(**Relevant pressures:** underwater noise change, vibration)*

No significant effects on the qualifying features are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance.

In-combination effects
Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above, including only partial overlap of relevant Blocks with the site. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Moray Firth pSPA

Site information

Area (ha): 176,234
Relevant qualifying features (diving species listed only): Overwintering great northern diver, red-throated diver, Slavonian grebe, greater scaup, common eider, long-tailed duck, common scoter, velvet scoter, goldeneye, red-breasted merganser, shag; breeding shag.

Conservation objectives: See Table 5.1 above.

Significant numbers of breeding (March-September) and overwintering (October-February) qualifying features indicate year round presence of qualifying interests. Further relevant information on seasonality is provided below.

Relevant Blocks for underwater noise effects

Direct: 11/23, 11/24c, 11/25b, 17/5, 18/1, 18/2, 18/3
Indirect: none.

Assessment of effects on site integrity

Impulsive noise (3D seismic survey, rig site survey, VSP, conductor piling)
*(**Relevant pressures:** underwater noise change, vibration)*

Of the Blocks relevant to the Moray Firth pSPA, 11/25b and 18/3 have the shooting of new seismic within the proposed work programmes of the licence applications. Block 11/25b lies 8km from the northeast site boundary, with this northeastern extent of the site being a high density area of shags over-winter, and approximately 20km from an area identified as supporting a high density of foraging shags during the breeding season (SNH 2016). Block 18/3 lies 9km northeast of the southeast site boundary, with this southeastern extent of the site being identified as supporting high densities of divers (red-throated and great northern) over-winter from the coast to several kilometres offshore between Lossiemouth and Portsoy, and also with a smaller area of a high density of non-breeding shag up to the site boundary (SNH 2016). While individuals of other qualifying diving bird species may occur towards these northeast and southeast site boundaries, which are closest to the relevant Blocks, their reported distribution is more focussed on the central core of the site and therefore they are unlikely to be exposed to underwater noise from the relevant Blocks in significant numbers.

As detailed in Section 4.3.2, there is little information on the potential impact of underwater noise on diving birds, including underwater noise from seismic survey. Mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere, and flushing disturbance associated with the physical presence of the survey vessel would be expected to displace most diving seabirds from close proximity to seismic airgun arrays where sound pressure may be at sufficient levels to cause physical injury. This is particularly the case for qualifying diver species which are known to exhibit strong behavioural avoidance of vessels and surface infrastructure. Individuals of the qualifying features, primarily shag and diver species, have the potential to come into close proximity to seismic survey activities when foraging outside of the site boundaries; however, given the minimum distances of 8-9km between the site and Blocks for which 3D seismic surveys are proposed in the work programmes, this is highly unlikely for the majority of individuals. In addition to this limited likelihood of close exposure to high intensity underwater noise, the evidence (albeit limited) of low hearing sensitivity and a lack of reported injury or disturbance effects, combined with the likely avoidance of the physical presence of survey vessel(s) suggests that the risk of significant mortality, injury or disturbance is very low. Considering the seasonal nature of the sensitivity, where necessary, control of timing of offshore activities allows for mitigation, which would be identified once project plans are known.

Considering the above, it is concluded that underwater noise effects from 3D seismic survey associated with the licensing of Blocks 11/25b and 18/3 will not represent an adverse effect on the integrity of the Moray Firth pSPA, or the source colony (shag) site of East Caithness Cliffs SPA.

In addition to the aforementioned relevant Blocks, Blocks 11/23, 11/24c, 17/5, 18/1 and 18/2 either have minor overlap or are within 2km of the site boundary, again being restricted to the northeast and southeast extents of the site. Considering the limited potential for effects of 3D seismic survey on diving birds identified above and in Section 4.3.2, and the lower amplitude, shorter duration and smaller geographic footprint associated with other impulsive noise such as VSP, rig site survey and conductor piling, it is concluded that these activities, in any relevant Blocks, will not result in an adverse effect on the integrity of the site or its source colony site.

Continuous noise (drilling, vessel & rig movements)
*(**Relevant pressures:** underwater noise change, vibration)*

No significant effects on the qualifying features are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance.

In-combination effects
Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above, including the very limited overlap between relevant Blocks with the site. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Troup, Pennan and Lion's Heads SPA

Site information

Area (ha): 174.22
Relevant qualifying features (diving species listed only): Breeding guillemot; breeding seabird assemblage (including guillemot, razorbill). See Natura 2000 standard data form for full details of qualifying features[76].

Conservation objectives:
To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

Significant numbers of qualifying features are present during the breeding season (April-July). Further relevant information on seasonality is provided below.

Relevant Blocks for underwater noise effects

Direct: 18/3, 18/4, 18/5

[76] http://jncc.defra.gov.uk/pdf/SPA/UK9002471.pdf

Indirect: none.

Assessment of effects on site integrity

Impulsive noise (3D seismic survey, rig site survey, VSP, conductor piling)
*(**Relevant pressures:** underwater noise change, vibration)*

The relevant Blocks all lie ≥ 13km from the boundary of the SPA, which extends approximately 2km offshore to include those inshore waters adjacent to the colony which support the highest densities of birds during the breeding season. Nonetheless, guillemot and razorbill are wide-ranging species, with reported mean foraging ranges of 38km and 24km respectively, so some individuals can be expected to forage within the relevant Blocks and be present in this area when dispersing from the colony during the post-breeding season moult.

As detailed in Section 4.3.2, there is little information on the potential impact of underwater noise on diving birds, including underwater noise from seismic survey. Mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere, and flushing disturbance associated with the physical presence of the survey vessel would be expected to displace most diving seabirds from close proximity to seismic airgun arrays where sound pressure may be at sufficient levels to cause physical injury. Individuals of the qualifying features have the potential to come into close proximity to seismic survey activities when foraging outside of the site boundaries; however, given minimum distances between the site and relevant Blocks, this is highly unlikely for the majority of individuals. In addition to this limited likelihood of close exposure to high intensity underwater noise, the evidence (albeit limited) of low hearing sensitivity and a lack of reported injury or disturbance effects, combined with the likely avoidance of the physical presence of survey vessel(s) suggests that the risk of significant mortality, injury or disturbance is very low. Considering the seasonal nature of the sensitivity, where necessary, control of timing of offshore activities allows for mitigation, which would be identified once project plans are known.

Negative indirect effects of seismic survey activities on qualifying features may arise through effects on prey species, primarily sandeels and other small fish, if these species are subject to injury or disturbance which reduces their availability to qualifying seabirds. While there is evidence that a reduction in fish catches can be associated with seismic survey activity, these are temporary in nature, and the disturbance of sensitive spawning periods will be considered through the activity consenting process (Jan-Jun and Nov-Dec are identified as periods of concern for seismic surveys for fish spawning in each of the three relevant Blocks). As such, any underwater noise effects on fish associated with licensing the relevant Blocks are not anticipated to result in significant effects on the food resources of the qualifying seabird features of Troup, Pennan and Lion's Heads SPA.

Considering the above, it is concluded that underwater noise effects from 3D seismic survey associated with the licensing of Blocks 18/3, 18/4, 18/5 will not represent an adverse effect on the integrity of the site.

Considering the limited potential for effects of 3D seismic survey on diving birds identified above, and the lower amplitude, shorter duration and smaller geographic footprint associated with other impulsive noise such as VSP, rig site survey and conductor piling, these activities will not result in an adverse effect on site integrity.

Continuous noise (drilling, vessel & rig movements)
*(**Relevant pressures:** underwater noise change, vibration)*

No effects on the qualifying features are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance.

In-combination effects
Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above, the distance between the relevant Blocks and the site, and the limited underwater noise emissions which are likely to result from adjacent, more distant Blocks. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Berriedale and Langwell Waters SAC
Site information
Area (ha): 58.25 **Relevant qualifying features**: Atlantic salmon. See Natura 2000 standard data form for full details of qualifying features[77]. **Conservation objectives**: See Table 5.1 above.
Relevant Blocks for underwater noise effects
11/23, 11/24c
Assessment of effects on site integrity
None of the Blocks relevant to the Berriedale and Langwell Waters SAC include the shooting of 3D seismic survey within the proposed work programmes of the licence applications. **Impulsive noise (rig site survey, VSP, conductor piling)** *(**Relevant pressures:** underwater noise change, vibration)* Block 11/23 covers coastal waters around the mouth of the site, while 11/24c lies 5km east of the site and abuts the coast approximately 10km northeast of the mouth of the site. Given the proximity of the Blocks to the site, salmon migrating to and from the site have the potential to be exposed to underwater noise. Juveniles migrate from river to sea in the spring with the peak in the Moray Firth considered to be between April and May, while adults may migrate back to their natal rivers at any time of year; the core period in the Moray Firth is between May and October (SNH 2018). Considering the evidence for salmon having a low sensitivity to underwater noise compared to other species (Section 4.3.2), the likely noise levels generated by activities such as VSP, rig site survey and conductor piling, and the relatively short duration and small geographic footprint of these activities, it is concluded that adverse effect on site integrity will not occur. **Continuous noise (drilling, vessel & rig movements)** *(**Relevant pressures:** underwater noise change, vibration)* No effects on the qualifying features are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance. **In-combination effects** Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above and that there are only two adjoining relevant Blocks. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.
Moray Firth SAC
Site information
Area (ha): 151,273.99 **Relevant qualifying features**: Bottlenose dolphin. See Natura 2000 standard data form for full details of qualifying features[78]. **Conservation objectives**: See Table 5.1 above.
Relevant Blocks for underwater noise effects
11/23, 17/5
Assessment of effects on site integrity
The distribution of key habitat for bottlenose dolphins within the Moray Firth SAC is reasonably well understood, while good-moderate survey coverage and passive acoustic monitoring along the southern shore of the outer Moray Firth and in some offshore areas of the outer Moray Firth provide an understanding of the distribution of the

[77] http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030088.pdf
[78] http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0019808.pdf

species in the surrounding areas.

None of the Blocks relevant to the Moray Firth SAC include the shooting of new seismic within the proposed work programme of their licence application. The closest Block where new seismic survey is proposed is 11/25b, which lies 25km to the north east of the site boundary in an area where very few bottlenose dolphin sightings have been recorded. New seismic survey is proposed within the work programmes for Blocks 18/3, 18/4 and 18/5, but these are all ≥ 41km east of the site boundary and so were not screened in for the Moray Firth SAC. These three Blocks lie offshore of the southern Moray Firth coast, which has been shown to be regularly used by a significant proportion of the east Scotland bottlenose dolphin population (e.g. Culloch & Robinson 2008); however, they are all ≥ 14km from the coast and likely significant effects on the SAC were ruled out at the screening stage.

Impulsive noise (rig site survey, VSP, conductor piling)
*(**Relevant pressures:** underwater noise change, vibration)*

In the absence of 3D seismic survey, the most intense noise sources which may follow licensing of the relevant Blocks include VSP site surveys, which produce noise of a very similar low-frequency spectrum but lower intensity (see Table 2.2) than 3D seismic survey. Any conductor piling carried out will generate noise of an even lower intensity. Blocks 11/23 and 17/5 are both 9km from the Moray Firth SAC boundary. Block 11/23 abuts the east Caithness coast in an area where very few sightings of bottlenose dolphins have recorded, with the closest area of high use being the coastline around the mouth of the Cromarty Firth (Sutors) which is over 50km southwest of the Block. Consequently, underwater noise generated by activities such as VSP and site surveys within Block 11/23 is highly unlikely to be at levels which may cause behavioural disturbance to bottlenose dolphins within key areas of the SAC. Block 17/5 is 9km from the nearest site boundary, but 13km to the nearest coastline at Lossiemouth - a stretch of coast which is known to be regularly used by bottlenose dolphins associated with the SAC, albeit not in the same numbers of regularity as areas within the inner Moray Firth. Animals are likely to use this southern coastline both as foraging habitat and as a transit route to other areas of preferred habitat to the east.

Negative indirect effects of seismic survey activities on qualifying features may arise through effects on prey species of bottlenose dolphins, including salmonids and a variety of other fish and cephalopods, if these species are subject to injury or disturbance which reduces their availability to the qualifying bottlenose dolphin. While there is evidence that a reduction in fish catches can be associated with seismic survey activity, these are temporary in nature, and the disturbance of sensitive spawning periods will be considered through the activity consenting process. As such, any underwater noise effects on fish associated with licensing the relevant Blocks are not anticipated to result in significant effects on the food resources of the bottlenose dolphin qualifying features of the Moray Firth SAC.

Considering the location of the Blocks relative to the SAC, the reported importance of adjacent waters within and outside of the SAC to the bottlenose dolphin qualifying feature, the likely noise levels, duration and geographic footprint associated with activities such as VSP and site survey, and the reported evidence of bottlenose dolphins responses to similar, louder noise sources, it is concluded that adverse effect on site integrity will not occur.

Continuous noise (drilling, vessel & rig movements)
*(**Relevant pressures:** underwater noise change, vibration)*

No effects are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance. While licencing of the relevant Blocks may result additional vessel movements between the Blocks and the inner firths, any associated disturbance will be temporary, short-term, and will occur in the context of existing such vessel movements in the region.

In-combination effects
Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above and that there are only two relevant Blocks, neither of which overlap the site or include 3D seismic survey within their proposed work programmes. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

5.3.3 Further mitigation measures

The assessment concluded that no further mitigation measures were required beyond existing regulatory controls (see Section 2.3.2) in order to avoid adverse effects on the integrity of the relevant sites. BEIS require operators to provide sufficient information in the EIA on the potential impact of proposed activities on relevant sites and their qualifying features as well as proposed further mitigation measures in their applications for a Geological Survey consent. Due to the temporary nature of the activities, mitigation measures could include activity timing to avoid the most sensitive periods. Operators must demonstrate how seasonal sensitivities have been taken into account when planning their operations (see BEIS 2019). The information provided by operators must be detailed enough for BEIS (and their advisors) to make a decision on whether the activities could lead to a likely significant effect (see BEIS 2019), and whether the activities should require HRA. Depending on the nature and scale of the proposed activities (e.g. area of survey, source size, timing and proposed mitigation measures) and whether likely effects have been identified, BEIS may undertake further HRA to assess the potential for adverse effects on the integrity of sites at the activity specific level. A standard consent condition requires operators to follow the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys.

Consent for project-level activities will not be granted unless the operator can demonstrate that the proposed activities, which may include 3D seismic survey, rig site survey, VSP and drilling (including conductor piling), will not have an adverse effect on the integrity of relevant sites.

5.3.4 Conclusion

The risks of injury and disturbance to relevant qualifying features is limited both by the nature of the indicative work programmes for the Blocks applied for and controls currently in place, such that it is concluded that activities arising from the licensing of Blocks listed in Table 5.2, in so far as they may generate underwater noise effects, will not cause an adverse effect on the integrity of the relevant sites identified. Consent for project specific activities will not be granted unless the operator can demonstrate that the proposed activities will not have an adverse effect on the integrity of relevant sites. These activities may be subject to activity level EIA and where appropriate, HRA.

5.4 In-combination effects

5.4.1 Introduction

Potential incremental, cumulative, synergistic and secondary effects from a range of operations, discharges and emissions (including noise) were considered in the latest Offshore Energy SEA (DECC 2016; see also OSPAR 2000, 2010[79] and BEIS 2018b). There are a number of potential interactions between activities that may follow licensing and those existing or planned activities in the Moray Firth, for instance in relation to renewable energy, other oil and gas related activity, fishing and shipping. These activities are subject to individual

[79] Note that an intermediate assessment was published by OSPAR in 2017: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/

permitting or consenting mechanisms or are otherwise managed at a national or international level. The relevant Blocks are located in Scottish waters and therefore the Scottish National Marine Plan policies, adopted in March 2015, are relevant to the management of oil and gas and other offshore activities.

The potential for intra-plan in-combination effects was considered for those sites subject to AA in Sections 5.2 and 5.3 (i.e. that multiple Blocks have the potential to be licensed within the same site). The following section considers the potential for in-combination effects with other relevant plans and programmes.

5.4.2 Sources of potential effect

Projects for which potential interactions with operations that could arise from the licensing of 31st Round Blocks (see Table 1.1) have been identified. Interactions were identified on the basis of the nature and location of existing or proposed activities and spatial datasets in a Geographic Information System (GIS). The principal sources of in-combination effects are related to noise, physical disturbance, and physical presence, primarily arising from offshore wind development, and fisheries. OWF development will introduce noise and disturbance sources (particularly during construction) and present an additional physical presence in the marine environment. Offshore wind zones (e.g. Round 3) have already been subject to SEA and HRA, and any related projects have been or will be subject to their own individual assessment and HRA processes[80]. Figure 5.3 indicates the location of other relevant projects in relation to the Blocks subject to this assessment and relevant Natura 2000 sites.

The UK Government believes that the oil & gas and the renewables industries can successfully co-exist, as stated in OGA's Other Regulatory Issues for the 31st Round, "…*we [(OGA)] advise that potential applicants on such blocks [(areas where oil and gas licences and proposed or actual wind farm sites exist and indeed overlap)] should make early contact with the holders of any relevant wind farm lease or Agreement for lease (AfL), or the relevant zone developer(s), and establish in good time a mutual understanding of the respective proposals and time frames envisaged (acknowledging that not all aspects of the future plans of either side will necessarily be definitively decided at that time)*"[81]. In addition to renewables activities, early engagement with other users (e.g. through fisheries liaison, vessel traffic surveys, consultation with the MoD or holders of other Crown Estate offshore interests)[82] where scheduling overlaps may occur should allow both for developer cooperation, and the mitigation of potential cumulative or in-combination effects.

This is also reflected in the Scottish National Marine Plan, for example the general policy GEN4 Co-existence, "*Proposals which enable coexistence with other development sectors and activities within the Scottish marine area are encouraged in planning and decision making*

[80] For those sites having already been subject to HRA, note that the competent authority is under an obligation to reconsider and review consents for projects that are likely to have a significant effect on new SAC and SPA sites once they become a candidate site.
[81] OGA 31st Round Other Regulatory Issues
[82] https://www.ogauthority.co.uk/licensing-consents/overview/the-crown-estate-interests/

processes, when consistent with policies and objectives of this Plan", and more specifically, policy OIL&GAS3, which states "*Supporting marine and coastal infrastructure for oil and gas developments, including for storage, should utilise the minimum space needed for activity and should take into account environmental and socio-economic constraints*".

Table 5.3: Projects relevant to the in-combination effects assessment

Relevant projects	Project summary	Project status	Relevant sites[1]
Offshore Renewables			
Beatrice offshore wind farm	Located on the Smith Bank ca. 13.5km from the Caithness coastline. When completed, the wind farm will have a capacity of 588MW from 84 turbines with a rated power of 7MW, installed on jacket-type foundations.	Under construction, due to be complete in 2019.	East Caithness Cliffs SPA, Moray Firth pSPA, North Caithness Cliffs SPA, Hoy SPA, Berriedale and Langwell Waters SAC, Moray Firth SAC
Moray East Offshore Wind Farm (Stevenson, Telford, MacColl)	The wind farm is 22km from the Caithness coastline and will have an installed capacity of 950MW. It is presently uncertain how many turbines will be installed as this is subject to a final decision on their capacity, however, a conditional agreement with Vestas could result in the capacity being met by 100 9.5MW turbines. The export cable landfall is on the Aberdeenshire coast approximately 45km from the wind farm, and 572km of inter-array cabling is predicted to be installed as part of the project.	Consented. Construction due 2019.	East Caithness Cliffs SPA, Moray Firth pSPA, North Caithness Cliffs SPA, Hoy SPA, Berriedale and Langwell Waters SAC, Moray Firth SAC
Moray West Offshore Wind Farm	The wind farm is 22.5km from the Caithness coastline and has an anticipated installed capacity of 850MW. It is presently uncertain how many turbines will be installed as this is subject to a final decision on their capacity, however, it thought that up to 85 turbines could be installed. The foundation type to be used remains open, with monopile, jacket, gravity base and suction caisson all being considered. Turbine heights could be up to 265m. An option for those up to 285m was dropped following concerns raised about the scale of the project. The export cable landfall is on the Aberdeenshire coast approximately 65km from the wind farm, and 275km of inter-array cabling is predicted to be installed as part of the project.	In planning. Predicted to be operational in 2025, subject to consent.	East Caithness Cliffs SPA, Moray Firth pSPA, North Caithness Cliffs SPA, Troup, Pennan and Lion`s Heads SPA, Buchan Ness to Collieston Coast SPA, Moray Firth SAC
Meygen	Located in the Inner Sound tidal lease zone, Meygen consists of two 1.5MW turbines.	Operational	Pentland Firth pSPA (and related source colonies), North Caithness Cliffs SPA
Interconnectors			
Caithness-Moray HVDC link	HVDC cable connecting converter stations at Spittal in Caithness and Blackhillock in Moray.	Due to be commissionin g by late 2018	Moray Firth pSPA, East Caithness Cliffs SPA, Moray Firth SAC

Relevant projects	Project summary	Project status	Relevant sites[1]
Oil & Gas			
Beatrice	The topsides and jackets of the Beatrice Alpha, Bravo and Charlie will be removed. Options for platform removal are still being considered and include single lift, reverse installation, piece small or a combination of these. The two Beatrice offshore wind turbine generators will be removed in single lift operations. The pipelines will be left *in situ* where buried already, undergo trenching or other remediation such as rock cover placement or section removal.	Offshore works planned 2025-2029.	No related HRA to consider. For the purposes of this assessment relevant sites considered to be East Caithness Cliffs SPA, Moray Firth pSPA, Moray Firth SAC
Jacky	The removal of the Jacky platform by reverse installation (the tripod jacket used suction caissons) using a heavy lift vessel. A subsea manifold will be removed and the pipelines, which are buried, will be left *in situ*.	Offshore works expected 2022-2023.	No related HRA to consider. For the purposes of this assessment relevant sites considered to be East Caithness Cliffs SPA
Wick prospect exploration well	The Wick prospect in Block 11/24b, approximately 2.3km from the Caithness coast, was explored by a well drilled using a jack-up rig with a check shot survey also undertaken.	Exploration well completed, plugged and abandoned.	Moray Firth SAC, Dornoch Firth and Morrich More SAC, East Caithness Cliffs SPA

Sources: Marine Scotland Marine Projects (http://marine.gov.scot/marine-projects - accessed 27/11/18). OGA Oil & Gas Pathfinder current list of projects (https://itportal.ogauthority.co.uk/pathfinder/currentprojectsindex.html – accessed 26/11/2018), BEIS Oil & gas: decommissioning of offshore installations and pipelines (https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines – accessed 26/11/2018)
Notes: [1] – those sites considered to be relevant to 31st seaward round exploration activities, and also relevant to the other projects

5.4.3 Physical disturbance and drilling

Potential sources of physical disturbance to the seabed, and damage to biotopes, associated with oil and gas activities that could result from licensing were described in Section 4.2 and Section 5.2 and include the siting of jack-up drilling rigs, drilling discharges and wellhead placement and recovery.

Existing or proposed oil & gas projects

There is limited existing oil and gas infrastructure in the Moray Firth, and those closest to the 31st Round Blocks (Beatrice and Jacky field facilities) are currently non-producing and subject to decommissioning planning (see Table 5.3). Activities related to the decommissioning programmes for these facilities will cause some seabed disturbance (e.g. use of a jack-up rig to abandon wells, jacket removal and seabed remediation), though this was assessed as not significant in their respective environmental assessments. These assessments indicate that sufficient information has been provided for the Competent Authority to undertake HRA for the respective projects if required. Other than the Beatrice and Jacky decommissioning projects, the closest surface infrastructure is at the Captain field (Block 13/22a), 13km to the east of Block 12/20. A review of field development projects (as of April 2019) published by OGA's Oil

& Gas Pathfinder[83] indicates an enhanced oil recovery project is associated with the Captain field involving additional injection wells and platform modifications. In view of the distance of the 31st Round Blocks to this project there is no foreseeable interaction. No other developments are presently proposed within the quadrants for which Blocks have been applied for in the 31st Round (including those not subject to assessment, see Figure 5.4). An exploration well has recently been drilled in Block 11/24b which targeted the Wick prospect. No temporal or spatial interaction with this exploration well and 31st Round activities are considered possible.

When considered against the potential scale of activity which could follow the licensing of relevant 31st Round blocks (as assessed in Section 5.2), likely cumulative physical effects from existing or proposed activity are not envisaged. Given the small and temporary seabed footprint associated with drilling activities which may follow the licensing of 31st Round Blocks and the standard and additional control measures set out in Section 2.3 and 5.2.3, significant in-combination effects associated with those limited other oil and gas projects is not expected.

With respect to drilling discharges, previous discharges of WBM cuttings in the UKCS have been shown to disperse rapidly and to have minimal ecological effects (See Section 4.2). Dispersion of further discharges of mud and cuttings could lead to localised accumulation in areas where reduced current allows the particles to accumulate on the seabed. In view of the scale of the proposed activity, extent of the region, the water depths and currents, discharges are considered unlikely to be detectable and to have negligible cumulative ecological effect (DECC 2016). Similarly, the potential for in-combination effects relating to chemical usage and discharge from exploratory drilling is limited by the existing legislative and permitting controls that are in place, which the UK Marine Strategy[84] has identified as making an ongoing contribution to managing discharges.

Offshore renewables

OWFs are the only type of renewable energy project commercially deployed in the Moray Firth, and include the Beatrice OWF in Scottish Territorial Waters, and and those of Moray East (incorporating the Stevenson, MacColl and Telford projects) and Moray West in the former Moray Firth Round 3 leasing zone (Table 5.3 and Figure 5.3). Of particular relevance would be any damage to shallow sandbank habitats, including that of the Moray Firth SAC, as these are potentially important foraging areas for bottlenose dolphins and other marine mammals. The advice on operations for Moray Firth SAC[85], while dated, reflect the sensitivity of the site habitat feature (sandbanks which are slightly covered by sea water all the time) to physical effects from renewables development, and the conservation objectives recognise the importance of supporting habitat in achieving favourable conservation status for the bottlenose dolphin feature, which would include the sandbank habitat.

83 https://itportal.ogauthority.co.uk/eng/fox/path/PATH_REPORTS/pdf
84 https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures
85 http://jncc.defra.gov.uk/page-6508

Figure 5.3: Other projects relevant to the Moray Firth: renewables and cables

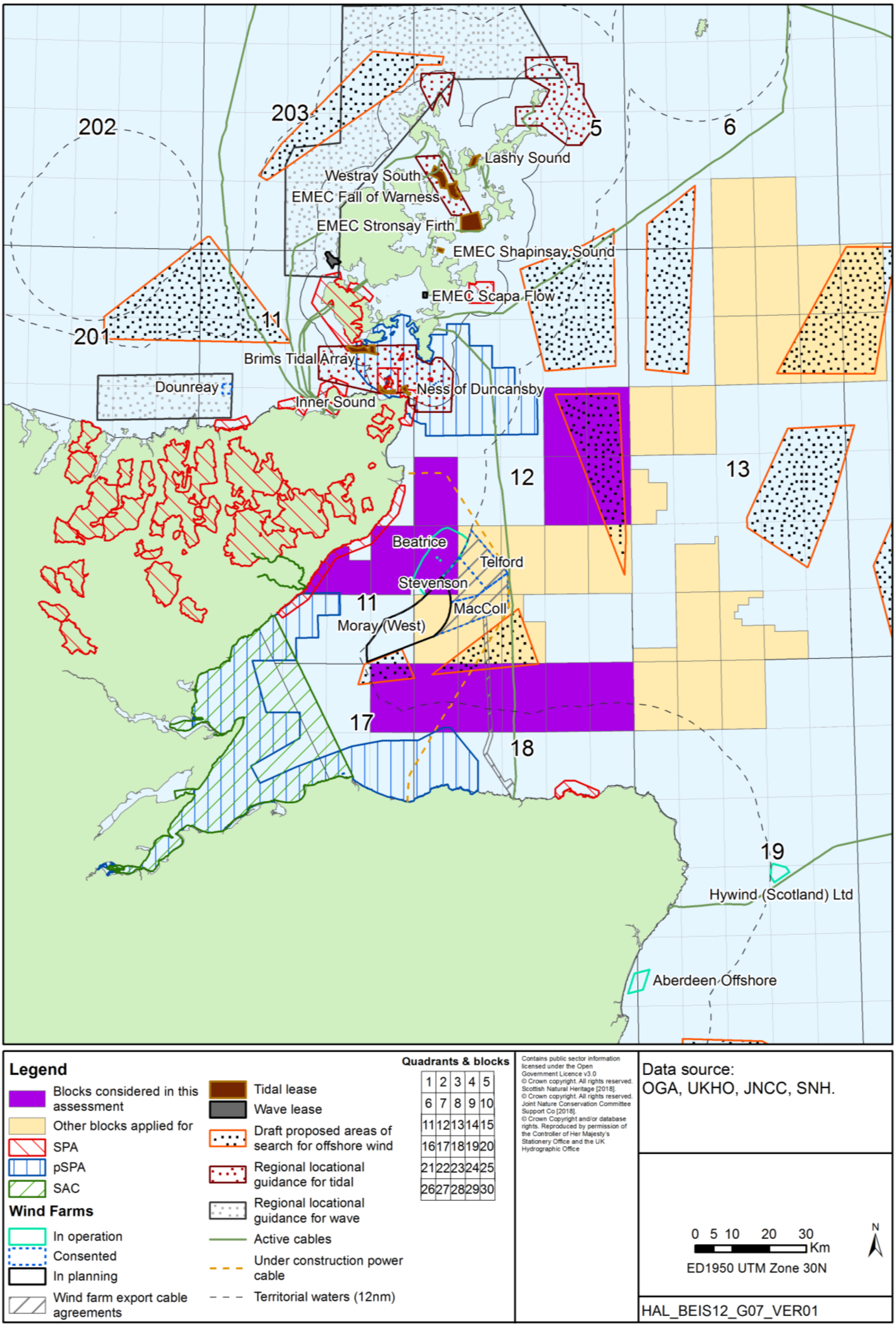
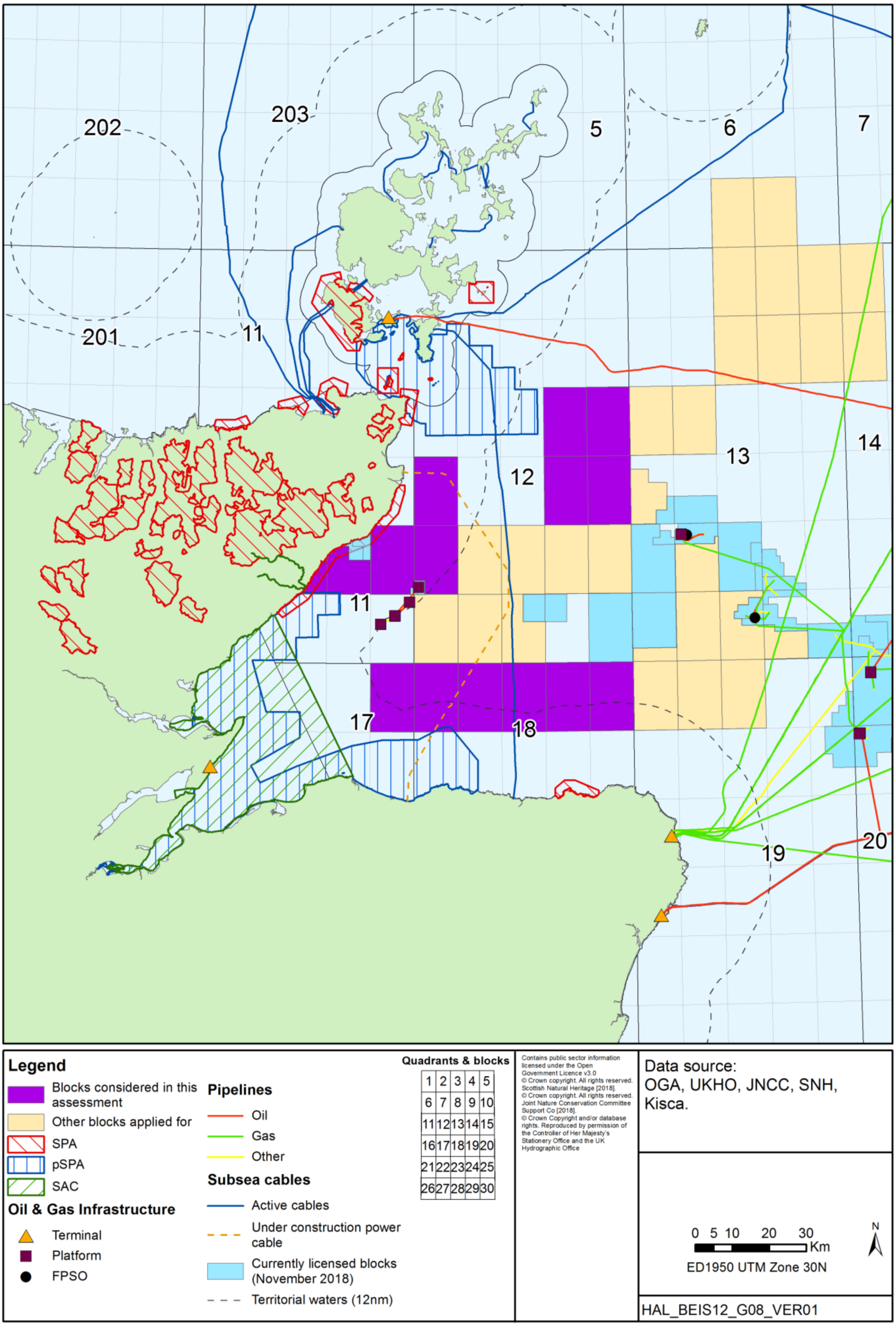


Figure 5.4: Other projects relevant to the Moray Firth: oil & gas



HRAs[86] for those OWFs noted above concluded that there would not be an adverse effect on site integrity from physical impacts on the sandbank habitat of the Moray Firth SAC, alone or in-combination with other projects. The current project timelines for project proposals[87] indicate the potential for interaction with exploration activity as part of the Initial Term of 31st Round licences (up to 9 years), as construction is proposed to take place within this period. The magnitude of physical impacts associated with rig placement and drilling has already been discussed in Section 4.2 and Section 5.2. Applicants taking part in the 31st Round were made aware of such relevant Crown Estate interests[88].

Thirteen Blocks were identified on the basis of a potential for likely significant effect in relation to the Moray Firth SAC, and were considered in Section 5.2.2, and of these, two also coincide with an offshore wind project area (Parts of the Stevenson, Moray West and Beatrice wind farms overlap Block 12/21b, and Block 18/12 overlaps with the cable export route for the Moray East development). None of the Blocks entirely cover any project area. Mitigation may be provided by the ability to locate any drilling rig, if used, outside of the wind farm boundaries or through dialogue to avoid any conflict of interest and any in-combination effect, though these are not predicted. Further mitigation is available through activity timing/phasing, such that those sources of effect from wind farm installation and operation (e.g. localised and temporary increases in suspended sediment concentrations including re-suspension of contaminants, loss of sandbank habitat[89]) are not compounded by rig installation – note that the footprint of any drilling rig would be small (approximately 0.001km^2 – also see Table 2.2). It is therefore not regarded that activity which could take place in the initial term of 31st Round licences would, with offshore renewables in-combination lead to a physical change significant enough to cause an adverse effect on site integrity of the Moray Firth SAC.

Crown Estate Scotland is preparing for new leasing in Scottish waters[90], with a final approach to leasing expected to be released in early 2019[91]. The earliest expected launch of the leasing round is July 2019[92]. In response, a screening and scoping report for a Scottish Government Sectoral Marine Plan for Offshore Wind Encompassing Deep Water Options was published in June 2018[93]. The draft plan and SEA are intended to inform spatial aspects of future leasing,

[86] See: http://marine.gov.scot/marine-projects. Note that an HRA for the Moray West development has not yet been undertaken, but a report to inform Appropriate Assessment has concluded that there would be no adverse effects on the integrity of the Moray Firth SAC from physical impacts (https://www2.gov.scot/Resource/0053/00538038.pdf).
[87] See: https://www.renewableuk.com/news/415071/Offshore-Wind-Project-Timelines-2018.htm
[88] https://www.ogauthority.co.uk/licensing-consents/overview/the-crown-estate-interests/ and https://itportal.ogauthority.co.uk/web_files/gis/ukcs_maps/TCE_Leases_and_OG_Licences.pdf
[89] See the record of the HRA undertaken in relation to the Dogger Bank Creyke Beck Offshore Wind Farm: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010021/EN010021-000003-Habitats%20Regulations%20Assessment.PDF
[90] Crown Estate Scotland (2018). New offshore wind leasing for Scotland - discussion document - http://www.crownestatescotland.com/maps-and-publications/download/172
[91] https://www.crownestatescotland.com/media-and-notices/news-media-releases-opinion/timescales-and-next-steps-for-new-offshore-wind-leasing-for-scotland
[92] https://www.crownestatescotland.com/media-and-notices/news-media-releases-opinion/scotwind-leasing-update-on-timescales-and-next-steps
[93] https://consult.gov.scot/marine-scotland/offshore-wind-scoping/

and include establishing suitable areas of search. The SEA will build on the information and approach of the 2011 sectoral plan and its 2013 review. A consultation on the draft plan and its related SEA Environmental Report is expected in spring 2019 and be concluded by the year end. Draft areas of search in Scottish waters have been identified as part of the 2018 scoping exercise for the Scottish sectoral offshore wind plan (see Figure 5.3). Crown Estate Scotland propose that applications for new lease areas are within these areas, which is in keeping with the Scottish National Marine Plan policy RENEWABLES 1 that, on adoption, proposals for future offshore wind are likely to be made in these areas. There is limited overlap with 31st Round Blocks with these areas, including parts of Blocks 17/5, 18/1, 18/2, 18/3, 12/14, 12/15, 12/19 and 12/20. For the purposes of this HRA, it is noted that these areas are yet to be finalised, the draft sectoral plan is yet to complete its formal SEA process, and the timing and nature of any subsequent development is unknown and are unlikely to take place within the timing of the initial term of 31st Round activities. At this stage, in-combination effects have, therefore, not been identified in relation to any of these areas of search. Any subsequent SEA Environmental Report or HRA for further leasing in Scottish waters would take account of any exploration activities at that time.

A number of tidal stream leasing areas are north of the Moray Firth in the Pentland Firth, only the Inner Sound lease area contains an active project (Meygen), with the Ness of Duncansby and Brims zones not currently subject to firm project proposals. Meygen consists of two 1.5MW tidal turbines which were redeployed in December 2018. The nearest Block (12/16) is at least 20km away from the project, and in view of the nature and scale of potential effects from Block licensing (Table 2.2) which could occur in this Block, or any other of relevance to sites including the Pentland Firth pSPA (and related colonies) and North Caithness Cliffs SPA (Section 5.2), significant in-combination effects are not predicted.

Cables

Two cables traverse blocks applied for in the 31st Round: the SHEFA-2 telecommunications cable running between Banff and Mance Bay, Orkney installed in 2007 crosses Block 18/3, and the recently installed Caithness to Moray HVDC interconnector crosses Blocks 18/1, 18/2 and 12/16. The proposed Shetland HVDC Link[94] would cross the northern part of Block 12/16 (not shown on Figures 5.3 and 5.4 above), but this is at an early stage of development and a formal application is yet to be made on which to base an in-combination consideration. The surface area of these cables is extremely small, and they are well-charted features and avoided by oil and gas operators, including during exploration, limiting the potential for localised in-combination effects. In view of the small and temporary footprint of any well which could follow the licensing of the 31st Round Moray Firth Blocks and the limited overlap of Blocks crossed by these cables with any relevant site (only 18/1, with most of the Block outside of the Moray Firth pSPA), there is limited potential for incremental in-combination effects with subsea cables of any significance which has the potential to undermine the conservation objectives of any relevant site.

[94] https://www.ssen-transmission.co.uk/projects/shetland/

Fisheries

Fishing and particularly bottom trawling has historically contributed to seabed disturbance over extensive areas, and was identified as an ongoing issue in the UK initial assessment for MSFD[95]. Depending on the nature of future measures (e.g. in relation to MPA management in the wider environment and within MPAs), such effects are likely to be reduced and therefore some improvement in benthic habitats could be expected. The management of fisheries in relation to Article 6 of the Habitats Directive is fundamentally different to other activities such as offshore energy development, and a revised approach to the management of commercial fisheries in European sites[96] has sought to implement steps to ensure that they are managed in accordance with Article 6.

Fishing activity using both mobile and static gear types is noted in supporting management advice for the Pentland Firth pSPA and Moray Firth pSPA[97], and contain a number of recommendations. These include that pelagic fishing for herring/sprat does not prevent or disrupt the availability of prey species for common guillemot, Arctic tern and indirectly to Arctic skua for the Pentland Firth pSPA; or divers, red-breasted merganser, Slavonian grebe or shag respectively, or habitats of the prey for bottom-feeding seaducks, in the Moray Firth pSPA. Advice on operations for the Moray Forth SAC notes the sensitivity of the site's qualifying features to a range of mobile and static gears. Marine Scotland is developing further fisheries management measures for inshore sites, including for the Moray Firth SAC and East Caithness Cliffs SPA[98], but consultation on the proposals is yet to take place and formal measures are pending.

Whilst fishing may be linked to historical damage to site features, and presents a continuing risk to these, future management measures should limit the potential for in-combination effects with other activities. Effects on sites from exploration activity can be reduced or avoided (see Sections 2.3.1 and 5.2.3), and other oil and gas related activities are subject to statutory environmental impact assessment and where appropriate, HRA.

When an oil and gas surface structure (fixed and floating installations) becomes operational, a safety zone with a radius of 500m is created under the *Petroleum Act 1987* and other activities are excluded from taking place within the zone, including fisheries. Safety zones apply to mobile drilling rigs and are notified to other users of the sea (e.g. through notices to mariners and Kingfisher charts). In view of the differences in relative scale of physical impacts resulting from trawling and from oil and gas exploration (both spatially and temporally), significant in-combination effects are not predicted.

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95 https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status
96 https://www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery and see https://www2.gov.scot/Topics/marine/marine-environment/mpanetwork/SACmanagement
97 https://www.nature.scot/pentland-firth-proposed-marine-spa-supporting-documents, https://www.nature.scot/moray-firth-proposed-marine-spa-supporting-documents
98 https://www2.gov.scot/Topics/marine/marine-environment/mpanetwork/inshorempas/Management

5.4.4 Physical presence

Physical presence of offshore infrastructure and support activities may potentially cause behavioural responses in fish, birds and marine mammals (see Section 5.6 of BEIS 2018a). Previous SEAs have considered the majority of behavioural responses resulting from interactions with offshore oil and gas infrastructure (whether positive or negative) to be insignificant; in part because the number of surface facilities is relatively small (of the order of a few hundred) and because the majority are at a substantial distance offshore. The larger numbers of individual surface or submerged structures associated with offshore wind developments, the presence of rotating turbine blades and considerations of their location and spatial distribution (e.g. in relation to coastal breeding or wintering locations for waterbirds and important areas for marine mammals), indicate a higher potential for physical presence effects. Potential displacement and barrier effects have been an important consideration at the project level for the large offshore wind developments that are planned for the Moray Firth (Figure 5.3) and formed an important part of associated HRAs[99].

It is not regarded that the temporary addition of a drilling rig and associated shipping will lead to adverse effects on the integrity of relevant sites considered in this AA when considered in-combination with those projects noted in Table 5.3. Further mitigation measures are available, which could include seasonal controls to limit interactions with particularly sensitive qualifying interests, in-combination with other activities. These would be identified at the project level, when there will be sufficient definition to make an assessment of likely significant effects, and for applicants to propose project specific mitigation measures (see Section 5.2.3).

As noted in Section 5.4.3 above, Crown Estate Scotland intend to consider new leasing areas for offshore wind as part of a further round of offshore wind leasing, however these plans are still subject to consultation or ongoing SEA processes which will include their own HRA. Therefore, details of the nature and timing of any potential project which could result from the leasing round is presently lacking on which to base an in-combination consideration at this stage.

Shipping densities over the relevant Blocks range from very low (12/21b, 17/5, 18/1, 18/2, 18/3, 18/4) to low (12/16, 12/20) and moderate (12/14, 12/15, 12/19, 18/5), for example with vessel densities varying from <1 to 10 per week per 2km grid cell[100]. Additional vessels associated with drilling and site survey will represent a small increment to existing traffic, or that which is likely to be generated from either the decommissioning work associated with the Beatrice or Jacky fields, or that from the construction and operation of the wind farms in the Moray Firth. For example, typical supply visits to rigs while drilling may be in the order of 2 to 3 per week. Though representing an incremental source of activity in and around OWF zones, it

[99] Refer to those HRAs in relation to Beatrice Offshore Wind Farm, Moray East Offshore Wind Farm, and Moray West Offshore Wind Farm. Note that the HRA and consenting process for the Moray West Offshore Wind Farm is ongoing and has not been concluded.

[100] https://www.ogauthority.co.uk/media/1419/29r_shipping_density_table.pdf, https://data.gov.uk/dataset/vessel-density-grid-2015. These datasets are derived from AIS data. AIS must be fitted to all ships of >300 gross tonnage engaged on international voyages, all cargo ships of >500 gross tonnage and all passenger ships irrespective of size. AIS has limited coverage of smaller commercial, fishing and recreational vessels.

is anticipated that in-combination effects can be avoided through early engagement with lease holders. The transient nature of exploration drilling and the timing of OWF construction activities are such that any activity associated with the work programmes could be phased in such a way as to avoid in-combination effects from physical presence on any qualifying features of relevant European sites. Such interactions would need to be considered as part of assessments, including in HRA where appropriate, for project-level activity.

5.4.5 Underwater noise

A number of projects are relevant to the consideration of in-combination effects with activities which may follow the licensing of 31st Round Blocks (see Table 5.3). The associated activities can generate noise levels with the potential to result in disturbance or injury to animals associated with relevant sites (see DECC 2016).

Of most relevance to the Blocks being considered are a series of Scottish Territorial Water or former Round 3 wind farms. While the operation, maintenance and decommissioning of offshore wind energy developments will introduce noise into the marine environment, these are typically of low intensity. The greatest noise levels arise during the construction phase, and it is these which have the greatest potential for acoustic disturbance effects (see DECC 2016). Pile-driving of mono-pile foundations or pin piles used in jacket-type foundations is the principal source of construction noise, which will be qualitatively similar to pile-driving noise resulting from harbour works, bridge construction and oil and gas platform installation. Mono-pile foundations are the most commonly used for OWF developments at present (and the focus of most studies of the effects of wind farm construction on harbour porpoise behaviour, see Section 4.3.2). The water depths over much of the Moray Firth dictate jacket (e.g. as used at the Beatrice demonstrator and now in the Beatrice territorial waters project) or other structures such as gravity bases, resulting in less noise on installation than monopiles particularly if suction buckets are considered viable and used for jacket installation. The final selection of foundation type is uncertain for the remaining developments and the subject of detailed design.

Of those wind farms listed in Table 5.3, one is under construction with the others either consented or in planning, with target construction times ranging from 2019-2025 (see Section 2.2.3 and 4.2.8 of BEIS 2018b, and Appendix 1h of DECC 2016[101]). It is likely that the construction of the Beatrice Offshore Wind Farm will be complete in advance of any activity taking place within the 31st Round Moray Firth Blocks. In view of the length of the initial term of licences (up to 9 years) there is the potential for temporal overlap with those other wind farms.

There is the potential for seismic surveys to take place in adjacent Blocks which are not covered by the plan being assessed. The timing, location and scale of any such surveys are unknown and a meaningful assessment of these cannot currently be made, but they will be subject to activity specific permitting, including HRA where appropriate.

[101] Also see: RenewableUK Offshore Wind Project Timelines (August 2017): http://www.renewableuk.com/news/294516/Offshore-Wind-Project-Timelines.htm

Significant in-combination effects are considered to be unlikely given the spatially limited and temporary nature of noise generating activity associated with the 31st Round Blocks (see Section 5.3), and that there is significant scope to avoid concurrent OWF construction[102] and exploration well site survey activity either through dialogue with relevant licence/leaseholders or by virtue of wind farm construction timelines. The potential for seismic survey associated with the 31st Round and piling to overlap is in part reduced by the negative consequences of piling on seismic data collection. However, BEIS acknowledge the potential for in-combination effects to arise from sequential activities. Therefore, further HRA will be undertaken, where appropriate, at the activity specific level which will allow for the consideration of the spatial and temporal scope of seismic survey, including in-combination with other relevant projects.

In addition to those activities which may follow licensing of the Moray Firth Blocks and the other potentially relevant projects listed in Table 5.3, there are a variety of other existing (e.g. fishing, shipping, military exercise areas, wildlife watching cruises) and planned (e.g. oil and gas exploration) noise-producing activities in overlapping or adjacent areas. Despite this, BEIS is not aware of any projects or activities which are likely to cause cumulative and in-combination effects that, when taken in-combination with the likely number and scale of activities likely to result from Block licensing (Section 2.2), would adversely affect the integrity of the relevant sites. This is due to the presence of effective regulatory mechanisms (Section 5.3 and also Appendix 3 of DECC 2016) which ensure that operators, BEIS and other relevant consenting authorities take such considerations into account during activity permitting. These mechanisms generally allow for public participation in the process, and this has been strengthened by the May 2017 Regulations[103] amending the offshore EIA regime. These reflect Directive 2014/52/EU which provides for closer co-ordination between the EIA and Habitats Directives, with a revised Article 3 indicating that biodiversity within EIA should be described and assessed “with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC”.

5.4.6 Conclusions

Available evidence (see e.g. UKBenthos database and OSPAR 2010) for the Moray Firth indicates that past oil and gas activity and discharges has not led to adverse impacts on the integrity of European sites in the area. Any activities relating to the work programmes, and any subsequent development that may occur if exploration/appraisal is successful, will be judged on its own merits and in the context of wider development in the North Sea (i.e. any potential incremental effects). The current regulatory controls on terrestrial and marine industrial activities, including oil and gas operations that could follow licensing, can be expected to prevent significant in-combination effects affecting relevant European sites.

BEIS will consider the potential for in-combination effects whilst considering project specific EIAs and, where appropriate, through HRAs. This process will, if consented, projects will not

[102] Note that the encounter rate of UXO and its nature is uncertain and disposal operations are subject to separate marine licensing.

[103] *The Offshore Petroleum Production and Pipe-lines (Environmental Impact Assessment and other Miscellaneous Provisions) (Amendment) Regulations 2017*

result in adverse effects on integrity of European sites. Therefore, it is concluded that the in-combination effects from activities arising from the licensing of Blocks in the Moray Firth (Table 1.1) with those from existing and planned activities will not adversely affect the integrity of relevant European Sites.

6 Overall conclusion

Taking account of the evidence and assessment presented above, the report determines that the licensing through the 31st Licensing Round of the 15 Blocks considered in this AA will not have a significant adverse effect on the integrity of the relevant sites (identified in Section 1.3), and BEIS have no objection to the OGA awarding seaward licences (subject to meeting application requirements) covering those Blocks listed in Table 1.1. This is because there is certainty, within the meaning of the ECJ Judgment in the Waddenzee case, that implementation of the plan will not adversely affect the integrity of relevant European Sites (as described in Sections 5-8), taking account of the control measures that can be imposed through existing permitting mechanisms on the planning and conduct of activities (as described in Section 2.3, and in Sections 5.2.3 and 5.3.3).

These control measures are incorporated in respect of habitat and species interest features through the range of legislation and guidance (see https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation) which apply to activities which could follow licensing. Where necessary, project-specific HRA based on detailed project proposals would be undertaken by BEIS to ensure that permits/ consents are only granted where the proposed activity will not result in adverse effects on integrity of relevant sites.

Even where a site/interest feature has been screened out, or where a conclusion of no adverse effect on site integrity has been reached at plan level, the potential for likely significant effects on any relevant site would need to be revisited at the project level, once project plans are known. New relevant site designations, new information on the nature and sensitivities of interest features within sites, and new information about effects including in-combination effects may be available to inform future project level HRA.

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