RECORD OF THE HABITATS REGULATIONS ASSESSMENT UNDERTAKEN UNDER REGULATION 5 OF THE OFFSHORE PETROLEUM ACTIVITIES (CONSERVATION of HABITATS) REGULATIONS 2001 (As Amended).

*Tullow – Seabed Clearance Campaign: Horne and Wren, Orwell, Cameron*

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1 INTRODUCTION


1.2 The Habitats Directive provides for the designation of sites for the protection of habitats and species of European importance. These sites are called Special Areas of Conservation (SACs). SACs form part of a network of protected sites across Europe called Natura 2000.

1.3 Before SACs are designated, the Government will undertake a public consultation. Prior to consultation the site is considered to be a draft SAC (dSAC). At the public consultation stage, the site is referred to as a possible SAC (pSAC). When a pSAC is submitted to the European Commission it becomes a candidate SAC (cSAC), at which point it is legally afforded the same protection as a SAC. Following adoption by the European Community the site becomes a Site of Community Importance until formal designation by the Government when the site becomes a SAC. The Southern North Sea SAC became designated as a SAC in February 2019 (JNCC 2019a).

1.4 Any plan or project, which either alone or in-combination with other plans or projects would be likely to have a significant effect on a qualifying site must be subject to an Appropriate Assessment to determine the implications for a site’s integrity and conservation objectives. Such a plan or project may only be agreed after ascertaining that it will not adversely affect the integrity of a European Site unless there are imperative reasons of overriding public interest for carrying out the plan or project.


1.6 Regulation 5(1) of the 2001 Regulations provides that: The Secretary of State shall, before granting any Petroleum Act licence, any consent, any authorisation, or any approval, where he considers that anything that might be done or any activity which might be carried on pursuant to such a licence, consent, authorisation or approval is likely to have a significant effect on a relevant site, whether individually or in-combination with any other plan or project, including but not limited to any other relevant project, make an appropriate assessment of the implications for the site in view of the site’s conservation objectives.

1.7 Tullow Oil SK Limited (hereafter referred to as Tullow) have submitted to the Department for Business Energy and Industrial Strategy (BEIS) three applications for marine licences to
undertake seabed clearance activities at Horne and Wren, Orwell and Cameron fields. Application numbers ML/628/0 (DCA/120, Horne and Wren), ML/629/0 (DCA/121 Orwell), and ML/630/0 (DCA/119, Cameron). The applications were received from between 24 and 29 July 2020.

1.8 Advice received from the Joint Nature Conservation Committee (JNCC) during consultation was that ‘consider there may be a likely significant effect on the Southern North Sea Special Area of Conservation (SAC). JNCC advise that an Appropriate Assessment (AA) should be undertaken, as required under Regulation 28 of The Conservation of Offshore Marine Habitats and Species Regulations 2017’ (JNCC 2020a,b,c). BEIS agrees with this advice that an Appropriate Assessment should be undertaken and, as the competent authority, will undertake an assessment as required under the regulations.

1.9 This is a record of the Habitats Regulations Assessment (HRA), undertaken by the Secretary of State for BEIS in respect of proposed seabed clearance activities at the Horne and Wren, Orwell and the Cameron fields.

1.10 The proposed activities relevant to this assessment are not directly connected with, or necessary to, the management of any European sites but it may affect them. The purpose of this HRA is to determine whether the proposed activities will adversely affect the integrity of any European designated site.
2 PROJECT DESCRIPTION

2.1 The following is a brief summary of the proposed activities relating to the Marine Licence applications, ML/628/0 ML/629/0 and ML/630/0, further details may be found within the applications and associated EIA justifications (TOSK 2020a,b,c).

Horne and Wren

2.2 The proposed activities at the Horne and Wren location will be undertaken in licence Block 53/3 in the southern North Sea (Figure 1).

2.3 The infrastructure to be removed consists of:
   - A 3.2 m length of the Horne and Wren 30 inch diameter conductor,
   - A single concrete mattress (approximately 5 tonnes at 6 x 3 m) on the conductor,
   - Grout from the grout mound.

2.4 The 30 inch diameter conductor is to be severed at a minimum depth of 3 m below the mudline, which will equate to a total length of 3.2 m. The conductor is part encased in over spill grout from when the conductor was first installed. The grout extends around approximately half of the conductor circumference at a height of 1.2 m off of the seabed. The grout mound is approximately 1.5 m in diameter (TOSK 2020a).

2.5 Explosives have been chosen as the removal method for the conductor, as previous cutting techniques by TOSK on this conductor have been unsuccessful. A maximum of 70 kg of explosives will be used to sever the conductor, which will be detonated as a single charge. The explosives will be placed into a charge case and 3 m below the seabed to ensure that the cut is made at the desired depth (TOSK 2020a).

2.6 It is anticipated that the explosives used during the severance of the conductor will also break the grout. However, in the event that this does not occur further, detonations using up to two 8 kg charges will be used to dislodge the grout. The pieces of grout mound are to be collected from the seabed and disposed of onshore.

2.7 A single 5 tonne mattress (6 x 3 m) partially covering the top of the conductor will be removed to gain access to the inside of the conductor. The mattress is to be recovered transported ashore for onshore disposal (TOSK 2020a).

2.8 The earliest start date for the removal work to be the 17th September, with the work scheduled to be between three to seven days on location, depending on weather conditions. The latest end date, accounting for a delayed start date, is anticipated to be 31st October 2020. Conductor removal is planned to be undertaken during late September/early October.
Orwell

2.9 The proposed activities at the Orwell location will be undertaken in licence Block 50/26 in the southern North Sea (Figure 1).

2.10 The infrastructure to be removed consists of:

- A 6 m length of the Orwell 30 inch diameter conductor,
- 32 concrete mattresses (approximately 6 tonnes at 6 x 3m),
- A 4 m length of the export pipeline (16 inch diameter and 3.5 inch diameter, which is piggybacked),
- A 4 m length of the 5 inch diameter umbilical.

2.11 The 30 inch diameter conductor is to be severed at a minimum depth of 3 m below the mudline, which will equate to a total length of 6 m. The conductor was cut in 2019 but could not be recovered; consequently Tullow propose to use explosives to remove the conductor (TOSK 2020b). A maximum of 70 kg of explosives will be used to sever the conductor, which will be detonated as a single charge. The explosives will be placed into a charge case and 3 m below the seabed to ensure that the cut is made at the desired depth (TOSK 2020b).

2.12 The pipeline will be cut and recovered. All mattresses will also be recovered and returned to shore for onshore disposal (TOSK 2020b).

2.13 The earliest start date for the removal work to be the 17th September, with the work scheduled to be between three to seven days on location, depending on weather conditions. The latest end date, accounting for a delayed start date, is anticipated to be 31st October 2020. Conductor removal is planned to be undertaken during late September/early October.

Cameron

2.14 The proposed activities at the Cameron location will be undertaken in licence Block 44/19 in the southern North Sea (Figure 1).

2.15 The infrastructure to be removed consists of:

- A 3.2 m length of the Cameron 30 inch diameter conductor,
- Grout from the grout mound.

2.16 The 30 inch diameter conductor is to be severed at a minimum depth of 3 m below the mudline, which will equate to a total length of 3.2 m. The conductor was cut in 2019 but could not be recovered; consequently Tullow propose to use explosives to remove the conductor (TOSK 2020c). A maximum of 70 kg of explosives will be used to sever the conductor, which will be
detonated as a single charge. The explosives will be placed into a charge case and 3 m below the seabed to ensure that the cut is made at the desired depth (TOSK 2020c).

2.17 The 30 inch conductor is part encased in over spill grout from when the conductor was first installed. The grout extends around approximately half of the conductor circumference at a height of 1.2 m off of the seabed. The grout mound is approximately 1.5m in diameter. In the event that the detonation from the conductor removal does not break up the grout, up to two further detonations using 8 kg charges will be used to break the grout. The pieces of grout mound are to be collected from the seabed and disposed of onshore (TOSK 2020c).

2.18 The earliest start date for the removal work to be the 17th September, with the work scheduled to be between three to seven days on location, depending on weather conditions. The latest end date, accounting for a delayed start date, is anticipated to be 31st October 2020. Conductor removal is planned to be undertaken during late September/early October.

Figure 1: Location of the proposed Tullow seabed clearance activities.
3 DESIGNATED SITES

3.1 The proposed activities at Horne and Wren and at Orwell will be undertaken within the Southern North Sea SAC. The proposed activities to be undertaken at the Cameron field lies within 3.5 km of the Southern North Sea SAC boundary (Figure 2).

3.2 The proposed activities at the Cameron field will be undertaken within the Dogger Bank SAC (Figure 2).

3.3 Based on the information presented within the application, including the results from the noise modelling undertaken in support of the application and advice received during consultation it has been determined that there is potential of a likely significant effect on the qualifying species (harbour porpoise) of the Southern North Sea SAC and the qualifying habitats of the Dogger Bank SAC.

3.4 No other qualifying species or habitats have been identified as being potentially impacted by the proposed activities.

Figure 2: Location of proposed Tullow seabed clearance activities and Southern North Sea SAC and Dogger Bank SAC.

3.5 The qualifying sites and features relevant to this HRA are:

- Southern North Sea SAC (Harbour porpoise),
• Dogger Bank SAC (Sandbanks which are slightly covered by sea water all the time [Habitat code 1110]).

**Southern North Sea SAC**

**Harbour porpoise**

3.6 The harbour porpoise (*phocoena phocoena*) is a qualifying species for the:

• Southern North Sea SAC,

3.7 The harbour porpoise is the smallest and most abundant cetacean species in UK waters. They occur widely across shelf waters predominantly either individually or in small groups but larger aggregations have been reported (Defra 2015), with group sizes varying with season (Clark 2005). Harbour porpoise have a very broad distribution occurring predominantly over the continental shelf. Higher densities occur in areas of up-wellings and strong tidal currents and in water depths of predominantly between 20 and 40 m (Clark 2005, Whaley 2004). Their distribution may also be strongly correlated with seabed type, with areas of sandy gravel being preferred and this may be linked to prey availability (Clark 2005).

3.8 Harbour porpoise occur widely across the North Sea. Data from the three Small Cetacean Abundance in the North Sea (SCANS) surveys indicate that that there may have been a southward shift in the distribution of harbour porpoise in the North Sea. In the early 1990’s harbour porpoise were widespread but appear to have occurred predominantly around eastern Scotland and the northern North Sea to the southern North Sea (Hammond *et al.* 2013). Since the 1990’s harbour porpoise continue to be widespread across the North Sea but densities have increased in the southern and central North Sea. The cause of this apparent change in the distribution of harbour porpoises across the North Sea is unclear but may be related to changes in prey availability (IAMMWG *et al.* 2015).

3.9 Following the completion of the most recent SCANS survey (SCANS III), the latest estimated harbour porpoise populations within the whole of the SCANS survey area is 424,245 (CV 313,151 – 596,827). Since 1994 the population of harbour porpoises within the SCANS surveyed area has remained relatively stable (Figure 3) (Hammond *et al.* 1995, Hammond 2006, Hammond *et al.* 2017).
3.10 There are three Management Units identified for harbour porpoise in the north-east Atlantic, of which, the Southern North Sea SAC lies within the North Sea Management Unit. The harbour porpoise population within the North Sea Management Unit was originally estimated to be 227,298 (176,360 – 292,948) (IAMMWG 2015). This estimated population of harbour porpoise is recognised to have been derived from data collected in 2005 and 2016 during a single month and that the harbour porpoise population within the SAC will vary across seasons and years. The population estimated from the Joint Cetacean Protocol (JCP), where abundance and distribution data from multiple sources collected over a period of time have been integrated, is 333,808 individuals (JNCC 2017b). This population estimate has been used for the purposes of this assessment.

3.11 The SAC selection assessment document estimates that the site holds 18,500 harbour porpoise (98% C.I. 11,864 – 28,899) (JNCC 2017c; 2019a), which was 8.1% of the North Sea Management Unit population at the time the estimate was made (Hammond et al. 2013, IAMMWG 2015).

3.12 Harbour porpoise densities vary seasonally and across the Southern North Sea SAC (Evans and Tellmann 2009). Site-specific surveys undertaken by wind farm developers have shown considerable variation in the spatial and temporal distribution of harbour porpoises across years (e.g. Forewind 2013, SMart Wind 2017). Typically, peak abundance has been reported to occur between May and July at sites across the Dogger Bank area and between September and April at sites further south (e.g. Forewind 2014, SMart Wind 2015, EAOWL 2015). Lowest reported abundance across nearly all wind farm surveyed areas occurs between November and February,

Figure 3: Estimated number of harbour porpoise within the SCANS survey area recorded during SCANS I, II and III surveys (Hammond et al. 2017).
although the poorer survey conditions that occur predominantly during the winter months may be a contributing factor in the lower number of harbour porpoise recorded during this period.

3.13 Based on data in the JCP database highest densities in the central and northern area of the SAC occur during the summer period with modelled harbour porpoise densities greater than 3.0 per km² occurring widely. During the winter period the distribution of harbour porpoise in the southern North Sea changes, with reduced densities over the central and northern area but an increase in densities in nearshore waters and the southern part of the SAC (Heinänen and Skov 2015).

3.14 Surveys undertaken across the southern North Sea, including areas within and encompassing the SAC, have reported lower densities of harbour porpoise than that estimated from JCP data. Densities reported from SCANS III surveys are from between 0.888 ind./km² in SCANS block O and 0.607 ind./km² in SCANS block L (Hammond et al. 2017). Similarly, data obtained across the Dogger Bank area including the Southern North Sea SAC in 2011 recorded a density of 1.88 ind./km² (Gilles et al. 2012). Data obtained from surveys undertaken at proposed offshore wind farms located within or adjacent to the SAC indicate densities vary across the site and across seasons. Mean densities reported from surveys undertaken by offshore wind farm developers range from 0.11 ind./km² at Triton Knoll offshore wind farm including a 1 km buffer to 2.87 ind./km² within the Hornsea subzone 3 wind farm area plus a 4 km buffer (TKOWFL 2011, SMart Wind 2017).

3.15 Tagging studies undertaken in Denmark indicate that harbour porpoises are highly mobile and range widely in the North Sea, with individuals tagged in the Skagerrak travelling up to 100 km per day, with a mean distance of 24.5 km per day (Sveegaard 2011). Individuals tagged in Danish waters were recorded off the east coasts of England and Scotland (Sveegaard 2011).

3.16 Harbour porpoise swimming speeds vary with the highest recorded swimming speeds being 4.3 m/s (Otani et al. 2000). Mean recorded speeds are typically around 1 m/s (Otani et al. 2000, Kastelein et al. 2018). When disturbed by noise harbour porpoise can increase swimming speeds with increasing sound levels. Studies using playback experiments of pile-driving sounds have reported increases in swimming speed from an average of 1.2 m/s to 2.0 m/s at sound levels of 154 dB re 1 µPa that were sustained for at least 30 minutes (Kastelein et al. 2018).

3.17 Although harbour porpoises may dive to depths of up to 226 m and remain submerged for up to five minutes, they more frequently undertake relatively shallow dives of a short duration, with a mean depth of 14 m and duration of 44 seconds (Santos and Pierce 2003, Otani et al. 1998, 2000). Studies undertaken on 14 tagged harbour porpoise in Danish and adjacent waters reported that on average harbour porpoise spend 55% of the time in the upper 2 m of the surface waters. The most frequent dive depths were between 14 m and 32 m, with the maximum depth dived of 132 m. The number of dives per hour increased from an average of 29 dives hr⁻¹ between April and August to 43 dives hr⁻¹ in October and November when it was presumed that
higher levels of foraging activity occurred to compensate for the higher energy requirements required during the cooler winter period (Teilmann et al. 2007).

3.18 Harbour porpoise use echolocation to detect and track individual prey and are opportunistic feeders, foraging close to the seabed or near the sea surface, preying on a wide range of fish species including, herring (*Clupea harengus*), whiting (*Merlangius merlangus*), Gadoids spp. sprats (*Sprattus sprattus*), gobi (*Pomatoschistus minutus*) and sandeels (*Ammodytes* spp.), and their prey will vary during and between seasons (DeRuiter 2008, Santos and Pierce 2003, IAMMWG et al. 2015). The prey of harbour porpoise may change over time with a reported long-term shift in prey from clupeid species to sandeels and gadoid species (IAMMWG et al. 2015), indicating that harbour porpoise may be opportunistic feeders capable of feeding on a variety of species.

3.19 Studies undertaken in Denmark indicate that their local distribution may be correlated with prey availability (Sveegaard 2011). Due to the relatively high metabolic rate of harbour porpoise and the relatively small size of their predominant prey it has been suggested that harbour porpoise require a reliable source of food and frequent food consumption in order to maintain their body weight, with increased consumption in cooler environments (Kastelein et al. 1997, Wisniewska et al. 2016, 2018).

3.20 Harbour porpoise have a maximum life expectancy of 24 years, with an average life expectancy of around 12 years in UK waters (Lockyer 2003, Learmouth et al. 2014). Females become sexually mature at between three and five years old (Lockyer 2003, Learmouth et al. 2014). Breeding is thought to occur primarily during the summer months between May and September, particularly in August, with calving 10 months later. Calves are nursed for eight to ten months but may remain with the mother until a new calf is born (Defra 2015, Lockyer 2003, Weir et al. 2007).

3.21 The range at which marine mammals, including harbour porpoise, may be able to detect sound arising from offshore activities depends on the hearing ability of the species and the frequency of the sound. Other factors that can affect the potential impact include ambient background noise, which can vary depending on water depth, seabed topography and sediment type. Natural conditions such as weather and sea state and existing sources of human produced sound can also reduce the auditory range.

3.22 Porpoises are generally considered to be ‘high frequency’ or ‘very high frequency’ specialists with a relatively poor ability to detect lower frequency sounds (Southall et al. 2007, 2019). Studies undertaken on captive harbour porpoises indicate that porpoises have a functional hearing range of between 250 Hz and 180 kHz with their best hearing between 16 to 140 kHz and their maximum sensitivity between 100 and 140 kHz. It is within the frequency range of 130 to 140 kHz that harbour porpoise echolocate (Miller and Wahlberg 2013).
3.23 Their ability to detect sound below 16 kHz or above 140 kHz falls sharply (Kastelein et al. 2012, Southall et al. 2007). Harbour porpoise are therefore most sensitive to sound sources between 16 to 140 kHz and, although potentially audible, they are unlikely to be sensitive to sound either above or below those frequencies.

3.24 Harbour porpoise use echolocation to communicate and detect prey. Reported sound levels produced range from between 166 to 194 re: 1 μPa (rms SPL) and 178 and 205 dB re. 1 μPa (peak – peak SPL), with a mean level of 191 dB re. 1 μPa (peak – peak SPL) and within the peak frequency range of 110 to 150 kHz (Villadsgaard, et al. 2007, Miller and Wahlberg 2013, MMO 2015).

**Prey species**

3.25 Fish are not qualifying species for the Southern North Sea SAC. However, potential impacts on fish that are prey for harbour porpoise could affect the integrity of the sites by reducing their prey base. Harbour porpoise prey on a variety of fish species that could be impacted by the proposed activities including gobies, Sandeel Spp., whiting, herring and sprat (JNCC and NE 2019).

3.26 Sandeels are one of the main prey items for harbour porpoise and are also an important prey species for predatory fish such as whiting, cod and haddock, some of which may also be prey for harbour porpoise (Greenstreet et al. 2006).

3.27 Sandeels are one of the most abundant fish in the North Sea occurring widely over suitable sandy substrates where, once the larvae have settled, they remain in the area (Heath et al. 2011). Although widespread, sandeel distribution is highly substrate specific as they depend on seabed habitat comprising a high proportion of medium and coarse sands (particle size 0.25 - <2 mm) with low silt content (Holland et al. 2005).

3.28 Between September and April sandeels remain largely buried in the seabed except when spawning during December and January and when feeding during the late spring and summer (Greenstreet et al. 2006, Van der Kooij et al. 2008).

3.29 Within the Southern North Sea SAC sandeels occur across the site with their main spawning area over the Dogger Bank and a wider nursery area across most of the SAC (Judd et al. 2011).

3.30 Fish hearing is based on detecting particle motion directly stimulating the inner ear. However, those with swim bladders are also able to detect pressure waves and can detect a wider range of frequencies and sounds of lower intensity than fishes without swim bladders (Popper 2003). Fish with swim bladders that possess a coupling mechanism between the swim bladder and the auditory system, e.g. herring and sprats, are recognised to be hearing specialists. Fish that have swim bladders but lack a mechanised coupling mechanism or do not have swim bladders, e.g. sandeel spp. are considered hearing generalists and have a relatively lower sensitivity to sound than fish that have swim bladders and a coupling mechanism.
3.31 Studies on the behaviour of fish from noise, largely using play-back experiments, have reported a range of behavioural responses including avoidance behaviour, changes in swimming speed and direction (e.g. Hawkins 2014, Mueller-Blenkle et al. 2010) and reduced antipredator responses (Everley et al. 2016).

**Dogger Bank SAC**

3.32 The Dogger Bank SAC covers an area of 12,331 km² and lies entirely within UK territorial waters. The Dogger Bank is an extensive sandbank which was formed by glacial processes before being submerged through sea level rise and the site was formally classified as a SAC in September 2017 on account of its Sandbanks which are slightly covered by sea water all the time [Habitat code 1110]. The basis for the classification is set out in a Natura 2000 Standard Data Form (JNCC 2017c).

**Sandbanks**

3.33 Sandbanks which are slightly covered by seawater all the time are an Annex I habitat under the Habitats Directive and are described as *Sublittoral sandbanks, permanently submerged*. Water depth is seldom more than 20 m below Chart Datum (European Commission 2013). They are not Annex I priority habitats and occur widely in UK coastal and offshore waters. There are twenty designated sites in UK waters for which this habitat is a primary feature and a further 16 sites in which the habitat occurs but not identified as a primary reason for site selection (JNCC 2020d). There are five SACs in UK offshore waters for which this habitat is a primary feature, of which the Dogger Bank SAC is the largest.

3.34 Annex I Sandbanks are defined by their topography and substrate type rather than by a specific biological community, its range is determined by geological and/or hydrodynamic processes depending on the type of sandbank (JNCC 2019b). There has been no significant changes in the geographic extent and although there may have been localised declines the overall geographic spread and distribution of offshore sand banks have not been reduced (JNCC 2013).

3.35 The Dogger Bank is the largest sand bank feature in UK waters and comprises more than 70% of the UKs Annex I sandbank resource. Water depths across the site range from between 13 m and 58 m and the site is exposed to substantial wave energy that prevents the colonisation of the sand by vegetation on the shallower parts of the bank (JNCC 2019c).

3.36 The majority of sediments across the Dogger Bank are classified as sand to muddy sand, with patches of courser sediments. Patches of courser sediments occur across the site, with notable larger areas towards the western and southern edges. The underlying substrate comprise predominantly of clay material. Sand waves and mega ripples occur across the south-west and east central areas of the site (JNCC 2018b). The presence of mega ripples and sand waves indicates that some sediment transport arises from tidal currents. However, this maybe limited with the majority of sediment transport driven by storm waves (Van der Molen 2002).
3.37 Biological communities across the SAC vary depending on the substrate. The dominant biotope associated with the Dogger Bank is Ss.SSa.IFiSa.NcirBat (*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand). This biotope occurs in sediments subject to physical disturbance, as a result of wave action and occasionally strong tidal currents (EMU 2010, JNCC 2015). The species diversity and numbers of individuals are relatively low compared to less disturbed habitats. However, as a consequence to the dynamic nature of the environment disturbed communities recover relatively quickly and may be considered ‘mature’, often within a few days or weeks since the disturbance (MarLIN 2018).
Information Sources

3.38 This HRA draws on a number of information sources relating to the proposed project and the site designation which should be read in conjunction with this report including:

- Dogger Bank Advice on Operations Workbook v1.0. JNCC (2018c).

3.39 References to technical papers and other documents are given in the text as necessary.
4 POTENTIAL IMPACTS

4.1 The potential impacts arising from the proposed activities are sound from the detonation of explosives and physical impacts on the seabed. No other sources of potential impact that could affect qualifying habitats or species have been identified.

Noise impacts

4.2 There is a substantial volume of literature describing the potential effects of sound on marine mammals, and summarised in e.g. Thomsen et al. (2006), Southall et al. (2007) and OSPAR (2009).

4.3 There are four main types of potential effect from noise that are recognised within the marine environment:

- **Fatal effects** caused by significant levels of noise in close proximity to the receptor.
- **Physical injury**, specifically hearing impairment, which can be permanent or temporary. These effects can impact on the ability of marine mammals to communicate, forage or avoid predators.
- **Behavioural effects** such as avoidance, resulting in displacement from suitable feeding or breeding areas, and changes in travelling routes.
- **Secondary impacts** caused by the direct effects of noise on potential prey causing a reduction in prey availability.

4.4 The range at which marine mammals may be able to detect sound arising from offshore activities depends on the hearing ability of the species and the frequency of the sound. Harbour porpoise are potentially more sensitive to high frequency sounds than other cetaceans or pinnipeds. Other factors which may affect the potential impact of sound on marine mammals includes ambient background noise, which can vary depending on water depth, seabed topography and sediment type. Natural conditions such as weather and sea state and other existing sources of human produced sound, e.g. shipping, can also reduce the auditory range.

Fatal effects

4.5 If source peak pressure levels from the proposed operations are high enough there is the potential for a lethal effect on marine mammals. Studies suggest that potentially lethal effects can occur to marine mammals when the peak pressure level is greater than 246 or 252 dB re. 1 μPa (Parvin et al. 2007). Damage to soft organs and tissues can occur when the peak pressure level is greater than 220 dB re. 1 μPa.

Physical injury

4.6 Underwater sound has the potential to cause hearing damage in marine mammals, either permanently or temporarily. The potential for either of these conditions to occur is dependent on
the hearing bandwidth of the animal, the duty cycle of the sound source and duration of the exposure (Southall et al. 2019, OSPAR 2009).

**Behavioural Change**

4.7 Potential changes in behaviour may occur depending on the sound source levels and the species’ and individuals’ sensitivities. Behavioural changes can include changes in swimming direction, diving duration, avoidance of an area and reduced communication.

4.8 Masking effects may also cause changes in the behaviour as the level of sound may impair the detection of echolocation clicks and other sounds that species use to communicate or detect prey, thus causing them to alter their behaviour.

**Secondary Effects**

4.9 There is potential for impacts on prey species to affect marine mammals, in particular possible impacts of noise on fish species.

**Physical impacts on the seabed**

4.10 The use of explosives below or on the seabed could cause the formation of craters at the site of detonation and localised sediment plumes. Studies undertaken during Unexploded Ordnance Clearance (UXO) on the formation of craters in sandy / gravelly sand sediments indicates that, on average bombs ranging in size from between 500 lbs and 1,000 lbs (226 kg – 453 kg) can form craters of approximately 1 m deep and up to 11 m in diameter (Ordtek 2018). Smaller charges may be predicted to have smaller impacts on the seabed.
5 NOISE MODELLING

5.1 To assess the potential environmental impacts from the proposed activities the applicant has undertaken noise modelling to assess the potential impacts from pile-driving (TOSK 2020a,b,c).

5.2 The noise modelling has been undertaken using the ‘Faux Equation’ and based on the detonation of 70 kg of explosive 3 m below the seabed. Results from the noise modelling undertaken to support the application indicate that the onset of PTS in harbour porpoise could occur within 2,200 m of the explosion.

5.3 Noise modelling undertaken in order to assess the potential impacts on prey species indicates that fish mortality could occur within 152 m of the detonation.
6 EFFECTIVE DETERRENT RADIUS / RANGE

6.1 The Effective Deterrent Radius / Range (EDR) has been proposed by the Statutory Nature Conservation Bodies (SNCBs) as a means to measure potential impacts on harbour porpoise within the SAC (JNCC 2017e,f; JNCC 2020e). The EDR is an empirically derived generic distance within which deterrence, i.e. displacement, of harbour porpoise is predicted to occur. The EDR are based on published studies that have monitored the effects on harbour porpoise from various activities and reflects the overall loss of habitat if all animals vacate the area (e.g. Defra 2015). It is an area of displacement as opposed to disturbance, which may be greater.

6.2 The published precautionary EDR are presented in Table 1 (JNCC 2020e). Relevant to this assessment is the EDR for unexploded ordnance which is published as being 26 km.

Table 1: Precautionary Effective Deterrent Ranges (EDR) (Source: JNCC 2020e).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Effective Deterrent Range (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monopile</td>
<td>26</td>
</tr>
<tr>
<td>Unexploded Ordnance</td>
<td>26</td>
</tr>
<tr>
<td>Pin-pile</td>
<td>15</td>
</tr>
<tr>
<td>Monopile with noise abatement</td>
<td>15</td>
</tr>
<tr>
<td>Conductor piling</td>
<td>15</td>
</tr>
<tr>
<td>Seismic survey</td>
<td>12</td>
</tr>
<tr>
<td>High Resolution Geophysical Surveys</td>
<td>5</td>
</tr>
</tbody>
</table>

6.1 The SNCBs recognise that future data may require the suitability of the EDR to be reconsidered if it is found to be inappropriate (JNCC 2020e).
7 CONSERVATION OBJECTIVES

7.1 Conservation Objectives constitute a necessary reference for identifying site-based conservation measures and for carrying out HRAs of the implications of plans or projects (JNCC and NE 2019). They outline the desired state for any European site, in terms of the features for which it has been designated. If these features are being managed in a way which maintains their nature conservation value, they are assessed as being in a ‘favourable condition’. An adverse effect on the integrity of a site is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation (English Nature 1997).

7.2 The purpose of an Appropriate Assessment is to determine whether a plan or project adversely affects a site’s integrity. The critical consideration in relation to site integrity is whether the plan or project affecting a site, either individually or in-combination, affects the site’s ability to achieve its conservation objectives and favourable conservation status.

Southern North Sea SAC Conservation Objectives

7.3 The Southern North Sea SAC was designated as a SAC in 2019. The site covers an area of 36,951 km² and is designated for harbour porpoise.

7.4 Harbour porpoise are also protected throughout European waters under the provisions of Annex IV and Article 12 of the Habitats Directive, which are outwith the scope of this assessment. Harbour porpoise in UK waters are considered part of a wider European population and the mobile nature of this species means that the concept of a ‘site population’ is not thought to be appropriate for this species. Site based conservation measures therefore aim to complement wider ranging measures that are in place for the harbour porpoise (JNCC and NE 2019).

7.5 The Conservation Objectives for harbour porpoise are designed to ensure that human activities do not, in the context of maintaining site integrity:

- kill, or injure harbour porpoise (directly or indirectly),
- prevent their use of significant parts of the site (disturbance / displacement),
- significantly damage relevant habitats, or
- significantly reduce the availability of prey.
7.6 Harbour porpoises are considered to be a ‘viable component’ of the site if they are able to survive and live successfully within it. The first Conservation Objective aims to minimise the risk from activities that cause unacceptable levels of impact on harbour porpoise using the site, specifically those that could impact on the Favourable Conservation Status of harbour porpoise (JNCC and NE 2016, 2019).

7.7 The ‘integrity of the site’ is not defined in the Conservation Objectives. However, EU and UK Government guidance defines the integrity of a site as ‘the coherence of the site’s ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified’ (EC 2000, Defra 2012). Therefore, the integrity of the site applies to the whole of the site and it is the potential impacts across the whole of the site that are required to be appropriately assessed. Pressures that would affect site integrity include:

- killing or injuring harbour porpoise (directly or indirectly),
- preventing their use of significant parts of the site (disturbance / displacement),
- significantly damaging relevant habitats,
- significantly reducing the availability of prey. (JNCC and NE 2019).

7.8 The second Conservation Objective states that there should be ‘…no significant disturbance of the species’ and that ‘Disturbance is considered significant if it leads to the exclusion of harbour porpoise from a significant portion of the site’ (JNCC and NE 2019).

7.9 ‘Supporting habitats and processes’ relate to the seabed and water column along with the harbour porpoise prey.

7.10 JNCC advise that it is not appropriate to use the site population estimates in any assessments of effects of plans or projects (i.e. Habitats Regulation Assessments), as it is necessary to take into
consideration population estimates at the Management Unit level to account for daily and seasonal movements of the animals (JNCC and NE 2019).

7.11 There are no formal thresholds at which impacts on site integrity are considered to be adverse. However, a threshold of 1.7% of the relevant harbour porpoise population above which a population decline is inevitable has been agreed with Parties to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), with an intermediate precautionary objective of reducing the impact to less than 1% of the population (Defra 2003, ASCOBANS 2015). This threshold relates to impacts from fisheries by-catch on harbour porpoise where the impact on the harbour porpoise is permanent, i.e. up to 1.7% of the population may be caught as by-catch before a population decline is inevitable. An equivalent level of impact from disturbance, which is temporary and non-lethal, on a population will have a lower level of impact on the population compared to that from a fisheries by-catch.

7.12 The lack of agreed population thresholds either at the Management Unit level or site level, below which evidence demonstrates there would not be an adverse effect, does not prevent objective judgements to be made on site integrity.

7.13 Thresholds to assess and manage the effects of noise on site integrity have been proposed by the JNCC and NE (JNCC 2017e,f; JNCC and NE 2019, JNCC 2020e). The proposed approach is not based on a population level impact but is instead based on a temporal and spatial level where a proportion of the area (habitat) within the SAC may be affected over a period of time.

7.14 The JNCC and NE advice is that ‘noise disturbance within the site should not exclude harbour porpoise from more than 20% of the site on any given day. Over a season, the advice is that an average loss of access to more than 10% of the SAC should be considered significant, recognising that within the SAC the abundance of harbour porpoise per unit habitat is generally higher than the equivalent sized habitat in the rest of the relevant Management Unit. Management of temporary habitat ‘loss’ to below defined area/time thresholds is therefore designed to ensure that it continues to contribute in the best possible way to the maintenance of the species at FCS.’ (JNCC 2020e).

7.15 The potential extent of noise causing disturbance that would meet these proposed thresholds and therefore impact on the integrity of the site are presented in Table 2. The results indicate that should the impact occur wholly inside the SAC that, within the ‘summer’ area a sound source alone or in-combination causing disturbance for one day over an area of 7,390 km² would risk impacting site integrity. This is equivalent to a circular radius of noise out to 41.5 km. To exceed the threshold for the ‘winter’ area, noise in any one day should not extend over an area of more than 2,537 km²; equivalent to a circular radius of 28.4 km.

7.16 Over the course of a season the total extent of potential disturbance on average per day should, in the ‘summer’ area, not extend over an area of more than 3,695 km²; equivalent to a radius of
noise of 29.3 km and in the ‘winter’ area should not extend over an area of more than 1,269 km², equivalent to a radius of 20.1 km.

**Table 2: Estimated extent sound levels capable of causing displacement disturbance occur in order to impact on site integrity.**

<table>
<thead>
<tr>
<th>Site</th>
<th>Area (km²)</th>
<th>1 day threshold</th>
<th>Seasonal threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20% of area (km²)</td>
<td>Distance to threshold (km)</td>
</tr>
<tr>
<td>Southern North Sea SAC</td>
<td>36,951</td>
<td>7,390</td>
<td>48.5</td>
</tr>
<tr>
<td>‘summer’ area April - September</td>
<td>27,028</td>
<td>5,406</td>
<td>41.5</td>
</tr>
<tr>
<td>‘winter’ area October - March</td>
<td>12,696</td>
<td>2,539</td>
<td>28.4</td>
</tr>
</tbody>
</table>

The ‘Distance to threshold’ presumes sound propagation is circular in shape, i.e. the distance is the equivalent to a radius of circular noise.

7.17 Unlike the daily threshold, the area of the SAC that can be affected over the course of a season is an average over the season. The seasonal average is calculated by summing the proportion of the site impacted (for the relevant season) over the number of days the impact will occur and then averaging across the total number of days within that season, i.e. 183 days in the summer period and 182 days in the winter period. This provides a seasonal average spatial effect.

7.18 This assessment is based on both the potential impact on the North Sea Management Unit population using both the ASCOBANS thresholds and the proposed SNCB threshold approach.

7.19 In order to undertake any meaningful assessment using the threshold approach accurate information on the timing, duration and extent of activities being undertaken is required. Where this information is lacking or where speculative ‘worst-case’ scenarios are used there is little or no confidence that the results will bear any resemblance to the true extent of impact within the SAC on any single day or across the course of a season. The threshold approach proposed by the SNCBs has not been agreed with the competent authorities. However, the thresholds have been noted within the assessment as a high-level management tool to limit the spatial distribution of noise from offshore activities within a large offshore SAC, such as the Southern North Sea SAC.

**The Dogger Bank SAC Conservation Objectives**

7.20 The following Conservation Objectives have been produced by the JNCC for the Dogger Bank SAC (JNCC 2018a).
The ‘extent’ refers to the whole distribution of the qualifying feature within the site, which in the case of the Dogger Bank SAC is 12,331 km$^2$. A reduction in the extent of the sand bank feature has potential to impact on the physical and biological functioning of sedimentary habitat types. The distribution of a habitat influences the component communities present and can contribute to the health and resilience of the feature (JNCC 2018b).

The JNCC advise a ‘restore’ objective which is based on ‘expert judgment’; specifically, their understanding of the feature’s sensitivity to pressures which can be exerted by ongoing activities i.e. cabling and oil and gas industry activities on the extent and distribution of sandbank feature’s sediment composition and consequently that of associated biological communities (JNCC 2018b).

The JNCC advise that ‘Activities must look to minimise, as far as is practicable, changes in substratum within the site to minimise further impact on feature extent and distribution’ (JNCC 2018b).

The ‘structure’ refers to the physical structure of a habitat type together with the biological structure. The physical structure refers to the finer scale topography and sediment composition and distribution. The biological structure refers to the ‘key and influential species’ and ‘characteristic communities’ (JNCC 2018b). Based on ‘expert judgement’ the objective is to restore the structure of the site on the basis of there being impacts from oil and gas related activities as well as aggregates, dredging and cable laying within the site. However, it is not clear what the impacts from deposits on the seabed have on structure and function of the site (JNCC 2018b).

The ‘function’ of the site refers to the ecological processes within the site. ‘The natural range of sandbank communities within the site should be conserved to ensure the functions they provide support the health of the feature and the provision of ecosystem services to the wider marine environment’ (JNCC 2018b). The functions identified within the site include:

- The extent and distribution of the qualifying habitat in the site;
- The structure and function of the qualifying habitat in the site; and
- The supporting processes on which the qualifying habitat relies.
• Nutrition – The site provides feeding grounds where prey is made available for a variety of species of commercial importance.

• Bird and whale watching - the site provides some supporting function for wider marine bird and mammal populations.

• Climate Regulation - the range of sedimentary habitats and associated communities in the site perform known ecological processes common to sandbanks such as deposition and burial of carbon in seabed sediments through bioturbation, living biomass and calcification of benthic organisms.

7.26 The JNCC advise that the objective for the, function, of the site should be to restore it.

7.27 The ‘supporting processes’ have been identified as being the hydrodynamic regime, water and sediment quality. It is unclear whether the physical presence of subsea infrastructure impacts on the movement of sediment across the sandbank. Based on the Environmental Quality Standards (EQS) there is no evidence to suggest that water or sediment quality across the Dogger Bank is below the standards. However, there is potential for contamination from produced water and drill cuttings. Based on ‘expert judgement’ a maintain objective has been advised by the JNCC (JNCC 2018b).

7.28 The HRA has been carried out in light of best scientific knowledge with reference to the Conservation Objectives of the SAC and the potential impacts on the integrity of the site.
8 IN-COMBINATION IMPACTS SOUTHERN NORTH SEA SAC

8.1 Under the Habitats Regulations, it is necessary to consider the in-combination effects of plans or projects on European Sites. These refer to effects, which may or may not interact with each other, but which could affect the same receptor or interest feature (i.e. a habitat or species for which a European site is designated).

8.2 The in-combination assessment includes plans or projects that are:

- Under construction,
- Permitted application(s), but not yet implemented,
- Submitted application(s), not yet determined,
- Projects identified in the relevant Development Plan (and emerging Development Plans),
- Sites identified in other policy documents, as development reasonably likely to come forward.

Renewable energy activity

8.3 A source of potentially significant in-combination underwater noise impact is from pile driving activity occurring during the construction of offshore renewable developments, particularly offshore wind farms.

8.4 There are 21 UK offshore wind farms that lie wholly within the Southern North Sea SAC or are within 26 km of the boundary which is identified by the JNCC as an area that harbour porpoises may be displaced from by noise arising from pile-driving activities (JNCC 2017d, JNCC 2020e). (Table 3 and Figure 4). One wind farm (Triton Knoll) is currently undertaking offshore construction and Hornsea Two has started pre-construction activities offshore, including the clearance of UXO. All other wind farms are either operating, consented but not started offshore construction or have submitted applications and are awaiting determination.

8.5 There are further additional wind farms located in Dutch and Belgium waters that could impact on the Southern North Sea SAC when under construction. In the Dutch sector, offshore construction at the Borssele I and II wind farms has largely been completed and no piling is being undertaken. Offshore construction at the Borssele III and IV wind farms started in October 2019 and is on-going. Noise mitigation technology is being used at these wind farms during pile-driving activities.

8.6 In Belgium the SeaMade wind farms: Mermaid and Seastar are under construction and all the monopile foundations have been installed.
Table 3: Offshore wind farms located within 26 km of the Southern North Sea SAC.

<table>
<thead>
<tr>
<th>Wind farm</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Round 1</strong></td>
<td></td>
</tr>
<tr>
<td>Scroby Sands</td>
<td>Operating</td>
</tr>
<tr>
<td><strong>Round 2/2.5</strong></td>
<td></td>
</tr>
<tr>
<td>Dudgeon</td>
<td>Operating</td>
</tr>
<tr>
<td>Galloper</td>
<td>Operating</td>
</tr>
<tr>
<td>Greater Gabbard</td>
<td>Operating</td>
</tr>
<tr>
<td>Gunfleet Sands II</td>
<td>Operating</td>
</tr>
<tr>
<td>Humber Gateway</td>
<td>Operating</td>
</tr>
<tr>
<td>Thanet</td>
<td>Operating</td>
</tr>
<tr>
<td>Triton Knoll</td>
<td>Offshore construction started</td>
</tr>
<tr>
<td>Westermost Rough</td>
<td>Operating</td>
</tr>
<tr>
<td><strong>Round 3</strong></td>
<td></td>
</tr>
<tr>
<td>Creyke Beck A</td>
<td>Onshore construction started</td>
</tr>
<tr>
<td>Creyke Beck B</td>
<td>Onshore construction started</td>
</tr>
<tr>
<td>East Anglia One</td>
<td>Operating</td>
</tr>
<tr>
<td>East Anglia Two</td>
<td>Application submitted</td>
</tr>
<tr>
<td>East Anglia Three</td>
<td>Consented</td>
</tr>
<tr>
<td>Hornsea Project One</td>
<td>Operating</td>
</tr>
<tr>
<td>Hornsea Project Two</td>
<td>Onshore construction started</td>
</tr>
<tr>
<td>Hornsea Project Three</td>
<td>Application submitted</td>
</tr>
<tr>
<td>Norfolk Vanguard</td>
<td>Application submitted</td>
</tr>
<tr>
<td>Teesside A (Sofia)</td>
<td>Consented</td>
</tr>
<tr>
<td>Teesside B</td>
<td>Onshore construction started</td>
</tr>
<tr>
<td><strong>Belgium</strong></td>
<td></td>
</tr>
<tr>
<td>SeaMade (Mermaind and Seastar)</td>
<td>Offshore construction started</td>
</tr>
<tr>
<td><strong>Netherlands</strong></td>
<td></td>
</tr>
<tr>
<td>Borssele I and II</td>
<td>Offshore construction nearly complete</td>
</tr>
<tr>
<td>Borssele III and IV</td>
<td>Offshore construction started</td>
</tr>
</tbody>
</table>
Of the offshore wind farms that are relevant to the in-combination assessment, the Hornsea Two development could be undertaking pile-driving in September. The Hornsea two offshore wind farm plans undertake pile-driving between July and October 2020 (Ørsted 2020). However, BEIS have been informed the pile-driving will not commence before September 2020.

The Triton Knoll offshore wind farm has a licence to undertake pile-driving over a period of 23 days with completion by 13 June 2020 and is therefore completed. However, the construction activities undertaken at Triton Knoll will have contributed to the in-combination seasonal threshold.
8.9 An application to undertake UXO clearance from between 1 April 2019 to 31 December 2020 has been submitted to the MMO for Hornsea Two offshore wind farm (Ørsted 2018a). The application is for the clearance of up to 100 items of UXO which must be cleared from between July 2019 to 31 December 2019 and between 1 April 2020 and 31 December 2020 (Ørsted 2018b, MMO 2019a). UXO clearance during 2019 removed 26 items of UXO.

8.10 For items of UXO greater than 50 kg, bubble curtains must be used to mitigate against noise when undertaken in water depths of between 5 m and 40 m and when currents are less than 1.5 m/s (MMO 2019a). Bubble curtains were used for 23 of the 26 UXO clearances undertaken at Hornsea Two in 2019.

8.11 Ørsted have confirmed that the UXO clearance campaign has been completed, although there is potential for further items of UXO to be found during the current on-going seabed preparation activities. Consequently, there is potential for further items of UXO to be cleared during September 2020. Ørsted have also confirmed that they believe bubble curtains were used during all UXO clearance activities undertaken during 2020 (Ørsted pers. comm. 2020).

### Cable laying activity

8.12 The Viking Link project is a high voltage direct current (HVDC) electrical interconnector between Denmark and the UK. The 762 km long cable will be laid between Jutland in Denmark and Bicker Fen in Lincolnshire and crosses the Southern North Sea SAC (Figure 5) (NGVL 2018a).

8.13 An application was made for the clearance of up to 25 items of UXO between 1 April and 30 September 2019 some, or all, of which may occur within or adjacent to the SAC (NGVL 2018b). Following an HRA, consent was given by the MMO on 5 October 2018 (MMO 2018). Subsequent to consent, a variation to the application has been made for the clearance of 25 items of UXO to be detonated between 1 April 2020 and 1 September 2020 (NGVL 2019a, MMO 2020). BEIS have been informed that four items of UXO will be cleared in 2020, with one item within the Southern North Sea SAC and a further three within 26 km of the SAC boundary.

### Aggregate extraction and dredging activity

8.14 Existing localised aggregate dredging occurs primarily in the southern half of the SAC, along the east coast (Figure 6). In 2019 there were 29 aggregate production areas and five Exploration and Option areas covering an area of 579.2 km². Five of the aggregate areas occur in the ‘summer’ area of SAC covering 77.7 km² and the rest occur in the ‘winter’ area of the SAC and cover an area 533.8 km², with some sites occurring in both the ‘winter’ and ‘summer’ areas.
Figure 5: Viking Link Interconnector cable within UK waters and location of proposed Tullow seabed clearance activities.

Figure 6: Existing marine aggregate activities in the Southern North Sea SAC.
8.15 Studies have indicated that harbour porpoise may be displaced by dredging operations within 600 m of the activities (Diederichs et al. 2010). Noise modelling previously undertaken for aggregate assessments have predicted significant levels of avoidance at ranges of 500 m from suction dredging (Parvin et al 2008 (referenced in Hanson Aggregates Marine Ltd 2013)).

8.16 On a precautionary assumption that there is a level of behavioural displacement out to 600 m, there is potential for an area of 1.13 km² to be affected at each active dredging location. There are currently three aggregate production areas in the ‘summer’ area and 26 in the ‘winter’ area. Although the level of dredging activity within each of the active licence areas is unknown, as a worst-case scenario, with dredging occurring within each dredging area, porpoise may be displaced from an area of 3.39 km² in the ‘summer’ area and 29.38 km² in the ‘winter’ area. Therefore, a very small proportion (0.01% of the summer area and 0.2% of the summer area) of the SAC may be impacted by noise arising from dredging activities.

Oil and gas activity

8.17 There is a long history of oil and gas activities within the boundaries of the Southern North Sea SAC. Since 1965, when the first well was spudded (first drilled), there has been extensive oil and gas development with a total of 117 installations installed within the SAC. The vast majority (94%) of all the installations within the boundary of SAC are located in the ‘summer’ area of the site (Figure 7) (OGA NDR 2020).

8.18 Seismic surveys have regularly been undertaken within the SAC over the last 50 years, with a total of 23 2D or 3D seismic surveys carried out within the SAC between 2008 and 2017. The majority of surveys during this period took place in the northern half of the SAC, where the most recent oil and gas activity has occurred (Figure 8).

8.19 BEIS are aware of a number of planned oil and gas related activities within the area during the period the proposed pile-driving will be undertaken that could cause an in-combination effect including a seismic survey to be undertaken by ION in licence Blocks UKCS Blocks 35/23, 35/24, 35/25, 35/28, 35/29, 35/30, 36/21 – 36/30, 37/16 – 37/30, 38/16, 38/17, 38/18, 38/21, 38/22, 38/23, 38/26, 38/27, 38/28, 41/3 – 41/5, 42/1 - 42/5, 43/1 – 43/5, 44/1 – 44/3 (Table 4).
Figure 7: Existing oil and gas infrastructure within the Southern North Sea SAC.

Figure 8: Oil and gas industry related seismic surveys undertaken within the Southern North Sea SAC between 2008 and 2017.
### Table 4: Planned oil and gas activities within or adjacent to the SAC that could cause an in-combination impact.

<table>
<thead>
<tr>
<th>Applicant</th>
<th>Licence Reference No.</th>
<th>Licence Block(s)</th>
<th>Start and End Dates</th>
<th>Planned Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spirit Energy</td>
<td>ML/411/2</td>
<td>49/11a</td>
<td>23 November 2018 and 31 October 2020</td>
<td>Removal and temporary deposit of risers at Audrey B installation.</td>
</tr>
<tr>
<td>Spirit Energy</td>
<td>ML/431/1</td>
<td>49/11a</td>
<td>10 July 2019 – 30 April 2020</td>
<td>Removal and temporary deposit of risers at Audrey B installation.</td>
</tr>
<tr>
<td>Tampnet AS</td>
<td>ML/495/0</td>
<td>44/22</td>
<td>26 July 2019 – 30 June 2020</td>
<td>Deposit of two mattresses and telecommunications branching unit.</td>
</tr>
<tr>
<td>Chrysaor</td>
<td>ML/546/0</td>
<td>49/21</td>
<td>19 May 2020 – 31 December 2020</td>
<td>WIA using TCP guns and jet cutters</td>
</tr>
<tr>
<td>Chrysaor</td>
<td>ML/553/0</td>
<td>49/22</td>
<td>31 March -</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Chrysaor</td>
<td>ML/570/0</td>
<td>49/16</td>
<td>8 April – 31 October</td>
<td>Pipeline disconnect</td>
</tr>
<tr>
<td>Chrysaor</td>
<td>ML/574/0</td>
<td>49/22</td>
<td>10 April – 31 October 2020</td>
<td>Permanent deposits</td>
</tr>
<tr>
<td>Shell</td>
<td>DEP/1709/2</td>
<td>48/8</td>
<td>10 December 2019 – 31 August 2020</td>
<td>Deposits</td>
</tr>
<tr>
<td>Perenco</td>
<td>DR/1818/0</td>
<td>42/30</td>
<td>16 January – 31 August</td>
<td>Drilling.</td>
</tr>
<tr>
<td>Perenco</td>
<td>DR/1819/0</td>
<td>42/30</td>
<td>16 January – 31 August</td>
<td>Drilling.</td>
</tr>
<tr>
<td>ODE Asset management</td>
<td>DEP/1892/0</td>
<td>52/3 – 49/26</td>
<td>19 April -</td>
<td>Deposits</td>
</tr>
<tr>
<td>Spirit Energy</td>
<td>GS/1068/0</td>
<td>43/13b</td>
<td>7 April – 31 May</td>
<td>Shallow drilling.</td>
</tr>
<tr>
<td>Spirit Energy</td>
<td>GS/1071/0</td>
<td>42/3b</td>
<td>12 April – 1 April 2021 (delayed until October 2020)</td>
<td>Geophysical survey.</td>
</tr>
<tr>
<td>Spirit Energy</td>
<td>GS/1070/0</td>
<td>32/38</td>
<td>12 April – 1 April 2021 (delayed until October 2020)</td>
<td>Geophysical survey.</td>
</tr>
<tr>
<td>ION</td>
<td>GS/1074/0</td>
<td>Quadrants 35, 36, 37, 38, 41, 42, 43 and 44</td>
<td>1 April – 22 October 2020</td>
<td>Seismic survey</td>
</tr>
<tr>
<td>Premier Oil</td>
<td>DRA/808</td>
<td>42/28</td>
<td>1 September 2020 – 16 June 2021</td>
<td>Batch drilling.</td>
</tr>
<tr>
<td>Premier Oil</td>
<td>DRA/810</td>
<td>42/28</td>
<td>1 September 2020 – 16 June 2021</td>
<td>Batch drilling.</td>
</tr>
<tr>
<td>Premier Oil</td>
<td>DRA/811</td>
<td>42/28</td>
<td>1 September 2020 – 16 June 2021</td>
<td>Batch drilling.</td>
</tr>
<tr>
<td>Premier Oil</td>
<td>DRA/812</td>
<td>42/28</td>
<td>1 September 2020 – 16 June 2021</td>
<td>Batch drilling.</td>
</tr>
</tbody>
</table>
Shipping

8.20 Impacts from shipping on harbour porpoise within the SAC have been identified as arising from shipping noise and collision impacts. Shipping noise is the predominant anthropogenic source of noise within the marine environment and is reported to have a negative effect on harbour porpoise within the SAC when vessel traffic exceeds 80 vessels per day (JNCC 2017a). Shipping has been on-going in the southern North Sea for many hundreds of years and the area is important for shipping, with relatively high numbers of vessels occurring within it. Based on vessel track lines, in 2015 a total of 269,018 vessels track lines were recorded transiting across the SAC; an average of 737 vessels per day (MMO 2017a).

8.21 The level of vessel activity across the ‘summer’ and ‘winter’ areas of the SAC differs (Figure 9). There is relatively widespread vessel activity in low densities across the ‘summer’ area, with 76% of the quadrants having less than seven vessels per week and 17% having less than one vessel per week. Compared with the ‘winter’ area of the SAC where 14% of the quadrants had, on average, less than seven vessels per week and only 1% had less than one vessel per week. In contrast 11% of the ‘winter’ area had more than 70 vessels per week compared with none in the ‘summer’ area. The areas with relatively higher levels of shipping (>24 vessels per day), occur over 4% of the ‘winter’ area. Therefore, the ‘winter’ area has relatively localised, higher density, areas of vessel traffic compared with the ‘summer’ area that has widespread but low density vessel traffic.

Figure 9: Shipping density within the SAC during 2015.
**Fishing activity**

8.22 Fishing occurs widely across the southern North Sea and has also been on-going in the area for many hundreds of years. The majority of current fish landings are obtained from areas adjacent to the SAC but there is widespread fishing activity in the southern half and north-eastern edge of the SAC and relatively moderate to high levels of fishing activity along the western edge of the central part of the SAC (Figure 10) (MMO 2017b). Note however, this does not include the activities of non-UK registered vessels that will occur within the site or vessels greater than 15 m in length.

![Figure 10: Fishing intensity across the SAC during 2016 by UK registered vessels.](image)

8.23 There is a high risk of an impact from bycatch associated with the fishing industry to harbour porpoise across the North Sea, i.e. there is good evidence of a significant impact. There is a medium risk of an impact from removal of prey (JNCC and NE 2019).

8.24 The bycatch of harbour porpoise in fishing gear is reported to be one of the most significant anthropogenic pressures impacting on the harbour porpoise population (JNCC and NE 2019). It is estimated that between 1,235 and 1,990 harbour porpoise die each year in the North Sea due to bycatch, predominantly in gill nets (ICES 2016, Mitchell et al. 2018, OSPAR 2017). This is approximately 0.6% of the North Sea Management Unit population.
Southern North Sea SAC - In-combination conclusion

8.25 Following consideration of all known developments that may cause a likely significant effect, BEIS considers that there are plans or projects likely to cause an in-combination likely significant effect. The activities likely to cause an in-combination impact considered within this HRA are:

- UXO clearance at Hornsea Two offshore wind farm,
- UXO clearance along Viking Link Interconnector cable,
- Construction pile-driving at Triton Knoll offshore wind farm,
- Construction pile-driving at Hornsea Two offshore wind farm,
- Planned oil and gas activities including seismic and geophysical surveys.
- On-going routine activities such as shipping, that could contribute to impacts on qualifying species, will also be being undertaken for the duration of the proposed seabed clearance.
9 IN-COMBINATION IMPACTS DOGGER BANK SAC

9.1 For the purposes of this assessment, on-going impacts from current activities have been included within the in-combination assessment even though for some on-going activities, e.g. fishing, shipping and dredging disposal, it is technically not possible to determine what the baseline conditions would be without the influence the impacts from these on-going activities have on the qualifying features of the sites. However, it is recognised that they may be having an effect on the qualifying features of the sites.

Fishing in Dogger Bank SAC

9.2 Demersal fishing has the potential to cause physical damage to sandbank features within the SAC and may be having an on-going effect on the characteristic communities of the site and is capable of causing a significant effect on the qualifying features of the site (JNCC 2018b,d).

9.3 Fishing occurs widely across the Dogger Bank and has also been on-going for many hundreds of years. The predominant fishing activity within the SAC is beam and demersal trawling undertaken mainly by UK, Dutch and Danish registered vessels targeting demersal species such as plaice, megrim and sole (Brown & May Marine 2013).

9.4 The level of fishing across the Dogger Bank SAC varies with less than 30 hours per year occurring within each of the oil and gas licence blocks. Based on VMS data for UK registered vessels, in 2016 fishing occurred over 8,701 km² within the SAC. That is fishing occurred over 70.5% of the SAC, the vast majority of which was demersal fishing and therefore would impact on the seabed. This does not take into consideration non-UK vessels which may contribute a significant proportion of fishing within the site.

Renewable energy

9.5 There are four consented offshore wind farms located within the Dogger Bank SAC: Dogger Bank A, B and C and Sofia Wind FarmsC¹.

9.6 The Dogger Bank A offshore wind farm covers an area of 515 km². The consented development comprises up to 200 wind turbines, four offshore HVAC collector platforms, one HVDC offshore converter platform and two accommodation platforms. Up to five meteorological masts may be installed (Infrastructure Planning 2015a, Forewind 2013).

9.7 The Dogger Bank B offshore wind farm covers an area of 599 km². The consented development comprises up to 200 wind turbines, four offshore HVAC collector platforms, one HVDC offshore converter platform and two accommodation platforms. Up to five meteorological masts may also be installed.

¹ Note the wind farms were formally known as Creyke Beck A, Creyke Beck B, Teesside A and Teesside B.
9.8 The offshore construction start dates for any of the developments are not currently known.

9.9 The Dogger Bank C offshore wind farm covers an area of 560 km² and the Sofia offshore wind farm covers an area of 593 km². Both developments comprise up to 200 wind turbines, four offshore HVAC collector platforms, one HVDC offshore converter platform and two accommodation platforms. Up to five meteorological masts may be installed (Infrastructure Planning 2015b, Forewind 2014).

9.10 Should all four consented wind farms be constructed an estimated 2.5 km² of seabed may be physically lost by the presence of turbines and a further 0.5 km² due to associated infrastructure (BEIS 2019). The area of the Dogger Bank SAC is 12,331 km² and the potential loss of 3.0 km² of habitat is 0.02% of the site. The habitats within wind farm areas are predominantly subtidal sands and gravels and are widespread habitats across the SAC (Forewind 2013, 2014).

9.11 There is potential for temporary seabed disturbance caused by trenching and laying of cables within the wind farm area and the along the export cable route. The total area estimated could be impacted within the SAC is 4.48 km² from export cable laying and 50.8 km² from inter array cable laying (BEIS 2019).

9.12 In total an estimated 0.4% of the seabed within the SAC may be physically disturbed and 0.12% may be physically lost by cable protection across the SAC (BEIS 2019).

**Aggregate extraction and dredging activity**

9.13 Aggregate extraction areas 466/1, 485/1 and 485/2 lie within the boundary of the SAC. Applications were made to extract aggregates from these licensed areas in 2013. No further information has been found on these sites and it is thought that no aggregate extraction activities are currently taking place within the SAC.

9.14 It is recognised that dredging within the SAC would cause significant disturbance to the subtidal sandbank communities but as the sediment is left *in situ*, no long-term loss of substrate will occur which would allow re-colonisation once extraction activities have ceased (Forewind 2013).

**Existing oil and gas activity**

9.15 Since the original wells were drilled in 1964 there has been existing oil and gas industry activity within the SAC. This historical activity may have caused permanent loss of habitat within the site and temporary impacts to the seabed.

9.16 Within the SAC there is subsea equipment on the seabed impacting an area estimated to be approximately 0.001 km² (BEIS 2019). The majority of the items may be subject to future decommissioning programmes.

9.17 Since 1964 a total of 171 wells (including 40 side-tracks) have been drilled in the Dogger Bank SAC. A total of 122 wells, including 23 side-tracks, have been plugged and abandoned and
therefore no further activity will occur at these locations. There may be historical impacts on the site if rock was required for rig stabilisation. In the event that rock has been required at all well locations an estimated 0.52 km$^2$ of seabed may have been impacted by rock placement from well abandonment activities (BEIS 2019).

9.18 The total length of existing pipelines and piggy-backed umbilicals within the SAC is approximately 457.7 km, all of which, with the exception of the 34" Shearwater to Bacton export line, are reported to be buried. Therefore, a total of 76.72 km of pipeline is known to be on the seabed within the SAC. Assuming, as a worst-case scenario, that the physical presence of a surface laid pipeline has a physical effect on the seabed within 5 m either side of the line, an estimated 0.77 km$^2$ of the seabed could be impacted by the physical presence of existing pipelines.

9.19 A total 24 km of pipeline out of a total of 371 km of pipeline is known to have rock protection along it. Therefore, on average, 66 m of rock is placed along every 1 km of pipeline to reduce the risk of free spans occurring, i.e. 6.6% of the length of pipelines has required rock to be placed on it. In the absence of any additional data from existing pipelines within the SAC an estimate of the extent of existing rock within the SAC as a whole is based on the average extent of rock placed along known pipelines that are, at least, partially within the SAC. On this basis it is estimated that within the SAC a total length of 30.2 km of rock has been placed along the existing pipelines within the SAC$^1$.

9.20 Assuming that the rock placed along pipelines impacts 5 m either side of the pipeline then an estimated 0.3 km$^2$ of seabed could be impacted by existing rock along pipelines within the SAC; this is equivalent to 0.003% of the SAC.

**Existing subsea cables within the Dogger Bank SAC**

9.21 There are five subsea telecommunication cables passing through the Dogger Bank SAC. The combined total length of telecommunications cable within the SAC is 373.9 km, of which 198.6 km of cable is active and 175.3 km is disused. Assuming a maximum cable diameter of 50 mm the total area permanently impacted by existing cables is 0.018 km$^2$ (BEIS 2019).

**Dogger Bank SAC - In-combination conclusion**

9.22 There is potential for in-combination impacts to occur from proposed activities within the SAC that could cause physical impacts and loss of habitat to the qualifying features of the SAC.

9.23 The total area of physical loss of habitat arising from existing or planned activities within the SAC is estimated to be 19.7 km$^2$, a total of 0.16% of the SAC (Table 4).

9.24 The total area of temporary seabed disturbance within the SAC is largely unknown owing to uncertainties over the extent demersal fishing occurs within the site. However, it is estimated

$^1$ This is based on there being 457.7 km of pipeline and umbilical within the SAC and 6.6% of it is protected by rock deposits.
that between 56.5 km$^2$ and 8,757 km$^2$ of seabed could be impacted each year, which is between 0.46% and 70.0% of the SAC (Table 6).

**Table 5: Estimated area of seabed physically lost from in-combination impacts.**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total area of seabed impacted (km$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewables – Wind turbines and Infrastructure</td>
<td>3.0</td>
</tr>
<tr>
<td>Renewables – Cable protection</td>
<td>15.0</td>
</tr>
<tr>
<td>Existing oil and gas pipelines</td>
<td>0.77</td>
</tr>
<tr>
<td>Existing rock dump for rig stabilisation</td>
<td>0.52</td>
</tr>
<tr>
<td>Existing rock dump along pipelines</td>
<td>0.33</td>
</tr>
<tr>
<td>Existing Mattresses</td>
<td>0.02</td>
</tr>
<tr>
<td>Future Infrastructure (Pegasus)</td>
<td>0.06</td>
</tr>
<tr>
<td>Aggregate Extraction</td>
<td>0$^1$</td>
</tr>
<tr>
<td>Subsea cables</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Total area of physical loss (km$^2$)</strong></td>
<td>19.7</td>
</tr>
<tr>
<td><strong>Proportion of SAC impacted</strong></td>
<td>0.16%</td>
</tr>
</tbody>
</table>

Note that it is recognised that there are existing aggregate extraction sites located within the SAC. However, it is thought that they are currently inactive and therefore not contributing to the in-combination impacts.

**Table 6: Estimated area of seabed within the SAC physically impacted.**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total area of seabed impacted (km$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishing</td>
<td>Unknown but occurred over 8,701 km$^2$ of the SAC in 2016.</td>
</tr>
<tr>
<td>Renewables – Cable laying</td>
<td>55.3</td>
</tr>
<tr>
<td>Future Infrastructure (Pegasus)</td>
<td>1.18</td>
</tr>
<tr>
<td>Aggregate Extraction</td>
<td>unknown</td>
</tr>
<tr>
<td><strong>Total area of physical impact (km$^2$)</strong></td>
<td>56.5 – 8,757</td>
</tr>
<tr>
<td><strong>Proportion of SAC impacted</strong></td>
<td>0.46% – 71.0%</td>
</tr>
</tbody>
</table>
10 LIKELY SIGNIFICANT EFFECTS TEST

10.1 Regulation 5 of the 2001 Regulations requires the Competent Authority to consider whether a development will have a likely significant effect on a European site, either alone or in combination with other plans or projects. A likely significant effect is, in this context, any effect that may be reasonably predicted as a consequence of a plan or project that may affect the Conservation Objectives of the features for which the site was designated but excluding trivial or inconsequential effects. An Appropriate Assessment is required if a plan or project is likely to have a significant effect on a European site, either alone or in combination with other plans or projects. A judgement of likely significant effect in no way pre-supposes a judgement of adverse effect on site integrity.

10.2 There are no recognised criteria as to what can be considered to be trivial or inconsequential impacts. Where predicted impacts are relatively very small compared to either the population of the management unit or the area of the site or the duration of the impact, it is determined that the impact would not cause a likely significant effect.

10.3 The JNCC have advised BEIS that there will be a likely significant effect from all three applications on the qualifying features of the Southern North Sea SAC, namely harbour porpoise (JNCC 2020a,b,c) and that for seabed clearance at the Cameron field ‘evidence presented in the application suggests that there may be Annex I habitats affected by the proposed operations. Operations occur within in the Dogger Bank SAC’ (JNCC 2020a). No other qualifying features for any other designated sites have been identified as being at risk of a likely significant effect.

Southern North Sea SAC Likely Significant Effect

10.4 BEIS agrees with the advice received in that, based on the information presented within each of the applications, there is potential for a Likely Significant Effect on the qualifying features of the Southern North Sea SAC from the detonation of explosives at all three locations both alone and in-combination.

Dogger Bank SAC Likely Significant Effect

10.5 Proposed seabed activities at the Cameron field occur within the Dogger Bank SAC. The detonation of explosives within the site could impact on the seabed. Evidence from UXO clearance indicates that there is potential for a crater to be formed that could be up to approximately 1 m deep and have a diameter of up to 11 m (See Para 4.10). However, this is based on evidence from much larger explosives that are positioned on the seabed as opposed to 3 m below the seabed, which will be the case for the largest detonation to be undertaken at the Cameron field. Consequently, it is predicted that the impact on the seabed will be no greater than have been reported elsewhere from UXO clearance and most likely will be smaller.
10.6 The impact on the seabed will persist depending on the rate of local sediment movement. Measurements suggest this may be as short as only a few days in high energy environments such as the Bristol Channel and North Norfolk Banks but can be as long as several years for more stable deposits (Cooper et al. 2005, Hitchcock & Bell 2004, Kenny and Rees 1996). Evidence from monitoring studies of anchor mounds in the Dogger Bank indicate that within four weeks of the anchors being removed there was no sign of any mounds present (ConocoPhillips 2006). Consequently, it is predicted that the seabed will progressively recover although the length of time this may take depends on the local conditions of the site. However, the physical impacts on the sandbank feature will be localised and temporary.

10.7 Due to the nature and scale of impacts within the Dogger Bank SAC from the proposed works to be undertaken at the Cameron field and that the conductor along with the associated grout are to be removed and taken ashore it has been determined that there will be no Likely Significant Effect on that site alone or in-combination and no further assessment has been undertaken.
11 APPROPRIATE ASSESSMENT

11.1 An Appropriate Assessment is triggered when the competent authority, in this case the Secretary of State, determines that a plan or project is likely to have a significant effect on a European site. Guidance issued by the European Commission states that the purpose of an Appropriate Assessment is to determine whether adverse effects on the integrity of the site can be ruled out as a result of the plan or project, either alone or in-combination with other plans and projects, in view of the site's conservation objectives (EC 2000).

11.2 The following sections assess whether there will be an adverse effect on the Southern North Sea SAC.

11.3 A dual approach based on outputs from noise modelling and supported by the use of EDR has been used for harbour porpoise in order to determine whether an adverse effect on the integrity of the Southern North Sea SAC will occur.

Southern North Sea SAC (Harbour porpoise)

Physical Injury

11.4 Noise modelling undertaken indicates that, based on the weighted SEL threshold, there is potential for sound levels from seabed clearance activities to cause the onset of PTS to harbour porpoise out to 2,200 m of the sound source (TOSK 2020a,b,c).

11.5 The peak harbour porpoise density across the SAC is estimated to be >3 per km² (Heinänen and Skov 2015). Based on this peak density up to 46 harbour porpoise could be impacted. However, densities based on survey results indicate that the density of harbour porpoise within the area of the proposed activities may be lower than that based on modelling with recorded densities within the area of between 0.79 ind./km² to 2.7 ind./km² (Vattenfall 2018, SMart Wind 2017). This indicates that the number of porpoise at risk of PTS could be between 12 and 40 individuals depending upon the location.

11.6 The North Sea Management Unit harbour porpoise population is 333,808 individuals and therefore the worst-case scenario of one harbour porpoise being impacted is <0.01% of the Management Unit population.

11.7 The estimated area of potential impact from PTS is within 2,200 m of the explosive detonation and therefore the mitigation measures proposed by the applicant, which includes the use of an Acoustic Deterrent Device (ADD) will minimise the risk of any marine mammals are within the range at which the onset of PTS is predicted to occur (See Section 14: Mitigation).

Disturbance

11.8 No assessment has been undertaken using noise modelling outputs on the predicted number of harbour porpoise that could be disturbed by the detonation of explosives. The applicant has
based the assessment on a 26 km EDR. On this basis up to 6,372 harbour porpoise could be disturbed using the maximum modelled density of 3.0 ind./km². Using results from survey data between 1,678 and 5,734 harbour porpoise could be disturbed at each location. Consequently, between 0.5% and 1.9% of the Management Unit population could be impacted by each detonation.

**Threshold Approach**

11.9 The JNCC have advised that the assessment for harbour porpoise within the SAC should be undertaken by the proposed threshold approach whereby disturbance should not exceed 20% of the SAC ‘summer’ or ‘winter’ areas over the course of one day and on average 10% of an area over the course of a single season (see Section 7).

11.10 Based on information presented within the application, BEIS have estimated the area of the SAC impacted by the explosive detonations based on a 26 km EDR for each of the three locations (Figure 11 and Table 7). The daily threshold ranges from between 0.3% and 6.9% of the ‘summer’ area depending on the location. If seabed clearance at Horne and Wren is undertaken during the winter period an estimated 2.5% of the area could be impacted.

Figure 11: Tullow seabed clearance activities and 26 km EDR

11.11 Each detonation will last for one day. However, for the purposes of this assessment BEIS has allowed for an additional two days ‘recovery’ period during which time displaced harbour porpoise
may return to the area. Consequently noise from seabed clearance could contribute to between 0.03% and 0.12% of the summer seasonal threshold and 0.04% of the winter seasonal threshold (Table 7).

**Table 7: Daily and seasonal spatial overlap for Tullow seabed clearance.**

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Maximum area of SAC impacted (km²)</th>
<th>Daily Threshold (%)</th>
<th>No. of days detonation</th>
<th>Estimated duration of impact (days) ¹</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Horne and Wren</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>’summer’</td>
<td>2,006</td>
<td>7.4</td>
<td>1</td>
<td>3</td>
<td>0.12</td>
</tr>
<tr>
<td>’Winter’</td>
<td>346</td>
<td>2.7</td>
<td>1</td>
<td>3</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Orwell</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>’summer’</td>
<td>735</td>
<td>2.7</td>
<td>1</td>
<td>3</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Cameron</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>’summer’</td>
<td>470</td>
<td>1.7</td>
<td>1</td>
<td>3</td>
<td>0.03</td>
</tr>
</tbody>
</table>

¹ – This accounts for two days ‘recovery time’ following cessation of explosive detonations.

BEIS have calculated the area of impact within the SAC based on the coordinates presented within each of the applications. The area of impact within the SAC and consequently the daily thresholds differ from those presented in the applications. For both the Horne and Wren and Cameron fields that area calculated by BEIS is greater than calculated by the applicant. The BEIS calculations have been used in this assessment.

The seasonal threshold is not presented in any of the Tullow applications. It has therefore been calculated by BEIS for each activity.

**Conclusion**

11.12 Results from noise modelling indicate that between 12 and 46 harbour porpoise could be at risk of physical injury from noise arising from the explosive detonations. With proposed mitigation discussed in Section 14 there is a very low risk of any harbour porpoise being injured.

11.13 There is a risk of harbour porpoise being displaced or disturbed by the proposed seabed clearance activities. Based on a 26 km EDR up to 6,372 harbour porpoise may be disturbed based on the maximum densities within the SAC. However, site specific densities are predicted to be lower than this. The disturbance will be of short duration and once the activities have ceased harbour porpoise will return to the area and therefore the impacts are temporary.

11.14 The results from the threshold approach indicate that up to 7.4% of the ‘summer’ area may be impacted each day and up to 0.12% of the seasonal threshold. Neither the summer nor winter daily and seasonal thresholds are exceeded.

11.15 The proposed activities will not affect the supporting habitats and will have a temporary and localised impact on the supporting prey species, e.g. fish. Once the proposed activities have ceased there will be no effect on the distribution, abundance and population dynamics of the species.
11.16 Based on the best available information and supported by results from noise modelling and the threshold approach, BEIS is satisfied that the proposed seabed clearance activities at Horne and Wren, Orwell and Cameron fields alone will not have an adverse effect upon the integrity of the Southern North Sea SAC with respect to harbour porpoise.
12 IN-COMBINATION ASSESSMENT

12.1 There is potential for in-combination impacts to arise due to noise from other known or planned activities and the proposed seismic survey.

12.2 Projects identified as having potential to cause an in-combination impact are:

- Hornsea Project Two offshore wind farm - UXO clearance,
- Hornsea Project Two offshore wind farm – Pile-driving,
- Viking Link Inter Connector – UXO clearance,
- Triton Knoll offshore wind farm – Pile-driving,
- ION seismic survey – Airguns,
- Tolmount – Pile-driving,
- BP Endurance Surveys – Airguns and Sub-bottom profiler.
- Spirit Energy – Ossian rig site survey,
- Spirit Energy - Bonnie Brae rig site survey.

**Hornsea Project Two**

12.3 The Hornsea Two offshore wind farm is located within Subzone 2 of the Round 3 Offshore Wind Farm Zone; Zone 4: Hornsea. At its closest point Hornsea Two lies 89 km from shore and covers an area of 462 km²; of which 298 km² of the wind farm site lies within the SAC. In addition to the wind farm area an export cable route crosses the SAC. It is estimated that 36 km of the cable route is within the SAC (Figure 4).

12.4 Ørsted have a Marine Licence to undertake UXO clearance within the wind farm area and along the export cable route. The licence is for clearance by detonation of up to 100 items of UXO over a two year period: 40 items between July 2019 to 31 December 2019 and 60 items between 1 April 2020 to 31 December 2020 (MMO 2019b).

12.5 In order to reduce the potential in-combination effect associated with UXO clearance, Ørsted have proposed the following limitations when considering concurrent activities (Ørsted 2020):

12.6 During the summer 2020 season (April to September, inclusive):

- A maximum of five detonations all within 5 km of each other will occur in any 24-hour period within the SNS or a 26 km buffer surrounding the SAC (during the same 24-hour period);
• UXO detonations (within the SNS SAC or a 26 km buffer surrounding the SAC) will not occur during the same 24-hour period as piling at the substations (during the same 24-hour period).

12.7 These measures reduce the potential extent of impacts across the SAC during any one day.

**Hornsea Two UXO clearance**

12.8 Noise modelling undertaken by Ørsted indicates that the onset of PTS in harbour porpoise could occur within 11.6 km from a detonation of an 800 kg charge (Ørsted 2018c,d).

12.9 Assuming circular propagation of noise, in the event that the onset of PTS extends 11.6 km from the source the onset of PTS could occur over an area of 422.7 km². The density of harbour porpoise across the Hornsea Zone plus a 10 km buffer is between 1.72 and 2.22 ind./km² (SMart Wind 2015). Based on the higher recorded density, an estimated 425 harbour porpoise are at risk of PTS in the event that an 800 kg UXO is detonated at Hornsea Two. This is 0.13% of the North Sea Management Unit.

12.10 No assessment has been made by Ørsted on the estimated number of harbour porpoise that could be displaced or disturbed by UXO clearance based on noise modelling outputs.

12.11 Ørsted have undertaken an assessment based on the proposed SNCB threshold approach with an EDR of 26 km (Ørsted 2020).

12.12 The worst-case scenario of five detonations to be undertaken within a 5 km radius will impact a maximum area of 2,303 km² within the SAC, equivalent to 8.53% of the ‘summer’ area (Ørsted 2020).

12.13 In the event that up to 60 UXO detonations are undertaken during the ‘summer’ period with five detonations per day, the seasonal average is 0.65%. In the event that only one detonation per day occurs (the ‘worst-case’ seasonal scenario) the seasonal average is 2.5% (Table 8). There will be no impacts in the ‘winter’ area.

**Table 8: Seasonal spatial overlap for Hornsea Two UXO detonations without bubble curtains.**

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Maximum area of SAC impacted (km²)</th>
<th>Daily Threshold (%)</th>
<th>No. of detonations</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Single UXO detonation per day</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>’summer’</td>
<td>2,009</td>
<td>7.4</td>
<td>60</td>
<td>62</td>
<td>2.5</td>
</tr>
<tr>
<td><em>Five UXO detonations per day</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>’summer’</td>
<td>2,303</td>
<td>8.5</td>
<td>60</td>
<td>14</td>
<td>0.6</td>
</tr>
</tbody>
</table>

1 – This accounts for two days ‘recovery time’ following cessation of UXO clearance.
12.14 The potential impact from UXO detonations using the threshold approach is unrealistically worst-case:

- It assumes that there will be 60 detonations all of which will be undertaken during the summer period; this figure is speculative and considered to be a maximum.
- The assessment presumes that all 60 detonations have the same maximum area of effect within the SAC. It is highly unlikely that five items of UXO are positioned such that they could cause the maximum area of impact.
- The maximum area of impact can only occur on one day. It is therefore unrealistic and self-evidently not possible to have the same maximum level of impact over the course of a season.
- This assessment is based on the presumption that bubble curtains are not being used to reduce the risk of injury and extent of disturbance. During 2019 Ørsted cleared 26 items of UXO within the project area and used bubble curtains for 23 of them; therefore on 88% of occasions bubble curtains have been used. Ørsted have confirmed that bubble curtains were used for all UXO clearance undertaken in 2020 (Ørsted Pers. comm. 2020). This significantly reduces the potential area of displacement or disturbance.

12.15 The use of bubble curtains for pile-driving reduces the EDR from 26 km to 15 km (JNCC 2020e) and although not stated in the recent guidance a similar level of effect for UXO clearance has been considered for the purposes of this assessment.

12.16 The reduction in the EDR to 15 km reduces the daily threshold to between 2.6% and 4.6% depending on the number of detonations per day and the seasonal threshold to between 0.35% and 0.88% (Table 9).

**Table 9: Seasonal threshold for Hornsea Two UXO detonations with bubble curtains.**

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Maximum area of SAC impacted (km²)</th>
<th>Daily Threshold (%)</th>
<th>No. of detonations</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single UXO detonation per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>707</td>
<td>2.6</td>
<td>60</td>
<td>62</td>
<td>0.88</td>
</tr>
<tr>
<td>Five UXO detonations per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>1,257²</td>
<td>4.6</td>
<td>60</td>
<td>14</td>
<td>0.35</td>
</tr>
</tbody>
</table>

1 – This accounts for two days ‘recovery time’ following cessation of UXO clearance.
2 – Estimated based on all five detonations being within a 5 km radius of each other.
12.17 Ørsted have confirmed that they have completed their main UXO clearance for 2020, although they are continuing seabed clearance and preparation and could locate further UXO during August and September (Ørsted Pers. comm. 2020).

13 Hornsea Two Pile-driving

13.1 Between July and October 2020 Ørsted are planning to undertake pile-driving at two substations associated with the Hornsea Two wind farm: A Reactive Compensation Station (RCS) and an Offshore Substation (OSS). BEIS are aware that pile-driving will not commence before September 2020.

13.2 The Reactive Compensation Station will have four pin-piles installed over a period of between one and three days, the Offshore Substation has eight pin-piles and will take between two and five days to be installed. In total there will be between three and eight days of piling noise undertaken during the summer period.

13.3 For the purposes of this assessment noise modelling undertaken by BEIS for the Review of Consents for the installation of 3.5 m diameter piles using a 2,300 kJ hammer at Hornsea Two wind farm has been used (BEIS 2018).

13.4 The results from the modelling indicate that the onset of PTS could occur out to 585 m and encompass an area of 1.1 km$^2$. Levels of noise predicted to cause disturbance could occur out to 26.8 km and cover an area of 2,251 km$^2$.

13.5 Based on the results from noise modelling and a peak density of 2.22 ind./km$^2$ an estimated two harbour porpoise are at risk of PTS from the pile-driving and 1,683 harbour porpoise may be disturbed or displaced.

13.6 Ørsted have undertaken an assessment based on the proposed SNCB threshold approach (Ørsted 2020).

13.7 The results of the assessment based on a 15 km EDR for pin-pile driving at the Reactive Compensation Station indicate that up to 38 km$^2$ of the SAC may be impacted. Pile-driving at the Offshore Substation could impact 530 km$^2$ of the SAC. A maximum daily area of the SAC impacted is 2.0% and the average is 1%. The seasonal average has been calculated based on the average area of the SAC impacted over the course of the season by pile-driving and for activities to last the maximum number of eight days (Ørsted 2020). The seasonal average arising from pile-driving is 0.05%.
Table 10: Estimated extent of seasonal disturbance on harbour porpoise from proposed pile-driving at Hornsea 2 offshore wind farm within the SAC.

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Mean area of SAC impacted per day (km²)</th>
<th>Mean Daily Threshold (%)</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin-pile driving Hornsea Two substations</td>
<td>284</td>
<td>1.0</td>
<td>10</td>
<td>0.05</td>
</tr>
</tbody>
</table>

1 – This accounts for two days ‘recovery time’ following cessation of pile-driving.

13.8 Ørsted have committed to not undertake UXO clearance and pile-driving during the same 24 hr period. Therefore, the impacts of the two activities are not additive on a daily basis but are for the seasonal threshold (Ørsted 2020).

**Viking Link Interconnector**

13.9 The Viking Link Interconnector is a HVDC cable between Denmark and the UK. The total cable length in the marine environment is 620 km, of which 64 km is within the Southern North Sea SAC (NGVL 2018a). Prior to installing the cable a UXO clearance campaign is planned to be undertaken no sooner than 31 May 2020 and end in September 2020 (NGVL 2019a, MMO 2020).

13.10 The Marine Licence application is for the clearance of no more than 25 items of UXO across the entire length of cable. Licence conditions state that no more than one item of UXO can be cleared in any 24 hr period (MMO 2017c, 2018).

13.11 Results from noise modelling presented in the application indicate that the onset of PTS could occur out 8.5 km and cover an area of 226.98 km² for a UXO with a 260 kg charge weight and estimated up to 200 harbour porpoises to be at risk of PTS, this is equivalent to 0.06% of the North Sea Management Unit population (NGVL 2018a, MMO 2017c). However, this is without mitigation, which includes the use of an ADD and where appropriate the use of bubble curtains that will reduce the risk of harbour porpoise being within the area when UXO are detonated (NGVL 2019b). The estimated number of individuals potentially displaced or disturbed from UXO clearance based on the outputs from noise modelling is not available.

13.12 NGVL have estimated the number of harbour porpoise displaced based on the 26 km EDR and estimate up to 1,886 harbour porpoise may be disturbed from clearance of UXO, this is equivalent to 0.56% of the North Sea Management Unit population (NGVL 2018a).

13.13 NGVL have undertaken an assessment using the draft SNCB threshold approach. The assessment is based on the detonation of UXO having an EDR of 26 km and all 25 items of UXO being wholly within the SAC (NGVL 2019a). The worst-case scenario for a single detonation within the SAC is that it will impact an area of 2,124 km² during any 24 hr period and consequently...
affect 7.8% of the ‘summer’ area and over the course of the season affect 1.2% of the seasonal threshold (Table 11). There will be no impact on the ‘winter’ area.

13.14 In the event that bubble curtains are used the daily threshold is reduced to 2.6% and the seasonal threshold to 0.38%.

**Table 11: Worst-case scenario seasonal threshold for Viking Link Interconnector UXO detonations with and without bubble curtains.**

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Maximum area of SAC impacted (km²)</th>
<th>Daily Threshold (%)</th>
<th>No. of detonations</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single UXO detonation per day without bubble curtains</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>2,124</td>
<td>7.8</td>
<td>25</td>
<td>27</td>
<td>1.15</td>
</tr>
<tr>
<td>Single UXO detonation per day with bubble curtains</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>707</td>
<td>2.6</td>
<td>25</td>
<td>27</td>
<td>0.38</td>
</tr>
</tbody>
</table>

1 – This accounts for two days ‘recovery time’ following cessation of UXO detonations.

13.15 The maximum number of detonations permitted under the Marine Licence is 25 and was approved prior to the completion of the UXO clearance surveys. Consequently, the exact number and locations of UXO that may need to be cleared were unknown. Subsequent to the Marine Licence being issued NGVL have undertaken surveys and identified one item of UXO within the SAC and a further three within 26 km of the boundary. Consequently the worst-case scenario will not occur. A revised assessment based on known UXO clearance is presented in Table 12. The results show that based on known survey results the seasonal threshold does not exceed 0.25%. In the event that bubble curtains are used for all four detonations the seasonal threshold is reduced to 0.08%.

**Table 12: Likely seasonal threshold for Viking Link Interconnector UXO detonations with and without bubble curtains**

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Maximum area of SAC impacted (km²)</th>
<th>Daily Threshold (%)</th>
<th>No. of detonations</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single UXO detonation per day without bubble curtains</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>2,124</td>
<td>7.8</td>
<td>4</td>
<td>6</td>
<td>0.25</td>
</tr>
<tr>
<td>Single UXO detonation per day with bubble curtains</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>707</td>
<td>2.6</td>
<td>4</td>
<td>6</td>
<td>0.08</td>
</tr>
</tbody>
</table>

1 – This accounts for two days ‘recovery time’ following cessation of UXO detonations.
13.16 This assessment is precautionary in that it is based on the maximum area of impact within the SAC for all four detonations and it is known that for three items of UXO this cannot be the case as they lie outwith the SAC and for the one item of UXO within the SAC to have the maximum impact it must occur along a length of no more than 6.9 km of cable route.

13.17 NGVL have committed to using bubble curtains when conditions are suitable for their use (NGVL 2019b). Based on the reported 100% usage of bubble curtains by Ørsted in 2020 and 88% usage in 2019, it is highly likely that NGVL will also use bubble curtains during UXO clearance along the cable route.

13.18 BEIS have been made aware that Ørsted and NGVL will be using the same vessel when operating bubble curtains; both projects cannot operate bubble curtains at the same time. A realistic worst-case scenario is for only one project to undertake UXO clearance during any one day.

**Triton Knoll**

13.19 The Triton Knoll offshore wind farm is a Round 2 offshore wind farm. At its closest point the Project site lies 32 km off the coast of Lincolnshire and covers an area of approximately 145 km² (TKOWFL 2011). The project lies wholly outwith the SAC but partially within 26 km of the SAC boundary.

13.20 Offshore construction requiring pile-driving is anticipated to last no more than 23 days and be completed by 13 June 2020. Construction activities that could cause an impact on harbour porpoise within the SAC have been completed. However there is a seasonal in-combination impact.

13.21 Results from the noise modelling undertaken for BEIS indicate that there is potential for sound levels arising from pile-driving to cause the onset of PTS from between 1.56 km and 2.54 km depending on the hammer energy used to install the pile and the location of the pile-driving within the wind farm area. Noise capable of causing the onset of PTS may extend over an area of between 7.8 km² and 20.5 km² (BEIS 2018).

13.22 The harbour porpoise density across the Triton Knoll wind farm area is estimated to be 0.11 ind./km² (TKOWL 2011). Based on this site specific density, between one and two harbour porpoise are predicted to be at risk of PTS at the start of pile-driving activity; this is equivalent to no more than 0.0005% of the North Sea Management Unit population.

13.23 Displacement of harbour porpoise may extend from between 16.1 km and 16.9 km and cover an area of between 689.9 km² and 934.5 km² depending on the pile-driving location and the hammer energy used to install the pile. Based on results using a dose response curve and a zonal specific mean density of 0.11 ind./km², the estimated number of harbour porpoise predicted to be displaced is between 27 and 39 individuals; 0.008% and 0.01% of the North Sea Management...
Unit population. Within the SAC it is estimated that no harbour porpoise will be displaced by pile-driving during construction of the wind farm (BEIS 2018).

13.24 Based on the threshold approach the maximum daily impact is 0.18% of the ‘summer’ area and the seasonal threshold is 0.02% (Table 13).

Table 13: Daily and seasonal spatial overlap for Triton Knoll pile-driving.

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Maximum area of SAC impacted (km²)</th>
<th>Daily Threshold (%)</th>
<th>No. of days pile-driving</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pile-driving</td>
<td>‘summer’ 47.86</td>
<td>0.18</td>
<td>23</td>
<td>25</td>
<td>0.02</td>
</tr>
</tbody>
</table>

1 – This accounts for two days ‘recovery time’ following cessation of pile-driving.

**Oil and gas industry activities**

13.25 The currently planned or consented oil and gas related activities that could have the potential to cause an in-combination are presented in Table 4.

13.26 BEIS have identified three projects that could cause an in-combination impact within the SAC. They are:

- ION Seismic survey,
- Tolmount Pile-driving,
- BP Endurance Marine surveys,
- Pegasus West – Geophysical survey

**ION 3D Seismic Survey**

13.27 An application to undertake a 3D seismic survey by GX Technology / ION Geophysical Corporation (hereafter ION) was submitted to BEIS on 23 March 2020.

13.28 The proposed regional survey will be undertaken across the Southern North Sea in quadrants 35, 36, 37, 38, 41, 42, 43 and 44 off of the east coast of England. The planned survey is located within UKCS Blocks 35/23, 35/24, 35/25, 35/28, 35/29, 35/30, 36/21 – 36/30, 37/16 – 37/30, 38/16, 38/17, 38/18, 38/21, 38/22, 38/23, 38/26, 38/27, 38/28, 38/29, 41/3 – 41/5, 42/1 - 42/5, 43/1 – 43/5, 44/1 – 44/3. The Permit area covers approximately 22,980 km², with the Survey Area covering 13,269 km² (Figure 12) (ION 2020a, b).
13.29 The survey was scheduled to take place between 1 April and 22 October 2020 and expected to last up to 165 days (ION 2020c). However, since the application was made the start date has been delayed and now planned to start during August 2020.

13.30 The total length of line to be surveyed is between 15,392 km and 36,109 km and will be undertaken over either 198 or 128 survey lines (ION 2020c). The total length of survey line wholly within the SAC is not presented in the application but has been calculated by BEIS to be a maximum of 11,513 km, with a maximum length of any single line within the SAC of 89 km (BEIS 2020a).

13.31 Noise modelling undertaken by ION indicates that, based on the weighted SEL threshold, there is potential for sound levels from the proposed seismic survey to cause the onset of PTS to harbour porpoise out to 320 m of the sound source.

13.32 Based on a peak harbour porpoise density of 3.0 ind./km² and the worst-case scenario of PTS occurring out to 320 m of the survey, an estimated one harbour porpoise could be affected at the start of the seismic survey.

13.33 The largest distance any noise likely to cause disturbance is estimated to propagate out to is 12 km from the airguns, covering an area of 452 km² (BEIS 2020a). Based on a peak site density of 3.0 ind./km² an estimated 1,356 harbour porpoise could be disturbed by a seismic survey. This

Figure 12: Location of ION seismic survey.
is equivalent to 0.4% of the North Sea Management Unit harbour porpoise population being disturbed.

13.34 BEIS have undertaken an HRA for the proposed ION seismic survey (BEIS 2020a). In order to undertake the HRA BEIS calculated the daily and seasonal thresholds based on the threshold approach.

13.35 Based on the pre-determined survey lines the maximum area within the SAC that could be impacted in any one day is estimated to be 2,136 km². This is equivalent to impacting 5.8% of the SAC as a whole and 7.9% of the ‘summer’ area per day. This maximum extent of impact could only occur during one day as all other survey lines within the SAC are shorter and subsequently the daily impacts will be less.

13.36 The mean daily impact accounts for not all survey lines having the same level of impact within the SAC and averages the length of line surveyed each day within the SAC over the period of 46 days within the ‘summer’; on this basis the daily impact is 6.7%. This level of impact is more likely to arise each day during the ‘summer’ period and is therefore considered a realistic worst-case scenario. Based on the daily average impact, the seasonal threshold would be 1.7% of the SAC (Table 14).

13.37 There will be no impact on the ‘winter’ area from the ION seismic survey.

Table 14: Estimated extent of seasonal disturbance on harbour porpoise from proposed ION seismic survey within the SAC.

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Area impacted per day (km²)</th>
<th>Daily Threshold (%)</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst-case (Maximum daily impact - 46 days in summer period)</td>
<td>2,136</td>
<td>7.9</td>
<td>46</td>
<td>2.0</td>
</tr>
<tr>
<td>‘summer’</td>
<td>2,136</td>
<td>7.9</td>
<td>46</td>
<td>2.0</td>
</tr>
<tr>
<td>Realistic worst-case (Mean daily impact 46 days in summer period)</td>
<td>1,805</td>
<td>6.7</td>
<td>46</td>
<td>1.7</td>
</tr>
<tr>
<td>‘summer’</td>
<td>1,805</td>
<td>6.7</td>
<td>46</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Assuming a survey start date of no earlier than 15 August 2020

**Tolmount Pile-driving**

13.38 Premier Oil submitted a Consent to Locate application to install the Tolmount normally unmanned installation (NUI) at the Tolmount field, located approximately 3 km from the perimeter of the Southern North Sea SAC boundary. Part of the works require pile-driving eight 2.59 m diameter piles to anchor the jacket legs into the seabed. Installation of the NUI was planned to be undertaken in May (or possibly June) 2020 (Premier Oil 2020). The works have now been delayed until September 2020 and therefore there will be an in-combination impact.
13.39 Noise modelling undertaken to support the application indicates that the onset of PTS could occur in harbour porpoise within 234 m of the pile-driving and strong behavioural disturbance out to 3.1 km (Premier Oil 2020). Site specific data on the density of harbour porpoise in the area is not readily available. However, at Triton Knoll (the closest wind farm to the proposed pile-driving) densities of harbour porpoise were reported as being 0.11 km\(^2\) (TKOWFL 2011). Similar densities of harbour porpoise are predicted to occur at Tolmount. Based on these densities less than one harbour porpoise is predicted to be at risk of PTS and three may be displaced.

13.40 Based on the thresholds and a 15 km EDR it is estimated that sound from pin pile-driving could affect 200 km\(^2\) of the ‘summer’ area of the SAC (BEIS 2020b). Pile-driving is expected to last over a period of five days (Premier Oil 2020). Consequently noise from pile-driving could affect 0.5% of the SAC as a whole and 0.8% of the ‘summer’ area. The seasonal threshold is 0.03% (Table 15). There will be no impact on the ‘winter’ area.

**Table 15: Daily and seasonal spatial overlap for Tolmount pile-driving.**

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Maximum area of SAC impacted (km(^2))</th>
<th>Daily Threshold (%)</th>
<th>No. of days pile-driving</th>
<th>Estimated duration of impact (days)</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'summer'</td>
<td>200</td>
<td>0.8</td>
<td>5</td>
<td>7</td>
<td>0.03</td>
</tr>
</tbody>
</table>

1 – This accounts for two days ‘recovery time’ following cessation of pile-driving.

**BP Endurance Surveys**

13.41 An application to undertake a Marine Survey by BP Exploration Operating Company Limited (hereafter BP) was submitted to BEIS on 21 August 2020.

13.42 The proposed surveys will be undertaken at two locations the Southern North Sea. Survey Area One is located in UKCS Blocks 42/25, 43/21, 43/26 and Survey Area Two 43/27 and 43/28. The Greater Working Area covers 160 km\(^2\) in Area One and 48 km\(^2\) in Area Two. Data will be collected over an area of 14 km by 8 km (112 km\(^2\)) in Area One and 7 km by 5 km (35 km\(^2\)) in Area Two.

13.43 The surveys are scheduled to take place between 1 September and 31 October 2020 and expected to last a total of 14 days (BP 2020a,b).

13.44 Three surveys will be undertaken:

- A 2DHR (Two Dimensional High Resolution) survey in Survey Area One. Thirteen survey lines will be undertaken over a period of three days.
- A 4D Test Line survey in Survey Area One. Four survey lines will be undertaken in one day.
- Geophysical survey using a sub-bottom profiler stacked sparker. A total of 51 survey lines will be undertaken over a period of six days in Survey Area Two.

13.45 In addition to the above surveys a sub-bottom profiler (pinger) will be used in both survey areas simultaneously as the airguns. A single-beam echo-sounder, multibeam echosounder, side-scan sonar and a magnetometer will also be used.

13.46 The proposed surveys will be undertaken along predetermined lines. Within Survey Area One the lines will be approximately 2,000 m apart during the 2DHR survey. Within Survey Area Two they will be between 150 m and 500 m apart depending on the line direction. The airguns used in Survey Area One may be kept on during the line turns, which will last between 30 and 60 minutes depending on their location (BP 2020b).

13.47 Noise modelling undertaken by the applicant indicates that, based on the weighted SEL threshold, there is potential for sound levels to cause the onset of PTS to harbour porpoise out to between 110 m and 590 m depending on the sound source.

13.48 Based on a peak density of >3 ind./km² and the worst-case scenario of PTS occurring out to 590 m of the survey, an estimated three harbour porpoise could be affected at the start of the seismic survey.

13.49 The applicant estimated the total area that could be impacted for the duration of each of the surveys. The total area potentially impacted ranges from 380 km² during the 2DHR and 590 km² for the 4D Test Line survey and therefore between 1,140 and 1,770 porpoises have been estimated to be impacted by each of the surveys. The worst case scenario is that an estimated total of 2,910 porpoise could be disturbed by both surveys undertaken in Survey Area One, equivalent to 0.9% of the North Sea Management Unit population (BEIS 2020c). However, the 4D Test Line survey and the 2DHR surveys will be undertaken over the same area and therefore, depending on the length of time between the two surveys, the density of porpoises within the area may be lower at the time the second survey commences and the number of individuals disturbed may therefore also be lower. Furthermore, this estimate is based on the highest density of porpoises modelled within the SAC and not from survey data which has reported lower densities within the SAC.

13.50 No noise modelling has been undertaken by the applicant on the use of a sparker sub-bottom profiler. However, previous modelling has indicated that disturbance from a sub-bottom profiler is limited and extends to 235 m from a similar sparker sub-bottom profiler (BEIS 2018). Consequently, a similar extent of impact may be predicted to arise here.

13.51 On the basis of the information provided by the applicant and the advice received from the JNCC the maximum area of impact within the SAC from the proposed 2DHR is 1,369 km² and the 4D Test Line survey is slightly smaller at 1,064 km² (Table 16). This is equivalent to between 5.1% and 3.9% of the ‘summer’ area for each of the surveys respectively.
13.52 The maximum daily impact from the geophysical survey using the sparker sub-bottom profiler in Survey Area 2 is 255 km², equivalent to 0.9% of the ‘summer’ area. There will be no impact on the ‘winter’ area.

13.53 Based on the maximum daily impacts from each of the three proposed surveys the seasonal threshold would be 0.23% of the SAC (Table 16).

Table 16: Estimated extent of seasonal disturbance on harbour porpoise from proposed Endurance survey within the SAC (BEIS 2020c).

<table>
<thead>
<tr>
<th>SAC area</th>
<th>Area impacted per day (km²)</th>
<th>Daily Threshold (%)</th>
<th>Estimated duration of impact (days) *</th>
<th>Seasonal Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4D Test Line Survey (Area One)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>1,064</td>
<td>3.9</td>
<td>3</td>
<td>0.06</td>
</tr>
<tr>
<td>2DHR Survey (Area One)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>1,369</td>
<td>5.1</td>
<td>5</td>
<td>0.14</td>
</tr>
<tr>
<td>Geophysical Survey (Area Two)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘summer’</td>
<td>255</td>
<td>0.9</td>
<td>7</td>
<td>0.03</td>
</tr>
</tbody>
</table>

* Includes 2 day ‘recovery period’ for airguns and 1 day for sub-bottom profiler.

**Pegasus West geophysical surveys**

13.54 Spirit Energy submitted an application to undertake a pipeline route survey and a platform site survey at the Pegasus West field. The surveys were to be undertaken in Blocks 43/12, 43/13, 43/18, 43/19 and 43/24 and located within the Southern North Sea SAC. The surveys were to be undertaken sometime between April 2020 and April 2021 and last no more than 28 days in total (Spirit Energy 2020a). Subsequent to the application being made, Spirit Energy have confirmed that these surveys are now not being undertaken (Spirit Energy Pers. comm. 2020).

**Other oil and gas applications**

13.55 Other oil and gas applications for activities planned to be undertaken between April and September 2020 are summarised below.

13.56 An application to undertake a rig site survey at the Ossian prospect within UKCS Blocks 36/28, 42/2a and 42/3a has been made by Spirit Energy (Spirit Energy 2020b). The survey entails the use of a two-dimensional High Resolution Seismic (2D-HR) and a two-dimensional Ultra High Resolution Seismic (mini-gun) (2D-UHR) plus a sub-bottom profiler and side-scan sonar. The work is planned to be undertaken between 12 April 2020 and 1 April 2021 and last over a period of six days. BEIS have recently been advised that the planned activities may not now start until September/October 2020.
13.57 The survey lies 22.6 km from the closest boundary of the Southern North Sea SAC and therefore will not impact on harbour porpoise within the SAC.

13.58 An application to undertake a rig site survey at the Bonnie Brae prospect located within UKCS Blocks 42/3 and 42/8 has been made by Spirit Energy. The survey covers an area of 42 square kilometres (inner working area) and 144 square kilometres (greater working area which also includes Block 42/7) across UK waters (Spirit Energy 2020c). The survey entails the use of a two-dimensional High Resolution Seismic (2D-HR) and a two-dimensional Ultra High Resolution Seismic (mini-gun) (2D-UHR) plus a sub-bottom profiler and side-scan sonar. The work is planned to be undertaken between 12 April 2020 and 1 April 2021 and last over a period of six days. BEIS have recently been advised that the planned activities may not now start until September/October 2020.

13.59 The Greater Working Area for the Bonnie Brae survey lies 10.3 km from the closest boundary of the Southern North Sea SAC and the Inner Working Area lies 14.3 km from the boundary. Consequently, the area where airguns will be operating lies beyond the distance at which impacts on harbour porpoise within the SAC are predicted to occur.

13.60 Spirit Energy have applied for two Marine Licences to undertake decommissioning activities at the Audrey B installation, located within the Southern North Sea SAC (ML/411/2 and ML/431/1). The work is to be undertaken between 23 November 2018 and 31 October 2020 and entails the removal and temporary deposit of risers on to the seabed. Noise arising from this activity will be primarily from the vessel(s) undertaking the work. Vessel noise will be localised and temporary and will not contribute in any significant way to the current levels of shipping and noise within the SAC.

13.61 Chrysaor Production (U.K.) Limited have applied for a Marine Licence to remove mattresses and move rock within the SAC as part of their ongoing decommissioning activities at the LOGGS complex. (ML/570/0). Work will be undertaken between 1 May and 31 October 2020. The work will require the use of vessels and a small electric dredger to reposition the rock. The predominant noise source will be vessel noise which could cause a localised area of disturbance and not contribute in any significant way to the current levels of shipping occurring within the SAC.

13.62 Premier Oil have submitted an application to prepare seabed prior to installing two pipelines (a 20” production pipeline and 3” methanol pipeline) from the Tolmount field to Easington terminal (ML/551/0). The proposed activities will be undertaken between 1 March and 30 September 2020. Activities include pre-cut trenching operations, dredging and post-lay trenching operations. Noise from dredging operations is predicted to impact on a localised area and cause localised level of displacement out to no more than 600 m (See Para.8.15). The impacts from disturbance will be temporary with any harbour porpoise returning to the area once the activities have been
completed. The small scale and temporary nature of the disturbance is not predicted to cause an in-combination impact.

**Shipping**

13.63 There is potential for an in-combination impact with the proposed surveys and existing vessel activity.

13.64 The impacts of shipping on harbour porpoise within the SAC were assessed by BEIS in the Review of Consents HRA (BEIS 2018). The assessment estimated that across the SAC an average of 737 vessel movements were undertaken each day and at any one time harbour porpoises may be being displaced across an area of 369 km² within the SAC. Based on an average density of 0.71 ind./km² harbour porpoise across the SAC, an estimated 262 harbour porpoise may be temporarily displaced; 0.08% of the North Sea Management Unit population.

13.65 The number of vessels operating in the ‘summer’ area during the summer period each year is unknown and therefore it is not possible to calculate the potential daily or seasonal areas of impact required for the threshold approach. Although it is recognised that there will be localised areas of displacement surrounding vessels, the impacts will be very temporary with harbour porpoise predicted to remain in the areas following the departure of the vessel. Consequently, there will be no daily or seasonal disturbance equivalent to those arising from other activities.

**In-combination scenarios**

13.66 The in-combination assessment has been undertaken using outputs from both noise modelling and the threshold approach. Due to the number of current and planned activities being undertaken within or adjacent to the SAC and the level of uncertainty surrounding them, there are a number of potential in-combination scenarios. This section assesses the potential levels of in-combination impact that could arise.

13.67 The timelines for each of the activities identified as having the potential to cause an in-combination impact are presented in Figure 13. There is potential for the greatest daily impact to occur in September.
In-combination Impacts on Southern North Sea SAC: Harbour porpoise.

Noise modelling

13.68 This section assesses the potential in-combination impacts based on the results from noise modelling undertaken for each of the applications.

Physical Injury

13.69 Based on the results from the noise modelling an estimated total of 675 harbour porpoise could be at risk of PTS from proposed activities affecting the Southern North Sea SAC (Table 17). Consequently, it is estimated that up to 0.2% of the North Sea Management Unit could, in theory, be impacted.
Table 17: Estimated number of harbour porpoise at risk of PTS from proposed activities in Southern North Sea SAC without mitigation.

<table>
<thead>
<tr>
<th>Activity</th>
<th>PTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolmount Pile-driving</td>
<td>&lt;1</td>
</tr>
<tr>
<td>ION Seismic Survey</td>
<td>1</td>
</tr>
<tr>
<td>Triton Knoll Pile-driving</td>
<td>2</td>
</tr>
<tr>
<td>Hornsea Pile-driving</td>
<td>2</td>
</tr>
<tr>
<td>BP Endurance survey</td>
<td>3</td>
</tr>
<tr>
<td>Tullow Seabed Clearance</td>
<td>42</td>
</tr>
<tr>
<td>Viking Link Interconnector UXO Clearance</td>
<td>200</td>
</tr>
<tr>
<td>Hornsea UXO Clearance</td>
<td>425</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>675</strong></td>
</tr>
</tbody>
</table>

13.70 For UXO clearance at Hornsea Two and Viking Link Interconnector, both Ørsted and NGVL have committed to incorporating mitigation measures in order to reduce the risk of injury (Ørsted 2018d, 2020, NGVL 2019a,b). Mitigation that may reduce the risk of injury include the use of MMO and the use of ADDs. Under certain conditions both developers may also use ‘scare charges’ and bubble curtains to help reduce the extent of injurious noise. Although the use of mitigation may reduce the risk of auditory injury it is recognised that it is not possible to totally prevent it and both developers have applied for European Protected Species (EPS) licences for both disturbance and injury.

13.71 Both BP and ION have committed mitigation during the use of seismic surveys including following the relevant JNCC guidance (JNCC 2017g), use of MMO’s and PAM (ION 2020a, BP 2020a).

13.72 The mitigation measures presented within the applications will significantly reduce the risk of physical auditory injury to harbour porpoises.

**Disturbance**

13.73 The total number of harbour porpoise predicted to be disturbed by the proposed seabed clearance is between 1,678 and 5,734 individuals, based on a 26 km radius of impact.

13.74 Due to the nature of the sound arising from the detonations, i.e. a number of single discrete events with each blast lasting for a very short duration, harbour porpoise are not predicted to be significantly displaced from an area. Should they occur, any changes in behaviour are predicted to be very short-lived. Existing guidance suggests that disturbance behaviour is not predicted to occur from explosive detonations if undertaken over a short period of time (JNCC 2010), which would be the case during the seabed clearance activities where there may be one subsurface detonation of 70 kg explosive and potential for up to two relatively small seabed detonations of...
8 kg that may be required in order to dislodge any remaining grout. It is also recognised that frequent detonations in a localised area could cause displacement and disturbance and this has been calculated for Viking Link based on a 26 km radius of disturbance (NGVL 2018a) but not been undertaken for clearance of UXO at Hornsea Two.

13.75 In addition to the proposed disturbance from detonations there could be up to 1,356 harbour porpoise disturbed by the consented ION seismic survey and 1,683 individuals disturbed from pile-driving at Hornsea Two.

13.76 The potential impacts from displacement or disturbance will be temporary. If displaced, harbour porpoise will be able to relocate elsewhere and evidence from studies indicate that they will return to the area within 24 hrs of the noise ceasing.

**In-combination threshold approach**

13.77 There are a number of potential scenarios that could be used for assessing the in-combination impacts using the threshold approach:

- ‘Potential worst-case’. This scenario is based on:
  - The maximum area of impact within the SAC from the proposed Tullow seabed clearance, i.e. conductor removal at the Horne and Wren field.
  - The maximum daily length of line and area impacted within the SAC from the proposed Endurance surveys.
  - The maximum area of impact possible within the SAC arising from the ION seismic survey.
  - The maximum area of impact from pile-driving at the Tolmount field.
  - There are five UXO detonations per day all within a 5 km radius at Hornsea Two.
  - It presumes that only one developer is clearing UXO during any one day.
  - All UXO is cleared with the use of a bubble curtain.
  - Pile-driving at Hornsea Two will not occur on the same day UXO clearance.

13.78 This scenario is a precautionary potential worst-case in that for it to arise the maximum area of potential impact from the projects must occur on the same day. The probability of all these activities occurring on one day during September is approximately 1 in 8,100,000 and therefore very remote and unrealistic.

- ‘Realistic worst-case’. Scenario 1 is based on:
  - There will be no overlap with seabed clearance at the Horne and Wren field and the proposed Endurance surveys using airguns but could occur on the same day as
activities are undertaken at Orwell and Cameron fields or when sub-bottom profilers are being used in Survey Area Two of the BP Endurance survey.

- The maximum daily length of line and area impacted within the SAC from the proposed Endurance surveys in Survey Area One.
- The estimated average daily length of line surveyed within the SAC by the proposed ION seismic survey.
- One detonation per day from the Hornsea Two project impacting the maximum possible area within the SAC (Ørsted have completed their main UXO clearance campaign).
- The maximum area of impact from pile-driving at the Tolmount field.
- UXO clearance will not occur on the same day at both Hornsea Two and Viking Links.
- Pile-driving at Hornsea two will not occur on the same day UXO clearance.
- Bubble curtains will be used by developers when undertaking UXO clearance.

- ‘Realistic worst-case’. Scenario 2 is based on:
  - There will be no overlap with seabed clearance activities at the Horne and Wren field and UXO clearance at Hornsea Two but could occur on the same day as activities are undertaken at Orwell and Cameron fields.
  - The maximum daily length of line and area impacted within the SAC from the proposed Endurance surveys.
  - The estimated average daily length of line surveyed within the SAC by the proposed ION seismic survey.
  - The maximum area of impact from pile-driving at the Tolmount field.
  - No more than one detonation per day from the Hornsea Two project (Ørsted have completed their main UXO clearance campaign).
  - UXO clearance will not occur on the same day at both Hornsea Two and Viking Links.
  - Surveys using airguns in BP Endurance Survey Area One will not occur on the same day as UXO clearance at Hornsea Two.
  - Pile-driving at Hornsea two will not occur on the same day as seabed clearance at Horne and Wren field.
  - Bubble curtains will be used by developers when undertaking UXO clearance.

13.79 These scenarios are the most realistic worst-case scenarios as all these activities have a higher probability (albeit still a very remote possibility) of occurring on the same day; each scenario having approximately 1 in 9,000 chance of occurring.
13.80 Based on the potential worst-case scenario the daily threshold could be exceeded during September 2020 (Table 18).

13.81 Based on the likely worst-case scenarios the daily thresholds are either not exceeded, or slightly exceeded under Scenario 2 during September 2020 (Table 19 and Table 20).

13.82 There is considerable uncertainty over the timing of some of the planned activities during September 2020. In particular, it is not known if any further UXO is to be cleared within the SAC at Hornsea Two or at Viking Links. Ørsted have stated that the main UXO clearance at Hornsea Two has been completed (Ørsted Pers. comm. 2020). It is therefore unlikely that further UXO will be identified and extremely improbable that up to five detonations will be cleared within a 5 km radius of each other, as per the potential worst-case scenario. It is therefore realistic and suitably precautionary to assess based on there being only one detonation during any one day in September.

13.83 There will be only one day during which the Tullow seabed clearance activities will cause the maximum impact, which is when detonation for conductor removal is undertaken at the Horne and Wren field.

13.84 The aim of the noise management is to keep below the thresholds as much as possible (JNCC 2020e) and therefore, although there is a risk of the daily threshold being exceeded under certain scenarios the probability of it occurring is small. Consequently, a licence condition will require Tullow to liaise with both BP and Ørsted in order to further minimise the risk of the use of explosive detonations at the Horne and Wren field occurring on the same day as airguns are operating as part of the BP Endurance surveys in Survey Area One or UXO clearance is undertaken by Ørsted at Hornsea Two.

13.85 Under both the potential and realistic worst-case in-combination scenarios the seasonal threshold is not exceeded (Table 21). In the event that activities are delayed the in-combination seasonal threshold during the summer period of 2020 may be further reduced.
Table 18: Potential worst-case in-combination daily threshold (%).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tullow Seabed Clearance at Horne and Wren 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7.4</td>
</tr>
<tr>
<td>BP Endurance 2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.1</td>
</tr>
<tr>
<td>ION Seismic Survey 3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7.9</td>
<td>7.9</td>
</tr>
<tr>
<td>Tolmount Pile-driving 4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>Hornsea Two UXO detonation (5/day) 5</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
</tr>
<tr>
<td>Viking Link UXO detonation (1/day) 6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Triton Knoll Pile-driving 7</td>
<td>0.18</td>
<td>0.18</td>
<td>0.18</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hornsea Two pile driving 8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total %</strong></td>
<td>4.8</td>
<td>4.8</td>
<td>4.8</td>
<td>4.6</td>
<td>12.5</td>
<td>25.8</td>
</tr>
</tbody>
</table>

1 Based on maximum area of impact within the SAC from Horne and Wren seabed clearance of 2,006 km².
2 Based on maximum possible area of impact within the SAC of 1,369 km².
3 Based on maximum possible area of impact within the SAC of 2,136 km².
4 Based on maximum possible area of impact within the SAC of 200 km².
5 Based on maximum number of five detonations undertaken within a 5 km radius of each other, encompassing the widest area within the SAC and the use of bubble curtains impacting an area of 1,257 km².
6 Based on only one developer clearing UXO on any single day as both projects are using the same bubble curtain vessel. Impacts from Hornsea two are greater than those from Viking and therefore Hornsea Two has been used in this assessment.
7 Based on maximum possible area of impact within the SAC of 47.86 km².
8 Pile-driving and UXO clearance at Hornsea Two will not occur on the same day and therefore is not additive. UXO clearance has the greater of the two daily impacts and has therefore been used.

---

Table 19: Likely worst-case in-combination daily threshold – Scenario 1 (%)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tullow Seabed Clearance at Orwell 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>BP Endurance 2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.1</td>
</tr>
<tr>
<td>ION Seismic Survey 3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Tolmount Pile-driving 4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>Hornsea Two UXO detonation 5</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Viking Link UXO detonation (1/day) 6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Triton Knoll Pile-driving 7</td>
<td>0.18</td>
<td>0.18</td>
<td>0.18</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hornsea Two pile driving 8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total %</strong></td>
<td>4.78</td>
<td>4.78</td>
<td>4.78</td>
<td>4.6</td>
<td>9.3</td>
<td>17.9</td>
</tr>
</tbody>
</table>

1 Based on maximum area of impact within the SAC from Orwell field seabed clearance of 735 km².
2 Based on maximum possible area of impact within the SAC of 1,369 km².
3 Based on estimated average daily length of survey line within SAC and an impacted area of 1,805 km².
4 Based on maximum possible area of impact within the SAC of 200 km².
5 Based on one detonation per day with the use of a bubble curtain during August and September as the main UXO clearance campaign has been completed. Impacting an area within the SAC of 707 km².
6 Based on only one developer clearing UXO on any single day as both projects are using the same bubble curtain vessel. Impacts from Hornsea two are greater than those from Viking and therefore Hornsea Two has been used in this assessment.
7 Based on maximum possible area of impact within the SAC of 47.86 km².
8 Pile-driving and UXO clearance at Hornsea Two will not occur on the same day and therefore is not additive. UXO clearance has the greater of the two daily impacts and has therefore been used.
### Table 20: Likely worst-case in-combination daily threshold – Scenario 2 (%).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tullow Seabed Clearance at Horne and Wren</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7.4</td>
</tr>
<tr>
<td>BP Endurance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.1</td>
</tr>
<tr>
<td>ION Seismic Survey</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Tolmount Pile-driving</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>Hornsea Two UXO detonation</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Viking Link UXO detonation (1/day)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Triton Knoll Pile-driving</td>
<td>0.18</td>
<td>0.18</td>
<td>0.18</td>
<td>0</td>
<td>0</td>
<td>2.0</td>
</tr>
<tr>
<td>Hornsea Two pile-driving</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Total %</strong></td>
<td>4.78</td>
<td>4.78</td>
<td>4.78</td>
<td>4.6</td>
<td>6.7</td>
<td>22.0</td>
</tr>
</tbody>
</table>

1. Based on maximum area of impact within the SAC from Horne and Wren seabed clearance of 2,006 km².
2. Based on maximum possible area of impact within the SAC of 1,369 km².
3. Based on estimated average daily length of survey line within SAC and an impacted area of 1,805 km².
4. Based on maximum possible area of impact within the SAC of 200 km².
5. Based on no detonations being undertaken on the same day as seabed clearance at Horne and Wren field.
6. Based on only one developer clearing UXO on any single day as both projects are using the same bubble curtain vessel. Impacts from Hornsea two are greater than those from Viking and therefore Hornsea Two has been used in this assessment.
7. Based on maximum possible area of impact within the SAC of 47.86 km².
8. Based on maximum area of impact from pile-driving being undertaken at Hornsea Two.

### Table 21: In-combination seasonal thresholds %

<table>
<thead>
<tr>
<th>Activity</th>
<th>Summer seasonal threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Potential worst-case</td>
</tr>
<tr>
<td>Tullow Seabed Clearance</td>
<td>0.16</td>
</tr>
<tr>
<td>BP Endurance</td>
<td>0.23</td>
</tr>
<tr>
<td>ION Seismic Survey</td>
<td>2.00</td>
</tr>
<tr>
<td>Tolmount Pile-driving</td>
<td>0.03</td>
</tr>
<tr>
<td>Hornsea Two UXO detonation</td>
<td>0.88</td>
</tr>
<tr>
<td>Viking Link UXO detonation (1/day)</td>
<td>0.38</td>
</tr>
<tr>
<td>Triton Knoll Pile-driving</td>
<td>0.02</td>
</tr>
<tr>
<td>Hornsea Two pile-driving</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3.78</td>
</tr>
</tbody>
</table>

1. Based on maximum area and duration of impact.
2. Based on maximum area and duration of impact.
3. Potential worst-case is based on maximum area of impact possible occurring every day. realistic worst-case is based on the estimated average extent of impact per day over the longest possible period of time.
4. Based on maximum area of impact and duration.
5. Based on maximum 60 detonations over the ‘summer’ period and only one detonation per day each impacting over the maximum possible area.
6. Potential worst-case based on consented 20 UXO detonations. Likely worst-case based on known number of UXO to be cleared following completion of UXO survey campaign. All detonations impact over maximum possible area.
7. Based on maximum area and duration of impact.
8. Based on maximum area and duration of impact.
There are varying levels of confidence in the extent and duration of impacts from each of the activities that could occur within the Southern North Sea SAC which affect the results of this assessment; a summary is presented in Table 22. Any changes in any of the Projects’ schedules or scopes of work would affect both the daily and seasonal threshold based assessments.

**Table 22: Confidence in extent and duration of potential impacts from planned activities within or adjacent to the Southern North Sea SAC between April and September 2020.**

<table>
<thead>
<tr>
<th>Project</th>
<th>Confidence</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tullow Seabed Clearance</td>
<td>Moderate</td>
<td>Moderate certainty activities will be undertaken during ‘summer’ 2020. Moderate to Low certainty on when activities will commence. Very limited evidence on the extent of displacement from detonations. No evidence supporting a 26 km EDR.</td>
</tr>
<tr>
<td>BP Endurance Surveys</td>
<td>High</td>
<td>High to Moderate certainty activities will be undertaken during ‘summer’ 2020. Moderate certainty on when activities will commence. Very High level of certainty that the survey will be undertaken along known pre-determined survey lines. Moderate to Low level of certainty from published evidence on the extent and duration of impacts from small airgun arrays.</td>
</tr>
<tr>
<td>ION Seismic Survey</td>
<td>High</td>
<td>High certainty activities will be undertaken during ‘summer’ 2020. High to Moderate certainty on when activities will commence. Very High level of certainty that the survey will be undertaken along known pre-determined survey lines. High level of certainty from published evidence on the extent and duration of impacts from large airgun arrays.</td>
</tr>
<tr>
<td>Tolmount pile-driving</td>
<td>High</td>
<td>High certainty activities will be undertaken during ‘summer’ 2020. High level of certainty in the area of SAC that could be impacted. High level of certainty from published evidence on the extent and duration of impacts.</td>
</tr>
<tr>
<td>Hornsea Two UXO Clearance</td>
<td>Moderate</td>
<td>Very High certainty activities will be undertaken during ‘summer’ 2020. Very High confidence of regular usage of bubble curtains to mitigate noise impacts. Low certainty on the location and number of UXO required to be detonated. Low certainty on the number of UXO to be cleared per day, ranging anywhere from between one and five. Daily and Seasonal thresholds are based on two opposing scenarios. Both cannot happen. Very limited evidence on the extent of displacement from UXO clearance. No evidence supporting either a 26 km EDR without bubble curtains or 15 km EDR with the use of bubble curtains.</td>
</tr>
<tr>
<td>Viking Link UXO clearance</td>
<td>High</td>
<td>Very High certainty activities will be undertaken during ‘summer’ 2020. Very High certainty in the location and number of UXO required to be detonated. Very limited evidence on the extent of displacement from UXO</td>
</tr>
<tr>
<td>Project</td>
<td>Confidence</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Triton Knoll pile-driving</td>
<td>Very High</td>
<td>Very High certainty activities will be undertaken during ‘summer’ 2020. High level of certainty in the area of SAC that could be impacted. High level of certainty from published evidence on the likely extent and duration of impacts.</td>
</tr>
<tr>
<td>Hornsea Two pile-driving</td>
<td>High</td>
<td>Moderate certainty activities will be undertaken during ‘summer’ 2020. High level of certainty in the area of SAC that could be impacted. High level of certainty from published evidence on the likely extent and duration of impacts.</td>
</tr>
</tbody>
</table>

**In-combination assessment Southern North Sea SAC conclusions**

13.87 Results from noise modelling indicate that up to 675 harbour porpoise could, in theory, be at risk of physical auditory injury in the form of PTS from all planned activities within or adjacent to the SAC. This is 0.2% of the Management Unit population and therefore below the level of 1.7% at which a population level effect is predicted to occur. Mitigation measures that are secured through licence conditions significantly reduce the risk of any harbour porpoise receiving sound levels capable of causing the onset of PTS.

13.88 The results from the threshold approach indicate that the daily thresholds could be exceeded under the potential worst-case scenario. Under realistic worst-case scenarios either the threshold will not be exceeded (Scenario 1) or potentially only marginally exceeded (Scenario 2). The applicant will be required to liaise with both BP and Ørsted to ensure that the proposed explosive detoantions at Horne and Wren do not occur on the same day as either the proposed BP Endurance surveys using airguns in Survey Area One, or if this is the case, that Ørsted are not undertaking UXO clearance on the same day. This does not affect planned activities at Orwell or Cameron fields.

13.89 This does not affect the already consented UXO clearance or pile-driving activities being undertaken by Ørsted at Hornsea Two; the activities for which have previously been assessed and approved.

13.90 The seasonal threshold will not be exceeded under any scenario.

13.91 Based on the best available information and supported by results from noise modelling and the threshold approach, BEIS is satisfied that the proposed Tullow seabed clearance activities in-combination with other plans or projects will not have an adverse effect upon the integrity of the Southern North Sea SAC with respect to harbour porpoise.
14 MITIGATION

14.1 The following section presents a summary of the planned mitigation submitted by the applicant that will reduce the risk of an adverse effect occurring. Tullow have committed to following the JNCC guidelines *JNCC guidelines for minimising the risk of injury to marine mammals from using explosives* (JNCC 2010). This will include:

- Adherence to the JNCC guidelines for minimising the risk of disturbance to marine mammals from using explosives;
- Tullow will use trained Marine Mammals Observers (MMO) to conduct visual monitoring for marine mammals;
- The MMOs will have access to Passive Acoustic Monitoring (PAM) equipment throughout the operations;
- Acoustic Deterrent Devices will be used prior to detonation to discourage marine mammals from entering the vicinity;
- A suitable mitigation zone, the area where mitigation measures must be put in place to ensure that injury is avoided, with a radius of one kilometre will be established around the vessel;
- Prior to detonation, a visual watch, known as the ‘pre-detonation search’ will be carried out within the mitigation zone. The pre-detonation search should continue until the MMO advises that no marine mammals can be observed within the mitigation zone, and the detonation can begin;
- Explosive detonations will not be undertaken within 20 minutes of a marine mammal being detected within the mitigation zone. If a marine mammal is sighted, the animal(s) should be monitored until it moves out of range;
- Wherever practicable, the sequence and order of the detonations should be controlled, with the aim of reducing the environmental impact;
- A post detonation search will be conducted within the mitigation zone by the MMO to look for any evidence of injury to marine life, including fish kills. Any unusual events will be recorded.

14.2 In addition to the mitigation proposed by the applicant, a licence condition will require the applicant to liaise with BP and Ørsted in order to minimise the risk of explosive detonations at the Horne and Wren field occurring on the same day as airguns are being used within the Endurance Survey Area One and UXO clearance is undertaken by Ørsted at Hornsea Two during September. This will be secured by a condition attached to the licence that may be issued by BEIS.
15 CONCLUSIONS

15.1 The Secretary of State has carefully considered all of the information available in order to undertake a Habitats Regulations Assessment. He considers the proposed seabed clearance activities at the Horne and Wren, Orwell and Cameron fields to have the potential to cause a Likely Significant Effect alone and in-combination with other plans or projects on the qualifying features of the Southern North Sea SAC but not on the Dogger Bank SAC.

15.2 The Secretary of State has undertaken an Appropriate Assessment in respect of the site’s Conservation Objectives to determine whether the project, either alone or in-combination with other plans or projects, will result in an adverse effect on integrity.

15.3 The Secretary of State has undertaken a robust assessment using all of the information available to him.

15.4 Having considered all of the information available to him the Secretary of State has concluded that the proposed seabed clearance activities will not have an adverse effect on the integrity of any European designated site either alone or in-combination with other plans or projects.

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Date: 7 September 2020
16 REFERENCES


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