

FS006982

REPORT OF THE MARINE LICENCE VETTING COMMITTEE (MLVC)

APPENDIX 1: CLARIFICATIONS REQUESTED AND RECEIVED.

CLARIFICATIONS REQUESTED

The applicant considered that there was no potential for significant effect from the proposed surveys, and that Appropriate Assessment was not required.

It is not considered that the applicant has provided sufficient information to conclude that, alone or in-combination with other plans or projects, there is no likely significant effect on Natura 2000 sites from the survey activities.

Further information is requested from the applicant under Regulation 42(3)(b) of the *European Communities (Birds and Natural Habitats) Regulations 2011* (as amended), covering:

- On the potential sources of likely significant effect on qualifying features of SPAs, in particular physical presence/disturbance from vessels and potential underwater noise-related effects, and whether this consideration alters the conclusions of the applicant's screening.

⁵ <https://www.gov.ie/en/foreshore-notice/5d5d9-sse-renewables-ceptic-sea/>

Appropriate Assessment Screening

- Explicit reference to what the sources of likely significance are, which site features and related sites these are considered against, and relate this to specific evidence to discount LSE, where appropriate.
- How the conservation objectives of relevant sites have been taken into account.
- On how the 15km site selection criterion was defined. The applicant should give further consideration of the potential for mobile species to interact with the survey area and present additional evidence to support the basis of their site selection, and whether additional sites should be considered at the LSE stage. At least the following SPAs should be addressed in the screening; Saltee Islands SPA (including for gannet, lesser black-backed gull, herring gull, kittiwake, fulmar, guillemot, razorbill, puffin), Old Head of Kinsale SPA (kittiwake) and, in a transboundary context, Grassholm SPA (gannet) and Skomer, Skokholm and the Seas of Pembrokeshire SPA (Manx shearwater). With respect to Annex II species, a number of sites have been identified that should be addressed in the screening:
 - Rockabill to Dalkey Island SAC, Roaringwater Bay and Islands SAC, Blasket Islands SAC, Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC, North Anglesey Marine / Gogledd Môn Forol SAC, North Channel SAC, West Wales Marine / Gorllewin Cymru Forol SAC (harbour porpoise).
 - Cardigan Bay/ Bae Ceredigion SAC, Pen Llŷn a'r Sarnau/ Lleyn Peninsula and the Sarnau SAC (bottlenose dolphin).
 - Lleyn Peninsula and the Sarnau SAC (grey seal)
 - Lower River Suir SAC, Blackwater River SAC (twaite shad)
- Which sources of potential effects from the proposed survey activities could act in-combination with other plans and projects, and whether they present sources of LSE for the sites and features identified.
- The seasonal timings of the survey as indicated in Table 2.1 are assumed to be correct for the purposes of this review, however, this must be confirmed by the applicant and a revised schedule provided.
- On how in-combination effects were addressed as part of the AA screening assessment.

CLARIFICATIONS RECEIVED

- The seasonal timings of the survey as indicated in Table 2.1 are assumed to be correct for the purposes of this review, however, this must be confirmed by the applicant and a revised schedule provided.*

Table 1 provides an update of the proposed survey schedule. It is worth noting that a Foreshore Licence is not required for Items 4 and 5.

Table 1: Updated survey schedule

Item No.	Activity	Timings as per Foreshore Application (May 2019)	Revised Timings (March 2021)	Reason for change
1	Geophysical Surveys	Spring 2020 (3 month campaign mid-April to Mid-July)	Spring / Summer 2021 (3 month period from issue of licence to September 2021 OR 3 month period from March to September 2022 depending on vessel availability.)	It is highly likely that the original seasonal timings will be retained however additional flexibility is now required due to missing the 2020 survey window and to ensure the data can be collected as soon as possible to input to the EIAR.
2	Geotechnical Surveys	Summer 2020 (2 months August – September) Completion campaign Spring/Summer 2021 (4-5 months)	Spring / Summer 2021 (2 months August - September 2021 OR 2 month period from March to September 2022, depends on vessel availability). Completion campaign Spring/Summer 2024 (4-5 months).	
3	Benthic sampling & Intertidal sampling	Summer 2019 (3 years duration, seasonal)	May to September 2021, 2022, 2023 (all attempts will be made to complete surveying in 1 of the above years however a second survey period may be required)	Updated survey window to reflect guidance (DCCAE, 2017) ¹
4	Fisheries and shellfish survey	Summer 2019 (3 years duration, seasonal)	From issue of licence to December 2023. Exact timing will be species specific.	
5	Marine mammals, reptiles and seabirds	Summer 2019 (3 years duration, seasonal)	Continue to end 2023	
6	Marine mammal acoustics		From issue of licence to December 2023.	
7	Meteocean	12-36 months with servicing anticipated to take place every 6-12 months.	Anticipated to commence Q3/Q4 2021 (depending on equipment availability), duration between 12-36 months, anticipated end date Q4 2024. Servicing anticipated to take place every 6-12 months.	

¹ DCCAE. 2017. Guidance on EIA and NIS preparation for offshore renewable energy projects. Report prepared for the Environmental Working Group of the Offshore Renewable Energy Steering Group and the DCCAE by MacCabe Durney Barnes.

- **On how the 15km site selection criterion was defined**

15km was selected as the ZOI based on the guidance for planning authorities provided by NPWS in 2010 (DEHLG, 2010²) which was derived from UK guidance (Scott Wilson *et al.*, 2006³) and it has become the norm in Ireland (DAFM, 2019⁴). It is noted that it may be necessary to extend the zone to include for further consideration based on a case-by-case basis. Two SPAs at >15km distance were also examined in the screening assessment on the following basis:

- Keeragh Islands SPA (IE004118). This site is designated for breeding cormorants and is located 16km to the northeast of the proposed survey area. It was included due to its proximity as it is one of the largest breeding colonies in Ireland.
- Saltee Islands SPA (IE004002). This site is designated for gannet, lesser black-backed gull, herring gull, kittiwake, fulmar, guillemot, razorbill, puffin, cormorant and shag. It is located 23km to the northeast of the proposed survey area and was included due to its proximity as it is an internationally important site holding over 20,000 seabirds.

With regards to SACs, a 50km upper limit was selected and this incorporated the Saltee Islands SAC designated for grey seals. The 50km upper limit for marine mammals was selected based on the scale and scope of the project including the localised range of the acoustic signal emanating from the survey equipment. Marine mammals foraging from locations beyond 50km were examined in the Marine Mammal Risk Assessment. A 15km ZOI was determined to be appropriate for all other SAC QI's given the scale and scope of the proposed surveys. Notwithstanding this rationale, the additional Natura 2000 sites which were requested to be included can be seen in the Tables 2, 3 and 5 below.

- **How the conservation objectives of relevant sites have been taken into account**

The Conservation Objectives (COs) have been incorporated into the Tables 2, 3 and 5 below.

- **On the potential sources of likely significant effect on qualifying features of SPAs, in particular physical presence/disturbance from vessels and potential underwater noise-related effects, and whether this consideration alters the conclusions of the applicant's screening.**

The impacts assessed with respect to birds are physical disturbance and underwater noise.

Physical disturbance is assessed in Table 2 in relation to the SPAs and their Special Conservation Interests (SCI) and underwater noise is discussed in detail below.

Deeper-diving species which spend longer periods of time underwater (e.g. auks) may be most at risk of exposure to underwater noise, but all species which routinely submerge in pursuit of prey and benthic feeding opportunities in marine and estuarine habitats (i.e. also including divers *Gavia* spp., grebes, diving ducks, cormorant, shag, gannet, and Manx shearwater) may be exposed to anthropogenic noise.

Most diving species have a hearing range of approximately 500Hz to 4kHz (Crowell, 2014⁵; Crowell *et al.* 2015⁶; Hansen *et al.* 2017⁷) and as a result the very high frequency survey activities (multibeam and side scan) and very low frequency activities (vibrocoring, DP vessel) would be inaudible to them. The low frequency (300Hz – 12kHz) sub-bottom profiler (pinger/sparker) noise would be within their hearing range while the noise from the borehole drilling (1-600Hz) would be towards their lower hearing limit.

As highlighted by the reviewer, little evidence exists of impacts to diving birds from seismic and other acoustic survey activities. McCauley (1994)⁸ inferred that individual penguins (possible proxy for auk species) might be adversely affected by low frequency seismic noise but only in close proximity to the source. With the exception

² Department of Environment, Heritage and Local Government. 2010. Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Revision 11th February 2010.

³ Scott Wilson, Levett-Therivel Sustainability Consultants, Treweek Environmental Consultants and Land Use Consultants. 2006. *Appropriate Assessment of plans*. <http://www.landuse.co.uk/Downloads/AppropriateAG.pdf>

⁴ DAFM. 2019. Appropriate Assessment Procedure Guidance Note & iFORIS SOP for DAFM Forestry Inspectors WORKING DOCUMENT v.05Nov19.

⁵ Crowell, S. 2014. In-air and underwater hearing in ducks. Doctoral dissertation, University of Maryland.

⁶ Crowell, S.E., Wells-Berlin, A.M., Carr, C.E., Olsen, G.H., Therrien, R.E., Yannuzzi, S.E. & D.R. Ketten. 2015. A comparison of auditory brainstem responses across diving bird species. *Journal of Comparative Physiology A* **201**: 803-815.

⁷ Hansen, K.A., Maxwell, A., Siebert, U., Larsen, O.N. & M. Wahlberg. 2017. Great cormorants (*Phalacrocorax carbo*) can detect auditory cues while diving. *The Science of Nature* **45**: <https://doi.org/10.1007/s00114-017-1467-3>

⁸ McCauley, R.D. 1994. Seismic surveys. In: Swan, JM, Neff, JM and Young, PC (Eds) *Environmental implications of offshore oil and gas developments in Australia - The findings of an independent scientific review*. Australian Petroleum Exploration Association, Sydney, NSW. 696pp.

of Pichegru *et al.* (2017)⁹, which relates to penguins, there are no published reports of changes in abundance or distribution of diving birds concurrent with seismic or other acoustic survey activity. The Pichegru *et al.* (2017) study showed displacement of African penguins during seismic activity, however reverted to normal foraging behaviour after cessation of activities. Stemp (1985)¹⁰ showed no significant difference in abundance of fulmar, kittiwake and thick-billed murre (Brünnich's guillemot) when comparing periods of shooting and non-shooting during seismic surveys.

It is also noted that mortality of seabirds has not been reported during extensive seismic operations in the North Sea and elsewhere which could potentially be attributed to flushing disturbance from vessel activity associated with the seismic operations. Seabird responses to approaching vessels are highly variable (e.g. Fliessbach *et al.* 2019¹¹), however, flushing disturbance would be expected to displace most diving seabirds from close proximity to the survey vessel and any towed equipment, and may limit their exposure to the highest sound pressures generated. Scoter, divers and cormorant species are likely to be less impacted due to higher sensitivity to visual disturbance (Garthe & Hüppop, 2004¹²).

Underwater noise generated by pile driving can also be used to study the impacts of underwater noise on diving seabirds. One such study carried out at an offshore windfarm development in Dutch North Sea waters concluded that, due to the large amount of surface activity associated with construction of an OWF, any birds present in the area would have been disturbed and fled the area before piling operations commenced (Leopold & Camphuysen, 2009¹³). The study also suggested that any remaining birds would most likely have been scared off from mitigation measures including the use of pingers, and soft start procedures to piling, which would make it unlikely that sensitive species would be close enough to the noise source to cause any physiological damage.

In summary, there is evidence that diving seabirds are receptive to underwater noise and may use this to aid in foraging / predator avoidance behaviours. There is also evidence that if in very close proximity to loud underwater noise, injury and mortality may occur. However, it has been stated that the likelihood of a noise sensitive diving bird being in the vicinity of a noise generating operation is very low due to the surface activity associated with such operations disturbing the birds prior to commencement of noise generation (BEIS, 2019¹⁴; Fliessbach *et al.* 2019¹¹, Garthe & Hüppop, 2004¹²; Leopold & Camphuysen, 2009¹³). Therefore, given the very low likelihood of interaction between the sound source and a diving bird due to the relatively short exposure time, the temporary and short-term nature of the survey work, the mobile nature of the surveys and the displacement of most diving species due to flushing disturbance, it was determined that underwater noise would not have a LSE on diving seabirds in the vicinity including those which may forage in the area (cormorant, shag, gannet, Manx shearwater, fulmar, guillemot, razorbill, puffin, red-breasted merganser¹⁵).

With regards to shipping activity within the area, a preliminary scoping exercise was carried out by Anatec¹⁶ as part of the EIA process. This assessment identified an average of between 20 and 30 unique vessels movements per day through the site, with a maximum of 66 vessels recorded in one day. The main shipping channel in and out of Waterford Harbour passes through the eastern portion of the site, while the route from Waterford to Cork passes through the site and the main shipping channel for vessels transiting the Celtic Sea between the Atlantic and Irish Seas passes just to the south of the site. The vast majority of vessels recorded were fishing vessels (43%). It is important to note that the fishing vessels recorded were predominantly those >15m that are required to carry AIS. Vessels of this size make up only 10% of the inshore fishing fleet and

⁹ Pichegru, L., Nyengera, R., McInnes, A.M. & P. Pistorius. 2017. Avoidance of seismic survey activities by penguins. *Scientific Reports* 7: 16305.

¹⁰ Stemp, R. 1985. Observations on the effects of seismic exploration on seabirds. In: Greene GD, Engelhardt FR & Paterson RJ (Eds) *Proceedings of the workshop on effects of explosives use in the marine environment*. Jan 29-31, 1985, Halifax, Canada.

¹¹ Fliessbach, K.L., Borkenhagen, K., Guse, N., Markones, N., Schwemmer, P. & S. Garthe. 2019. A Ship Traffic Disturbance Vulnerability Index for Northwest European Seabirds as a Tool for Marine Spatial Planning. *Frontiers in Marine Science* 6: 192, doi: 10.3389/fmars.2019.00192.

¹² Garthe, S. & O. Hüppop. 2004. Scaling possible adverse effects of marine windfarms on seabirds: developing and applying a vulnerability index. *Journal of Applied Ecology* 41: 724-734.

¹³ Leopold M.F. & C.J. Camphuysen. 2009. Local birds in and around the Offshore Wind Park Egmond aan Zee (OWEZ) (T-1). NoordzeeWind Rapport OWEZ R 221 T1 20080201

¹⁴ BEIS. 2019. Record of the Habitats Regulations Assessment undertaken under regulation 5 of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended). Spectrum Seismic Survey. Department of Business, Energy and Industry Strategy.

¹⁵ Note that red-breasted merganser is an overwintering species, listed as an SCI of Dungarvan Harbour SPA. As discussed in Table 3, there will be no temporal overlap between the proposed surveys and the presence of overwintering species, therefore there is no pathway to impact for this diving species.

¹⁶ Anatec. 2020. Shipping and Navigation Scoping / Preliminary Hazard Analysis North Celtic Sea Offshore Wind Farm. Unpublished report prepared by Anatec Ltd.

therefore the actual number of fishing vessels using the site is considerably higher. It is in the context of these baseline shipping levels that it was determined that the disturbance to seabirds by the addition of a very small number of survey vessels would be insignificant as it would be temporary in nature and comparable to that experienced due to existing shipping traffic. Species specific sensitivities to shipping traffic are discussed in Table 2.

Table 2: SPA Birds LSE Table

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
Saltee Islands SPA (IE004002)	Fulmar (<i>Fulmarus glacialis</i>) [A009] breeding	Maintain Favourable Conservation Condition (FCC) ¹⁷ <ul style="list-style-type: none"> • No Significant Decline (NSD) in Apparently of Occupied Nests (AONs) • NSD in productivity rate • NSD in distribution of breeding colonies • NSD in prey biomass availability • No Significant Increase (NSI) in barriers to connectivity • NSI in disturbance at breeding site • NSI in disturbance at marine areas immediately adjacent to colony (within 2km of breeding colony) 	23km northeast of proposed survey area	Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance in the marine area immediately adjacent to the colony. Fulmar and gannet display very low and low sensitivity respectively to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹) and therefore disturbance to foraging individuals from survey vessels will not have a LSE on this species. As there will be no LSE, the COs of this site will not be undermined (i.e. no decline in AON, productivity, breeding colony distribution, prey biomass and no increases in barriers to connectivity, disturbance at breeding site or disturbance in the marine area immediately adjacent to the colony).
	Gannet (<i>Morus bassanus</i>) [A016] breeding	Maintain FCC <ul style="list-style-type: none"> • NSD in AONs • NSD in productivity rate • NSD in distribution of breeding colonies • NSD in prey biomass availability • NSI in barriers to connectivity • NSI in disturbance at breeding site 		Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. While cormorant display high sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹), the addition of a small number of vessels to the existing traffic levels would be insignificant and not result in a LSE on foraging cormorants. In addition the vast majority of the site is beyond the max. foraging range of cormorants (35km) ²⁰ . As there will be no LSE, the COs of this site will not be undermined (i.e. no decline in AON, productivity, breeding colony distribution, prey biomass and no increases in barriers to connectivity and disturbance at breeding site).
	Cormorant (<i>Phalacrocorax carbo</i>) [A017]	Maintain FCC <ul style="list-style-type: none"> • NSD in AONs • NSD in productivity rate • NSD in distribution of breeding colonies • NSD in prey biomass availability • NSI in barriers to connectivity • NSI in disturbance at breeding site 		Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. Shag display moderate sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ;
	Shag (<i>Phalacrocorax aristotelis</i>) breeding [A018]			Physical Disturbance	No	

¹⁷ NPWS. 2011. Conservation Objectives: Saltee Islands SAC 000707 and Saltee Islands SPA 004002. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

¹⁸ Furness, R.W., Wade, H.M. & E.A. Masden. 2012. Assessing vulnerability of marine bird populations to offshore wind farms. *Journal of Environmental Management* **119**: 56-66

¹⁹ Bradbury, G., Trinder, M., Furness, R. W., Banks, A. N., Caldow, R. W. G. & D. Hume. 2014. Mapping Seabird Sensitivity to Offshore Wind Farms. *PLoS ONE* **9(9)**: e106366. doi:10.1371/journal.pone.0106366

²⁰ Thaxter, C.B., Lascelles, B., Sugar, K. Cook, A.S.C.P. Roos, S., Bolton, M., Langston, R.H.W. & N.H.K. Burton. 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. *Biological Conservation* **156**: 53-61.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
						Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹), however the proposed survey area is beyond the max. foraging range of shags (17km) ²⁰ . As there will be no LSE, the COs of this site will not be undermined (i.e. no decline in AON, productivity, breeding colony distribution, prey biomass and no increases in barriers to connectivity and disturbance at breeding site).
	Lesser Black-backed Gull (<i>Larus fuscus</i>) [A183]			Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. Lesser black-backed gulls, herring gulls and kittiwakes display low sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹) and therefore disturbance to foraging individuals from survey vessels will not have a LSE on this species. As there will be no LSE, the COs of this site will not be undermined (i.e. no decline in AON, productivity, breeding colony distribution, prey biomass and no increases in barriers to connectivity and disturbance at breeding site).
	Herring Gull (<i>Larus argentatus</i>) [A184]			Physical Disturbance	No	Breeding colony >1km from survey activities therefore there will be no disturbance in the marine area adjacent to the colony. Guillemots, razorbills and puffin display moderate sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹), however the addition of a small number of vessels to the existing traffic levels would be insignificant and not result in a LSE on foraging guillemots, razorbills or puffins. As there will be no LSE, the COs of this site will not be undermined (i.e. no decline in adult abundance, productivity, breeding colony distribution, prey biomass and no increases in barriers to connectivity, disturbance at breeding site or disturbance in the marine area immediately adjacent to the colony).
	Kittiwake (<i>Rissa tridactyla</i>) [A188] breeding	Maintain FCC • NSD in abundance of individual adult • NSD in productivity rate • NSD in distribution of breeding colonies • NSD in prey biomass availability • NSI in barriers to connectivity • NSI in disturbance at breeding site • NSI in disturbance at marine areas immediately adjacent to colony (within 1km of breeding colony)		Physical Disturbance	No	Breeding colony >1km from survey activities therefore there will be no disturbance in the marine area adjacent to the colony. Guillemots, razorbills and puffin display moderate sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹), however the addition of a small number of vessels to the existing traffic levels would be insignificant and not result in a LSE on foraging guillemots, razorbills or puffins. As there will be no LSE, the COs of this site will not be undermined (i.e. no decline in adult abundance, productivity, breeding colony distribution, prey biomass and no increases in barriers to connectivity, disturbance at breeding site or disturbance in the marine area immediately adjacent to the colony).
	Guillemot (<i>Uria aalge</i>) [A199] breeding			Physical Disturbance	No	
	Razorbill (<i>Alca torda</i>) [A200] breeding			Physical Disturbance	No	
	Puffin (<i>Fratercula arctica</i>) [A204] breeding	Maintain FCC • NSD in abundance of Apparently of Occupied Burrow (AOB) • NSD in productivity rate • NSD in distribution of breeding colonies • NSD in prey biomass availability • NSI in barriers to connectivity • NSI in disturbance at breeding site		Physical Disturbance	No	

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
		<ul style="list-style-type: none"> NSI in disturbance at marine areas immediately adjacent to colony (within 1km of breeding colony) Absent/under control mammalian predators 				
Tramore Back Strand SPA (IE004027)	Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A046]	Maintain FCC ²¹	300m east of potential Cable Corridor	Physical Disturbance	No	SPA is for overwintering species (October to March). As the survey work is proposed to run from April to September there will be no temporal overlap between the sensitive overwintering period and the survey works and therefore no pathway for LSE. If a survey opportunity arises and is planned for March, the survey works would be restricted to the offshore area and far in excess of the standard displacement buffer of 2km (JNCC, 2017 ²² , Fliessbach <i>et al.</i> , 2019 ¹¹), and as above there would be no pathway for LSE. As there is no pathway for LSE, the COs of this site will not be undermined (i.e. population will be maintained and no decline in range, timing or intensity of use of area).
	Golden Plover (<i>Pluvialis apricaria</i>) [A140]	<ul style="list-style-type: none"> Stable/Increasing population trend NSD in range, timing or intensity of use of area 				
	Grey Plover (<i>Pluvialis squatarola</i>) [A141]					
	Lapwing (<i>Vanellus vanellus</i>) [A142]					
	Dunlin (<i>Calidris alpina</i>) [A149]					
	Black-tailed Godwit (<i>Limosa limosa</i>) [A156]					
	Bar-tailed Godwit (<i>Limosa lapponica</i>) [A157]					
	Curlew (<i>Numenius arquata</i>) [A160]					
	Wetland and Waterbirds [A999]	<ul style="list-style-type: none"> Maintain FCC Stable habitat area 				
Dungarvan Harbour SPA (IE004032)	Great Crested Grebe (<i>Podiceps cristatus</i>) [A005]	Maintain FCC ²³	65m southwest of potential Cable Corridor	Physical Disturbance	No	SPA is for overwintering species (October to March). As the survey work is proposed to run from April to September there will be no temporal overlap between the sensitive overwintering period and the survey works and therefore no pathway for LSE. If a survey opportunity arises and is planned for March, the survey works would be restricted to the offshore area and far in excess of the standard displacement buffer of 4km for divers and ducks (JNCC, 2017 ²² , Fliessbach <i>et al.</i> , 2019 ¹¹), and as above there would be no pathway for LSE. As there is no pathway for LSE, the COs of this site will not be undermined (i.e. population will be maintained and no decline in range, timing or intensity of use of area).
	Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A046]	<ul style="list-style-type: none"> Stable/Increasing population trend NSD in range, timing or intensity of use of area 				
	Shelduck (<i>Tadorna tadorna</i>) [A048]					
	Red-breasted Merganser (<i>Mergus serrator</i>) [A069]					

²¹ NPWS. 2013. Conservation Objectives: Tramore Back Strand SPA 004027. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

²² JNCC. 2017. Joint SNCB Interim Displacement Advice Note Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments January 2017. <https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/Joint-SNCB-Interim-Displacement-AdviceNote-2017-web.pdf>

²³ NPWS. 2012. Conservation Objectives: Dungarvan Harbour SPA 004032. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
	Oystercatcher (<i>Haematopus ostralegus</i>) [A130]					undermined (i.e. population will be maintained and no decline in range, timing or intensity of use of area).
	Golden Plover (<i>Pluvialis apricaria</i>) [A140]					
	Grey Plover (<i>Pluvialis squatarola</i>) [A141]					
	Lapwing (<i>Vanellus vanellus</i>) [A142]					
	Knot (<i>Calidris canutus</i>) [A143]					
	Dunlin (<i>Calidris alpina</i>) [A149]					
	Black-tailed Godwit (<i>Limosa limosa</i>) [A156]					
	Bar-tailed Godwit (<i>Limosa lapponica</i>) [A157]					
	Curlew (<i>Numenius arquata</i>) [A160]					
	Redshank (<i>Tringa totanus</i>) [A162]					
	Turnstone (<i>Arenaria interpres</i>) [A169]					
	Wetland and Waterbirds [A999]	Maintain FCC • Stable habitat area				
Bannow Bay SPA (IE004033)	Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A046]	Maintain FCC ²⁴ • Stable/Increasing population trend • NSD in range, timing or intensity of use of area	10km northeast of potential Cable Corridor	Physical Disturbance	No	SPA is for overwintering species (October to March). As the survey work is proposed to run from April to September there will be no temporal overlap between the sensitive overwintering period and the survey works and therefore no pathway for LSE. If a survey opportunity arises and is planned for March, the survey works would be restricted to the offshore area and far in excess of the standard displacement buffer of 4km for divers and ducks (JNCC, 2017 ²² , Fliessbach <i>et al.</i> , 2019 ¹¹), and as above there would be no pathway for LSE. As there is no pathway for LSE, the COs of this site will not be undermined (i.e. population will be maintained and no decline in range, timing or intensity of use of area).
	Shelduck (<i>Tadorna tadorna</i>) [A048]					
	Pintail (<i>Anas acuta</i>) [A054]					
	Oystercatcher (<i>Haematopus ostralegus</i>) [A130]					
	Golden Plover (<i>Pluvialis apricaria</i>) [A140]					
	Grey Plover (<i>Pluvialis squatarola</i>) [A141]					
	Lapwing (<i>Vanellus vanellus</i>) [A142]					

²⁴ NPWS. 2012. Conservation Objectives: Bannow Bay SPA 004033. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
	Knot (<i>Calidris canutus</i>) [A143] Dunlin (<i>Calidris alpina</i>) [A149] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A157] Curlew (<i>Numenius arquata</i>) [A160] Redshank (<i>Tringa totanus</i>) [A162]					
	Wetland and Waterbirds [A999]	Maintain FCC • Stable habitat area				
Keeragh Islands SPA (IE004118)	Cormorant (<i>Phalacrocorax carbo</i>) [A017]	Maintain/Restore FCC ²⁵ • Population maintaining itself on a long-term basis as a viable component of its natural habitats • the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and • there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.	16km northeast of potential Cable Corridor	Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. While cormorant display high sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹), the addition of a small number of vessels to the existing traffic levels would be insignificant and not result in a LSE on foraging cormorants. In addition, the vast majority of the site is beyond the max. foraging range of cormorants (35km) ²⁰ . As there will be no LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).
Mid Waterford Coast SPA (IE004193)	Herring Gull (<i>Larus argentatus</i>) [A184]	Maintain/Restore FCC ²⁶ • Population maintaining itself on a long-term basis as a viable component of its natural habitats • the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and • there is, and will probably continue to be, a sufficiently	Borders potential Cable Corridor	Physical Disturbance	No	Herring gulls display low sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹) and therefore disturbance from the physical presence of a small number of survey vessels over a short time period will not have a LSE on breeding/nesting/foraging gulls in the area. As there will be no LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).

²⁵ NPWS. 2020. Conservation objectives for Keeragh Islands SPA [004118]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht.

²⁶ NPWS. 2020. Conservation objectives for Mid-Waterford Coast SPA [004193]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
	Peregrine (<i>Falco peregrinus</i>) [A103]	large habitat to maintain its populations on a long-term basis.		Physical Disturbance	No	Land-based birds therefore no pathway for LSE on foraging birds. Nest on grassy or earthen cliff ledge or other inaccessible undisturbed locations. Peregrines are well known to nest successfully in active quarries (e.g. Ruddock & Whitfield, 2007) ²⁷ with high levels of disturbance. There is the potential for nesting birds <2km from survey activities therefore potential pathway for LSE. However, the cable route geotechnical ²⁸ surveys are planned for Aug-September period outside the peregrine breeding season (March-July; Wilson-Parr & O'Brien, 2018) ²⁹ and as a result there would be no LSE. If a survey opportunity arises and is planned for March-July, the survey works would be restricted to the areas >2km from nesting sites and as a result there would be no pathway for LSE. As there is no pathway for LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).
	Chough (<i>Pyrrhocorax pyrrhocorax</i>) [A346]	Physical Disturbance		No	Land-based birds therefore no pathway for LSE on foraging birds. Nest in caves or crevasses along the coast. There is the potential for nesting birds <2km from survey activities therefore pathway for LSE. However, the cable route geotechnical ²⁵ surveys are planned for Aug-September period outside the chough breeding season (April-June; Gray <i>et al.</i> , 2003 ³⁰) and as a result there would be no LSE. If a survey opportunity arises and is planned for April-June, the survey works would be restricted to the areas >2km from nesting sites and as a result there would be no pathway for LSE. As there is no pathway for LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).	
	Cormorant (<i>Phalacrocorax carbo</i>) [A017]	Physical Disturbance		No	There is the potential for nesting birds <2km from survey activities therefore pathway for LSE. However, the cable route geotechnical ²⁸ surveys are planned for Aug-September period outside the cormorant breeding season	

²⁷ Ruddock M. & D.P. Whitfield. 2007. *A Review of Disturbance Distances in Selected Bird Species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage

²⁸ Given the stationary nature of these activities albeit for a very short timeframe, geotechnical surveys are considered to cause more disturbance than the geophysical surveys where the vessel is moving continually.

²⁹ Wilson-Parr, R. & I. O'Brien. (Eds.) (2018) *Irish Raptor Study Group Annual Review 2017*.

³⁰ Gray, N., Thomas, G., Trewby, M. & S. Newton. 2003. *Irish Birds*. Birdwatch Ireland.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
						(March-July; Cummins <i>et al.</i> 2019 ³¹) and as a result there would be no LSE. If a survey opportunity arises and is planned for March-July, the survey works would be restricted to the areas >2km from nesting sites and as a result there would be no pathway for LSE. Cormorant display high sensitivity to disturbance from vessel traffic and associated activities and moderate habitat specialisation (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹), however, the addition of a small number of vessels to the existing traffic levels would be insignificant and not result in a LSE on foraging cormorants. As there will be no LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).
Helwick Head to Ballyquin SPA (IE004192)	Herring Gull (<i>Larus argentatus</i>) [A184]	<p>Maintain/Restore FCC³²</p> <ul style="list-style-type: none"> Population maintaining itself on a long-term basis as a viable component of its natural habitats the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. 	4.5km west of proposed survey area	Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. Herring gulls and kittiwakes display low sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹) and therefore disturbance to foraging individuals from survey vessels will not have a LSE on this species. As there will be no LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).
	Kittiwake (<i>Rissa tridactyla</i>) [A188]			Physical Disturbance	No	Land-based birds therefore no pathway for LSE on foraging birds. Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. As there will be no LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).
	Peregrine (<i>Falco peregrinus</i>) [A103]			Physical Disturbance	No	
	Chough (<i>Pyrrhocorax pyrrhocorax</i>) [A346]			Physical Disturbance	Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. While cormorant display high sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹), the addition of a small number	
	Cormorant (<i>Phalacrocorax carbo</i>) [A017]			Physical Disturbance		No

³¹ Cummins, S., Lauder, C., Lauder, A. & T.D. Tierney. 2019. The Status of Ireland's Breeding Seabirds: Birds Directive Article 12 Reporting 2013 – 2018. *Irish Wildlife Manuals*, No. 114. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland

³² NPWS. 2020. Conservation objectives for Helwick Head to Ballyquin SPA [004192]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
						of vessels to the existing traffic levels would be insignificant and not result in a LSE on foraging cormorants. As there will be no LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).
Old Head of Kinsale SPA (IE4021)	Kittiwake (<i>Rissa tridactyla</i>) [A188]	Maintain/Restore FCC ³³ <ul style="list-style-type: none"> Population maintaining itself on a long-term basis as a viable component of its natural habitats the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. 	78km southwest of proposed survey area	Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance at the breeding site. Kittiwakes display low sensitivity to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness et al., 2013 ¹⁸ ; Bradbury et al., 2014 ¹⁹ ; Fliessbach et al., 2019 ¹¹) and therefore disturbance to foraging individuals from survey vessels will not have a LSE on this species. As there will be no LSE, the COs of this site will not be undermined (i.e. the population will be maintained, the natural range will not be reduced and there will be sufficiently large habitat to maintain population).
Skomer, Skokholm and the Seas Pembrokeshire SPA (UK9014051)	Manx shearwater (<i>Puffinus puffinus</i>) [A013]	Maintain or Enhance FCC ³⁴ <ul style="list-style-type: none"> Breeding population should be stable or increasing The distribution of the population within site should be maintained and not constrained by anthropogenic factors. Breeding and foraging habitat, should be stable or increasing. Factors affecting the population or its habitat within the site should be under appropriate control. 	85km southeast of proposed survey area	Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance in the marine area immediately adjacent to the colony. Manx shearwater display very low sensitivity respectively to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness et al., 2013 ¹⁸ ; Bradbury et al., 2014 ¹⁹ ; Fliessbach et al., 2019 ¹¹) and therefore disturbance to foraging individuals from survey vessels will not have a LSE on this species. As there will be no LSE, the COs of these sites will not be undermined (i.e. the breeding population and distribution will be maintained, breeding and foraging habitat will be maintained and factors affecting population or habitat will be under strict control).
Aberdaron Coast and Bardsey Island SPA (UK9013121)	Manx Shearwater (<i>Puffinus puffinus</i>) [A013]	Maintain FCC ³⁵ <ul style="list-style-type: none"> Breeding population is stable or increasing. Reproductive rates remain stable. 	155km northeast of proposed survey area			Breeding colony >2km from survey activities therefore there will be no disturbance in the marine area immediately adjacent to the colony. Manx shearwater display very low sensitivity respectively to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness et al., 2013 ¹⁸ ; Bradbury et al., 2014 ¹⁹ ; Fliessbach et al., 2019 ¹¹) and therefore disturbance to foraging

³³ NPWS. 2020. Conservation objectives for Old Head of Kinsale SPA [004021]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht.

³⁴ NRW & JNCC. 2015. Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro potential Special Protection Area: Draft conservation objectives.

³⁵ CCW. 2008. Core management plan including conservation objectives for Aberdaron coast and Bardsey Island SPA. Version 2.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives (CO)	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
		<ul style="list-style-type: none"> Deaths from the lighthouse attractions, fencing and other infrastructure are minimal. No ground predators are introduced. Nesting birds are not disturbed by restoration works on boundary walls or recreational activities. All factors affecting the achievement of these conditions are under control. 				individuals from survey vessels will not have a LSE on this species. As there will be no LSE, the COs of these sites will not be undermined (i.e. the breeding population and reproductive rates will remain stable, there will be no deaths from infrastructure, ground predators will not be introduced, nesting birds will not be disturbed and factors affecting population or habitat will be under strict control).
Grassholm SPA (UK9014041)	Gannet (<i>Morus bassanus</i>) breeding [A016]	<p>Maintain FCC³⁶</p> <ul style="list-style-type: none"> The population will not fall below 30,000 pairs in three consecutive years Population will not drop by more than 25% of the previous year's figures in any one year. There will be no decline in this population significantly greater than any decline in the North Atlantic population as a whole. Oil spills, marine litter, human disturbance and changes in availability of food due to changes in fisheries policy/methods and the factors considered to impact the population status. 	102km southeast of proposed survey area	Physical Disturbance	No	Breeding colony >2km from survey activities therefore there will be no disturbance in the marine area immediately adjacent to the colony. Gannet display low sensitivity respectively to disturbance from vessel traffic and associated activities (Garthe & Hüppop, 2004 ¹² ; Furness <i>et al.</i> , 2013 ¹⁸ ; Bradbury <i>et al.</i> , 2014 ¹⁹ ; Fliessbach <i>et al.</i> , 2019 ¹¹) and therefore disturbance to foraging individuals from survey vessels will not have a LSE on this species. As there will be no LSE, the COs of this site will not be undermined (i.e. there will be no decline in population and no human disturbance impacting population status).

³⁶ CCW. 2008. Core management plan including conservation objectives for Grassholm SPA. Version 2.

- Explicit reference to what the sources of likely significance are, which site features and related sites these are considered against, and relate this to specific evidence to discount LSE, where appropriate.*

Marine Mammals

In relation to marine mammals, Table 3 explicitly sets out what the sources of likely significance are, which site features, related sites and conservation objectives these are considered against, and the specific evidence to discount LSE. The impacts assessed with respect to marine mammals are auditory injury and physical disturbance due to underwater noise. Collision risk was adequately assessed in the information provided to date. Table 4 sets out the auditory thresholds of the species of relevance and the zone of impact determined from a noise assessment review³⁷.

Table 3: Marine Mammals LSE Table

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base /Justification
Saltee Islands SAC (IE000707)	<i>Halichoerus grypus</i> (Grey Seal) [1364]	Maintain Favourable Conservation Condition (FCC) ³⁸ <ul style="list-style-type: none"> Range within site should not be restricted by artificial barriers Maintain breeding sites in natural condition Maintain moult haul-out sites in natural condition Maintain resting haul-out sites in natural condition Population should contain adult, juveniles and pup cohorts annually Human activities should occur at levels that do not adversely affect the grey seal population. 	16.8km northeast of proposed survey area	Auditory Injury, Physical disturbance	No	The spring/summer timing of the surveys largely avoids the sensitive breeding and moulting season for the grey seals at the Saltees site. While there is the potential for PTS and TTS onset in foraging individuals in close proximity to the MBES, SSS and SBP (see Table 4), the risk is considered to be very low as the levels will not exceed the thresholds (218 and 212 SPL dB re 1 uPa @1m respectively) beyond more than a few 10's of meters from the source. An impact range of 50m was considered appropriate for the current surveys based on the noise assessment carried out for the survey activities (Table 4). The percentage of the reference population which have the potential to be affected is <0.00038% ³⁹ . In addition, the presence of the survey vessel is likely to lead to small-scale temporary displacement thereby reducing even further the likelihood of an individual being within the impact zone of the survey equipment. This impact is negligible and is not considered to be a LSE on the foraging grey seals in the area.

³⁷ A desk-based noise assessment review was undertaken based on indicative survey equipment to identify likely ranges of injury and disturbance to Annex II marine mammals and migratory fish. It should be noted that noise review did not account for factors which may reduce or attenuate noise propulsion, including water depth, pressure, temperature gradients, salinity, as well as water surface and seabed condition and as a result, should be considered highly precautionary.

³⁸ NPWS. 2011. Conservation Objectives: Saltee Islands SAC 000707 and Saltee Islands SPA 004002. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

³⁹ Highest density from the area from Russel *et al.* (2017)⁴³ [0.2] x area of potential impact [0.008km²; based on 0.05km radius impact range] = 0.002 individuals in impacted area. The percentage of the reference population that could potentially be affected: No. animals in the area [0.002] / abundance of reference population [529-680, O'Cadhla *et al.*, 2013⁴⁰]*100 = 0.00029 - 0.00038%.

⁴⁰ Ó Cadhla, O., Keena, T., Strong, D., Duck, C. & L. Hiby. 2013. Monitoring of the breeding population of grey seals in Ireland, 2009 - 2012. Irish Wildlife Manuals, No. 74. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base /Justification
Cardigan Bay SAC/ Bae Ceredigion (UK12712)	<i>Halichoerus grypus</i> (Grey Seal) [1364]	<p>Ensure the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for grey seal⁴⁴⁴⁵. In the context of natural change, this will be achieved by ensuring that:</p> <ul style="list-style-type: none"> • Grey seal is a viable component of the site; • The natural range of the population is not being reduced • Their range within the SAC and adjacent inter-connected 	133km ⁴⁶ to the east of proposed survey area			<p>It is possible that all of the survey activities may have the potential to cause disturbance to grey seals, ranging in distance from 150m for MBES and SSS to a few kms for vibrocoring (see Table 4). Thompson <i>et al.</i>, 2013⁴¹ provided evidence that short-term disturbance caused by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises, a species more sensitive to noise than grey seals. The most likely response will be temporary behavioural avoidance. An impact range of 2.5km was considered appropriate for the current surveys based on noise assessment carried out for the survey (see Table 4). The percentage of the Saltee Islands population which have the potential to be affected is <0.74%⁴². This is a conservation estimation as all of the grey seals at the site will not be from the Saltees population.</p> <p>Given the short-term temporary nature of the proposed surveys and the large foraging range of grey seals any temporary avoidance of a small area will not result in a LSE.</p>

⁴⁴ NRW. 2018. Cardigan Bay/ Bae Ceredigion Special Area of Conservation Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017.

⁴⁵ NRW. 2018. Pen Llŷn a'r Sarnau / Lleyn Peninsula and the Sarnau Special Area of Conservation Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017.

⁴⁶ By sea

⁴¹ Thompson, P.M., Brookes, K.L., Graham, I.M., Barton, T.R., Needham, K., Bradbury, G. & N.D. Merchant. 2013. Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. Proceedings of the Royal Society B 280: 20132001.

⁴² Highest density from the area from Russel *et al.* (2017)⁴³ [0.2] x area of potential impact [19.6km²; based on 2.5km radius impact range] = 3.9 individuals in impacted area. The percentage of the reference population that could potentially be affected: No. animals in the area [3.9] / abundance of reference population [529-680, O'Cadhla *et al.*, 2013⁴⁰]*100 = 0.57 – 0.74%.

⁴³ Russell, D.J.F., Jones, E.L. & C.D. Morris. 2017. Updated seal usage maps: the estimated at-sea distribution of grey and harbour seals. Scottish Marine and Freshwater Science Vol 8 No 25, 25pp. doi: 10.7489/2027-1 <https://data.marine.gov.scot/sites/default/files//SMFS%200825.pdf>

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base /Justification
Pen Llŷn a'r Sarnau/ Lleyn Peninsula and the Sarnau SAC (UK13117)	<i>Halichoerus grypus</i> (Grey Seal) [1364]	<p>areas is not constrained or hindered</p> <ul style="list-style-type: none"> • There are appropriate and sufficient food resources within the SAC and beyond • Contaminant burdens from human activity are below levels that may cause physiological damage, or immune or reproductive suppression; Populations should not be reduced due to human activity; and • The condition of supporting habitats and processes, and the availability of prey is maintained 	160km ⁴⁶ to the east of proposed survey area			<p>Overall it is determined that the proposed surveys will not have a LSE on the conservation objectives of the grey seal at the Saltee Islands (i.e. there will be no artificial barriers, the breeding, moulting and resting sites will be maintained, the population cohorts will be maintained and the levels of disturbance will not adversely affect the population of grey seals).</p> <p>Grey seals from the Cardigan Bay and Lleyn Peninsula and the Sarnau SACs have the potential to forage within the survey area. The rationale outlined above for the grey seals from the Saltee Islands also applies to the foraging individuals from these SACs. As a result it has been determined that the proposed surveys will not have a LSE on the conservation objectives of the grey seal at the Cardigan Bay and Lleyn Peninsula and the Sarnau SACs (i.e. their population size, structure, production and condition will be maintained and the population range will not be reduced, sufficient food resources will be maintained, contaminant levels below that which would cause harm and the condition of supporting habitats and processes, and the availability of prey will be maintained).</p>
Rockabill to Dalkey SAC (IE003000)	<i>Phocoena phocoena</i> (Harbour Porpoise) [1351]	Maintain FCC ⁴⁷⁴⁸⁴⁹	168km ⁴⁶ to the northeast of proposed survey area	Auditory Injury, Physical disturbance	No	<p>Harbour porpoises from the Rockabill to Dalkey SAC, Roaringwater Bay & Islands SAC, Blasket Islands SAC, West Wales Marine SAC, Bristol Channel Approaches SAC, North Channel SAC, North Anglesey Marine SAC have the potential to forage within the survey area. The Marine Mammal Risk Assessment prepared for the survey works by the Irish Whale & Dolphin Group (IWDG) reported that while harbour porpoise primarily use the area for foraging throughout the year but note that they range over a wide area when foraging and there is no evidence (high sighting rates) that the survey area is an important foraging area for this species. While there is the potential for PTS and TTS onset in foraging individuals in close proximity to the MBES, SSS, SBP and UHRS and TTS onset in close proximity to vibrocoring (see Table 4), the risk is considered to be very low as the levels will not exceed the thresholds (202 and 196 SPL dB re 1 uPa @1m respectively) beyond more than a few 10's to 100's of meters from the source. An impact range of 500m was considered appropriate for the current surveys based on the noise assessment carried out for the survey activities (Table 4). The percentage of the reference</p>
Roaringwater Bay & Islands SAC (IE000101)	<i>Phocoena phocoena</i> (Harbour Porpoise) [1351]		138km ⁴⁶ to the southwest of proposed survey area	Auditory Injury, Auditory Injury, Auditory Injury		
Blasket Islands SAC (IE002172)	<i>Phocoena phocoena</i> (Harbour Porpoise) [1351]		258km ⁴⁶ to the west of proposed survey area	Auditory Injury		
West Wales Marine SAC / Gorllewin Cymru Forol (UK0030397)	<i>Phocoena phocoena</i> (Harbour Porpoise) [1351]	Ensure the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for	91km ⁴⁶ to the east of proposed survey area			

⁴⁷ NPWS. 2013. Conservation Objectives: Rockabill to Dalkey Island SAC 003000. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

⁴⁸ NPWS. 2011. Conservation Objectives: Roaringwater Bay and Islands SAC 000101. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

⁴⁹ NPWS. 2014. Conservation Objectives: Blasket Islands SAC 002172. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base /Justification
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC (UK0030396)	<i>Phocoena phocoena</i> (Harbour Porpoise) [1351]	Harbour Porpoise ⁵⁴⁵⁵⁵⁶⁵⁷ . In the context of natural change, this will be achieved by ensuring that: <ul style="list-style-type: none"> • Harbour porpoise is a viable component of the site; • There is no significant disturbance of the species; and • The condition of supporting habitats and processes, and the availability of prey is maintained 	141km ⁴⁶ to the southeast of proposed survey area			population which have the potential to be affected is 0.00004% ⁵⁰ . In addition, the presence of the survey vessel is likely to lead to small-scale temporary displacement thereby reducing even further the likelihood of an individual being within the impact zone of the survey equipment. This impact is negligible and is not considered to be a LSE on the foraging harbour porpoises in the area.
North Channel SAC (UK0030399)	<i>Phocoena phocoena</i> (Harbour Porpoise) [1351]		278km ⁴⁶ to the northeast of proposed survey area			It is possible that all of the survey activities may have the potential to cause disturbance to foraging harbour porpoises, ranging in distance from 150m for MBES and SSS to a few kms for vibrocoring (see Table 4). Thompson <i>et al.</i> , 2013 ⁴¹ provided evidence that short-term disturbance caused by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. The most likely response will be temporary behavioural avoidance. An impact range of 2.5km was considered appropriate for the current surveys based on noise assessment carried out for the survey activities. The percentage of the reference population which have the potential to be affected is 0.001% ⁵³ . This impact is negligible and is not considered to be a LSE on the foraging harbour porpoises in the area.
North Anglesey Marine SAC/ Gogledd Môn Forol (UK0030398)	<i>Phocoena phocoena</i> (Harbour Porpoise) [1351]		193km ⁴⁶ to the northeast of proposed survey area			Overall it is determined that the proposed surveys will not have a LSE on the conservation objectives of the harbour porpoises at the Rockabill to Dalkey SAC, Roaringwater Bay & Islands SAC and Blasket Islands SAC (i.e. their access to suitable habitat will not be restricted by artificial barriers and the level of disturbance will not adversely affect the community at the site or adversely affect foraging individuals). In addition, it is determined that the proposed surveys will not have a LSE on the conservation objectives of the harbour porpoises at the West Wales Marine SAC, Bristol Channel Approaches SAC, North Channel SAC and North Anglesey

⁵⁴ NRW & JNCC. 2019. Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: West Wales Marine / Gorllewin Cymru Forol Conservation Objectives and Advice on Operations. March 2019.

⁵⁵ NRW, NE & JNCC. 2019. Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: Bristol Channel Approaches / Dynesfeydd Môr Hafren Conservation Objectives and Advice on Operations March 2019

⁵⁶ DAERA & JNCC. 2019. Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: North Channel Conservation Objectives and Advice on Operations March 2019

⁵⁷ DAERA, NRW & JNCC. 2019. Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: North Anglesey Marine/ Gogledd Môn Forol Conservation Objectives and Advice on Operations March 2019

⁵⁰ Highest density from the area (Stratum 8) from Rogan *et al.* (2018)⁵¹ [0.057] x area of potential impact [0.8km²; based on 0.5km radius impact range] = 0.05 individuals in impacted area. The percentage of the reference population that could potentially be affected: No. animals in the area [0.05] / abundance of reference population [104,695 IAMMWG, 2015⁵²]*100 = 0.00004%.

⁵¹ Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S. & M. Jessopp. 2018. Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017. Department of Communications, Climate Action & Environment and National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland. 297pp.

⁵² IAMMWG. 2015. Management Units for cetaceans in UK waters (January 2015). JNCC Report No. 547, JNCC Peterborough.

⁵³ Highest density from the area (Stratum 8) from Rogan *et al.* (2018)⁴⁸ [0.057] x area of potential impact [19.6km²; based on 2.5km radius impact range] = 1.1 individuals in impacted area. The percentage of the reference population that could potentially be affected: No. animals in the area [1.1] / abundance of reference population [104,695 IAMMWG, 2015⁴⁹]*100 = 0.001%.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base /Justification
						Marine SAC (i.e. their population size, structure, production and condition will be maintained, there will be no significant disturbance of species and the condition of supporting habitats and processes, and the availability of prey will be maintained). The survey works will not result in the exclusion of harbour porpoises from a significant portion of their respective sites, nor will there be any adverse impacts on foraging individuals from those SACs.
Cardigan Bay SAC/ Bae Ceredigion (UK12712)	<i>Tursiops truncatus</i> (Bottlenose Dolphin) [1349]	Ensure the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for bottlenose dolphin ^{34,35} . In the context of natural change, this will be achieved by ensuring that:	133km ⁴⁶ to the east of proposed survey area	Auditory Injury, Physical disturbance	No	Bottlenose dolphins from the Cardigan Bay SAC and Lleyn Peninsula and the Sarnau SACs have the potential to forage within the survey area. The Marine Mammal Risk Assessment prepared for the survey works by the IWDG reported that while bottlenose dolphin primarily using the area for foraging throughout the year but note that they range over a wide area when foraging and there is no evidence (high sighting rates) that the survey area is an important foraging area for this species.
Pen Llŷn a'r Sarnau/ Lleyn Peninsula and the Sarnau SAC (UK13117)	<i>Tursiops truncatus</i> (Bottlenose Dolphin) [1349]	<ul style="list-style-type: none"> • Bottlenose dolphin is a viable component of the site; • The natural range of the population is not being reduced • Their range within the SAC and adjacent inter-connected areas is not constrained or hindered • There are appropriate and sufficient food resources within the SAC and beyond • Contaminant burdens from human activity are below levels that may cause physiological damage, or immune or reproductive suppression; and • The condition of supporting habitats and processes, and 	160km ⁴⁶ to the east of proposed survey area			<p>While there is the potential for PTS and TTS onset in foraging individuals in close proximity to the MBES, SSS and SBP and TTS from vibrocoring (see Table 4), the risk is considered to be very low as the levels will not exceed the threshold (222 SPL dB re 1 uPa @1m respectively) beyond more than a few 10's of meters from the source. An impact range of 50m was considered appropriate for the current surveys based on the noise assessment carried out for the survey activities (see Table 4). The percentage of the reference population which have the potential to be affected is 0.0001%⁵⁸. In addition, the presence of the survey vessel is likely to lead to small-scale temporary displacement thereby reducing even further the likelihood of an individual being within the impact zone of the survey equipment. This is not considered to be a LSE on the foraging bottlenose dolphins in the area.</p> <p>It is possible that all of the survey activities may have the potential to cause disturbance to foraging bottlenose dolphins, ranging in distance from 150m for MBES and SSS to a few kms for vibrocoring (see Table 4). Thompson et al., 2013⁴¹ provided evidence that short-term disturbance caused by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises, a species more sensitive to noise than bottlenose dolphins. The most likely response will be temporary behavioural avoidance. An impact range of 2.5km was considered appropriate for the current surveys based on noise assessment carried out for the survey activities. The percentage of the reference population which</p>

⁵⁸There is a mismatch between the Observe surveys areas and the management units for bottlenose dolphins and as a result the density estimates from Stratum 8 from Rogan et al. (2018)⁵¹ are not appropriate to use. To obtain a reasonably accurate estimate of the population using the foreshore site and how this relates to the Irish Sea Management Unit, the proportion of sightings of BND vs HP from the IWDG 2000-2017 sightings included in the MMRA and the abundance data collected to date from July 2019 across the site were examined. BND were sighted 5 times less than HP (43 sightings vs 211) from IWDG sightings and from the site specific surveys HP were sighted 150 times (198 individuals) with BND sighted 3 times (14 individuals). Based on this, it was determined appropriate to use the density of HP as a very conservative proxy estimate for BND. Therefore, Density [0.057] x area of potential impact [0.008km²; based on 0.05km radius impact range] = 0.0005 individuals in impacted area. The percentage of the reference population that could potentially be affected: No. animals in the area [0.0005] / abundance of reference population [397 IAMMWG, 2015⁵²]*100 = 0.0001%.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base /Justification
		the availability of prey is maintained				<p>have the potential to be affected is <0.28%⁵⁹. This impact is negligible and is not considered a LSE.</p> <p>Overall it is determined that the proposed surveys will not have a LSE on the conservation objectives of the bottlenose dolphins at the Cardigan Bay SAC and Lleyn Peninsula and the Sarnau SAC (i.e. their population size, structure, production and condition will be maintained and the population range will not be reduced, sufficient food resources will be maintained, contaminant levels below that which would cause harm and the condition of supporting habitats and processes, and the availability of prey will be maintained) or on foraging individuals from those SACs.</p>

⁵⁹ Highest density (Stratum 8, HP proxy) from Rogan *et al.* (2018)⁵¹ [0.057] x area of potential impact [19.6km²; based on 2.5km radius impact range] = 1.1 individuals in impacted area. The percentage of the reference population that could potentially be affected: No. animals in the area [1.1] / abundance of reference population [397 IAMMWG, 2015⁵²]*100 = 0.28%.

Table 4: Noise assessment results from comparable survey equipment⁶⁰. Sound levels provided are at 1m from source. Auditory thresholds and predicted zone of impact for marine mammals.

Auditory Group	Auditory Bandwidth (Southall <i>et al.</i> , 2019 ⁶¹ , NMFS, 2018 ⁶²)	Threshold (NMFS, 2018 ⁵² ; Southall <i>et al.</i> , 2019 ⁶¹)		MBES (200-228 dB @ 100 kHz)	SSS (210 dB @ 100 kHz)	SBP (Pinger) (214dB @ 4 kHz)	UHRS (Sparker) (219 dB @ 300 Hz – 1.2 kHz)	Drilling (boreholes) (162 dB @ variable Hz) ⁶³	Vibrocoring (187 dB @ variable Hz) ⁶³
Phocid pinnipeds (in water)	50 Hz – 86 kHz (Grey seal 8-40kHz ⁶⁴)	PTS	218	<50m	<50m	<50m	Threshold not exceeded	Threshold not exceeded	Threshold not exceeded
		TTS	212						
Very High Frequency Cetacean (e.g. harbour porpoise)	275 Hz – 160 kHz Harbour porpoise (3-130 kHz) ⁶⁴	PTS	202	<50m	<50m	<50m	<50m	Threshold not exceeded	Threshold not exceeded
		TTS	196	<50m	<100m	<100m	<100m		<500m
High Frequency Cetacean (e.g. dolphin species)	150 Hz – 160 kHz Bottlenose dolphin (5-110 kHz) ⁶⁴	PTS	230	<50m	<50m	<50m	Threshold not exceeded	Threshold not exceeded	Threshold not exceeded
		TTS	224	<50m	<50m	<50m	Threshold not exceeded	Threshold not exceeded	<10m
Disturbance (all species)		140 dB re 1 µPa (rms) for impulsive sound; 120 dB re 1 µPa (rms) for continuous noise ⁶⁵⁶⁶		150-200m	150-200m	200m	200m	300-400m	2.5km ⁶⁷

⁶⁰ Magnetometer not included as no sound is emitted from this device.

⁶¹ Southall, Brandon L., James J. Finneran, Colleen Reichmuth, Paul E. Nachtigall, Darlene R. Ketten, Ann E. Bowles, William T. Ellison, Douglas P. Nowacek, and Peter L. Tyack. 2019. "Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects." *Aquatic Mammals* 45 (2): 125–232.

⁶² NMFS. 2018. "2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0)." NOAA Technical Memorandum NMFS-OPR-59. National Oceanic and Atmospheric Administration.

⁶³ Based on 24 hour continuous operation and is therefore highly precautionary and it is highly unlikely that any marine mammal would stay at a stationary location or within a fixed radius of a vessel (or any other noise source) for 24-hours.

⁶⁴ Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals* 33(4): 411-521.

⁶⁵ HESS. 1997. Summary of the recommendations of the expert panel at the workshop on high-energy seismic sound and marine mammals. In Workshop on High-Energy Seismic Sound and Marine Mammals, Pepperdine University, Malibu, CA.

⁶⁶ NMFS. 2005. Scoping Report for NMFS EIS for the National Acoustic Guidelines on Marine Mammals.

⁶⁷ Highly precautionary and based on one hour continuous operation per single core which is highly unlikely.

Migratory Fish

The proposed surveys will produce underwater noise, which has the potential to impact Annex II migratory fish. Although the proposed survey area does not overlap with any SACs for migratory fish, they may transit through or close to the survey area when migrating to/from their natal rivers.

The majority of research carried out to date with regards to noise from geophysical surveys and potential impacts on fish is focused on noise associated with airgun seismic surveys. Very few empirical field data are currently available to quantify the extent of noise impacts associated with SBPs and their potential to result in mortality/injury or behavioural effects on fish. However, their emitted sound fields are expected to be of much lower amplitude and extent compared to those associated with seismic airguns (Genesis, 2011)⁶⁸. Recent research has been carried out by BOEM in US, where the propagation of various High Resolution Geophysical Survey (HRGS) methods including SBPs were studied (Halvorsen & Heaney, 2018)⁶⁹ with further research on this matter currently on-going.

Carroll *et al.* (2017)⁷⁰ undertook a critical review of the potential impacts of marine seismic surveys on fish and invertebrates including a detailed review of evidence of changes in catch rate and abundance due to low-frequency sound. The potential effects of seismic operation were examined for a range of teleost species with varying results possibly due to gear and species-specific effects. Some studies found significant decreases in catch rates whilst other studies found no effects or increased catch rates in fish. Peña *et al.* (2013)⁷¹ investigating the real-time behaviour of herring schools exposed to a 3-D seismic survey found no changes were observed in school sizes, swimming speed or direction that could be attributed to the transmitting seismic vessel as it approached from a distance of 27 to 2km over a 6 hour period. The lack of a response to the seismic survey was interpreted by the authors as a combination of a strong motivation for feeding, a lack of suddenness of the airgun stimulus, and an increased level of tolerance to the seismic shooting. More recently, Slabbekoorn *et al.*, (2019)⁷² undertook a literature review of the impact of airgun acoustic exposure on fish with a focus on population level impact assessment. Sivle *et al.* (2014)⁷³ modelled population consequences of naval sonar exposure (235 dB, 1-2 kHz) for herring concluded that it is unlikely that today's naval sonar activity will lead to any population level effect for this species.

The majority of fish can only hear at relatively low frequencies (often no more than 800 - 1,000 Hz) (Popper *et al.*, 2019)⁷⁴. A smaller number of species (notably clupeids) can detect sounds to over 3 kHz while a few species can detect sounds to well over 100 kHz (Popper & Hastings, 2009)⁷⁵. As such, the operating frequencies of the MBE (190 – 500KHz), SSS (400-900KHz) and pinger systems (3.5kHz – 12kHz) proposed for the surveys would be outside of the hearing range of the majority of fish species, including hearing specialists such as herring⁷⁶. However, the frequencies used by the Ultra High Resolution Seismic (UHRS) sparkers/boomers (300 Hz - 1.2KHz) proposed, the drilling, vibrocoring and vessel dynamic positioning, may be audible to most fish.

Based on the different hearing abilities of fish ([1] no swim bladder, [2] with swim bladder not involved in hearing {salmon} and [3] with swim bladder involved in hearing {shad/herring}; Hawkins & Popper, 2016⁷⁷), sound

⁶⁸ Genesis. 2011. Review and Assessment of Underwater Sound Produced from Oil and Gas Sound Activities and Potential Reporting Requirements under the Marine Strategy Framework Directive. 2011. Genesis Oil and Gas Consultants report for the Department of Energy and Climate Change.

⁶⁹ Halvorsen, M.B. & K.D. Heaney. 2018. Propagation Characteristics of High-Resolution Geophysical Surveys: Open Water Testing. OCS Study BOEM 2018-052, 806p.

⁷⁰ Carroll, A.G., Przeslawski, R., Duncan, A., Gunning, M. & B. Bruce. 2017. A critical review of the potential impacts of marine seismic surveys on fish and invertebrates. *Marine Pollution Bulletin* **114**: 9-24.

⁷¹ Peña, H., Handegard, N.O. & E. Ona. 2013. Feeding herring schools do not react to seismic air gun surveys. *ICES J. Mar. Sci.* **70**: 1174–1180.

⁷² Slabbekoorn, H., Dalen, J., de Haan, D., Winter, H.V., Radford, C., Ainslie, M.A., Heaney, K.D., van Kooten, T., Thomas, L. & J. Harwood. 2019. Population-level consequences of seismic surveys on fishes: An interdisciplinary challenge. *Fish and Fisheries* **20**: 653-685.

⁷³ Sivle, L. D., Kvadsheim, P. H., & M.A. Ainslie. 2014. Potential for population-level disturbance by active sonar in herring. *ICES Journal of Marine Science*, 72, 558–567. <https://doi.org/10.1093/icesjms/fsu154>

⁷⁴ Popper, A.N., Hawkins, A.D., Sand, O. & J.A. Sisneros. 2019. Examining the hearing abilities of fishes. *J. Acoust. Soc. Am.* **146 (2)**: 948-955.

⁷⁵ Popper, A.N., & M.C. Hastings. 2009. The effects of anthropogenic sources of sound on fishes. *Journal of Fish Biology*, **75**: 455–489.

⁷⁶ Herring can hear frequencies up to 4 KHz, however, their hearing ability is best at frequencies between 10 and 1,000 Hz.

⁷⁷ Hawkins, A. D., and Popper, A. N. (2016). "A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates," *ICES J. Mar. Sci.* **74**, 635–671.

exposure criteria has been published by Popper *et al.* (2014)⁷⁸ in respect of mortality and potential injury from airgun seismic survey noise. For fish species lacking swim bladders, mortality or potential injury would be expected at noise levels >213dB re 1 µPa (peak) and for all other fish groups, including eggs and larvae, at noise levels >207dB re 1 µPa (peak).

Table 5 below explicitly sets out what the sources of likely significance are, which site features, related sites and conservation objectives these are considered against, and the specific evidence to discount LSE. The impacts assessed with respect to migratory fish are auditory injury and physical disturbance due to underwater noise.

Table 6 sets out the auditory thresholds and zone of impact determined from noise assessment review where thresholds are exceeded.

⁷⁸ Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Gentry, R.L., Halvorsen, M.B., Løkkeborg, S., Rogers, P.H., Southall, B.L., Zeddes, D.G. & W.N. Tavolga. 2014. Sound exposure guidelines for fishes and sea turtles: A technical report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

Table 5: Migratory Fish LSE Table

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
River Barrow and River Nore SAC (IE002162)	<i>Salmo salar</i> (Salmon) [1106]	<p>Restore Favourable Conservation Condition (FCC)^{79 80}</p> <p>Restore FCC:</p> <ul style="list-style-type: none"> • Ensuring 100 of rivers channels down to 2nd order accessible from estuary • Exceed Conservation Limit (CL) of adult spawning fish • Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling. • No significant decline in out migrating smolt abundance • No decline in number and distribution of spawning redds due to anthropogenic causes. • Water quality at least Q4 at all EPA sampled sites 	3.2km northeast of potential Cable Corridor	Auditory Injury, Physical disturbance	No	<p>Atlantic salmon are functionally deaf above 380Hz with best hearing at 160Hz (threshold 95 dB re 1µPa) (Hawkins & Johnstone, 1978⁸¹; Gill & Bartlett, 2010⁸²). Hence, their ability to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity (Hawkins & Johnstone, 1978⁸¹). There is, however, evidence that juvenile <i>S. salar</i> smolts are sensitive to very low frequency sound (i.e. Particle motion) avoiding localised high intensity sounds less than 10 Hz (Knudsen <i>et al.</i>, 1994⁸³) in experimental and river settings. Harding <i>et al.</i> (2016)⁸⁴ generally concurs with the previous findings of Hawkins & Johnstone (1978)⁸¹ that Atlantic salmon do not appear to have sensitive hearing relative to many other marine fish species. This is likely due to a lack of secondary hearing modifications linking the swim bladder to the auditory system.</p> <p>Based on the hearing capabilities of salmon and the survey sound sources (see Table 6 below), while salmon will hear UHRS, vibrocoring and drilling, only UHRS and vibrocoring exceed the mortality/injury threshold and only within a few meters to 10s of meters of the sound source. Given this very limited zone of impact it is considered highly unlikely that salmon would be in such close proximity to the geophysical/ geotechnical survey vessels and as such are not predicted to experience injury or impairment that might adversely affect these species or their pathway of migration. In addition, given the low sensitivity of Atlantic salmon to underwater noise, the limited period of time involved, the slow moving nature of the survey vessel in a constant direction and the mobile nature of the species there is considered to be no potential for LSE and therefore no adverse impacts on the conservation objectives of the SACs (i.e. access from estuary will not be compromised, conservation limits will not be compromised, fry abundance will not be compromised, there</p>

⁷⁹ NPWS. 2011. Conservation Objectives: River Barrow and River Nore SAC 002162. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

⁸⁰ NPWS. 2017. Conservation Objectives: Lower River Suir SAC 002137. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

⁸¹ Hawkins, A.D. & A.D.F. Johnstone. 1978. The hearing of the Atlantic salmon, *Salmo salar*. *J. Fish. Biol.*, **13**: 655-673.

⁸² Gill, A.B. & Bartlett, M. 2010. Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage Commissioned Report No.401, 43pp.

⁸³ Knudsen, F.R., Enger, P.S. & O. Sand. 1994. Avoidance responses to low frequency sound in downstream migrating Atlantic salmon smolt, *Salmo salar*. *J. Fish Biology* **45**: 227-233.

⁸⁴ Harding, H., Bruintjes, R., Radford, A.N. & S.D Simpson. 2016. Measurement of hearing in the Atlantic salmon (*Salmo salar*) using auditory evoked potentials, and effects of pile driving playback on salmon behaviour and physiology. Scottish Marine and Freshwater Science Report 7 No 11, 51pp.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
Lower River Suir SAC (IE002137)			16km ⁸⁵ to the north of potential cable corridor			will be no decline in migrating smolt abundance or distribution of spawning redds and water quality will not be reduced. On the basis that there is predicted to be no significant impact to salmon, there will also be no impact to the freshwater pearl (<i>Margaritifera margaritifera</i>), a species which uses salmon as a host during a critical parasitic phase of its life cycle.
River Barrow and River Nore SAC (IE002162)	<i>Petromyzon marinus</i> (Sea Lamprey) [1095]	Restore FCC ^{61,62} : <ul style="list-style-type: none">Ensuring >75% main stem length of rivers accessible from estuaryEnsure at least 2 age/size groups presentJuvenile density $\geq 1/m^2$No decline in extent and distribution of spawning bedsAvailability of juvenile habitat	3.2km northeast of potential Cable Corridor 16km ⁸⁵ to the north of potential cable corridor	Auditory Injury, Physical disturbance	No	Mickle <i>et al.</i> (2018) ⁸⁶ found that sea lamprey detected tones of 50-300 Hz with equal sensitivity but did not detect sounds above 300 Hz, therefore this was considered the limit of their physiological hearing range. Sea lamprey can detect low-frequency sounds, but their auditory bandwidth is limited just to those frequencies with a large particle motion component of the soundwave. Based on the hearing capabilities of lamprey and the survey sound sources (see Table 6 below), while the operating frequencies of vibrocoring and drilling overlap the hearing range of lamprey, the mortality/injury threshold will not be exceeded for drilling, while recoverable injury threshold will only be exceeded within 10s of meters of the sound source and is highly precautionary as it is based on a 48-hour continuous exposure and it is highly unlikely that a fish will stay in close proximity to a sound source for that length of time. As a result, lamprey are not predicted to experience injury or impairment that might adversely affect these species or their pathway of migration. In addition, given their low sensitivity to underwater sound, the limited period of time involved, the slow moving nature of the survey vessel in a constant direction and the mobile nature of the species there is considered to be no potential for LSE and therefore no adverse impacts on the conservation objectives of the SACs (i.e. access from estuary will not be compromised, age/size groups and juvenile density will not be compromised, the extent and distribution of spawning beds and juvenile habitat will not decrease).
Lower River Suir SAC (IE002137)	<i>Lampetra fluviatilis</i> (River Lamprey) [1099]	Restore FCC ^{61,62} : <ul style="list-style-type: none">Ensuring >75% main stem and major tributaries accessible from estuaryEnsure at least 3 age/size groups presentJuvenile density $\geq 2/m^2$No decline in extent and distribution of spawning bedsAvailability of juvenile habitat	3.2km northeast of potential Cable Corridor 16km ⁸⁵ to the north of potential cable corridor	Auditory Injury, Physical disturbance	No	Shad and herring are members of the Clupeiformes. Herring have a hearing range between 30 Hz and 4 kHz, with a peak frequency of between 30Hz and 1kHz (Nedwell <i>et al.</i> , 2004) ⁸⁸ . Teague & Clough (2011) ⁸⁹ observed that young-of-year twaite shad showed significant reactions at frequencies
River Barrow and River Nore SAC (IE002162)	<i>Alosa fallax fallax</i> (Twaite Shad) [1103]	Restore FCC ^{61,62, 87} : <ul style="list-style-type: none">Ensuring >75% main stem lengths of rivers accessible from estuary	3.2km northeast of potential Cable Corridor	Auditory Injury, Physical disturbance	No	

⁸⁵ By sea

⁸⁶ Mickle, M.F., Miehls, S.M., Johnson, N.S. & D.M. Higgs. 2019. Hearing capabilities and behavioural response of sea lamprey (*Petromyzon marinus*) to low-frequency sounds. *Canadian Journal of Fisheries and Aquatic Sciences* 2019 **76(9)**: 1541-1548.

⁸⁷ NPWS. 2012. Conservation Objectives: Blackwater River (Cork/Waterford) SAC 002170. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

⁸⁸ Nedwell, J.R., Edwards, B., Turnpenny, A.W.H. & J. Gordon. 2004. *Fish and marine mammal audiograms: a summary of available information*. Subacoustech report ref: 534R0214.

⁸⁹ Teague, N. & S.C. Clough. 2011. Investigations into the response of 0+ twaite shad (*Alosa fallax*) to ultrasound and its potential as an entrainment deterrent. *International Fish Screening Techniques*. 153-163.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
Lower River Suir SAC (IE002137)		<ul style="list-style-type: none"> • More than 1 age class present • No decline in extent and distribution of spawning beds • Oxygen levels $\geq 5\text{mg/l}$ • Maintain stable gravel substrate with very little fines and free of algal growth 	16km ⁸⁵ to the north of potential cable corridor	Auditory Injury, Physical disturbance	No	<p>between 30 and 60 kHz, peaking at 45 kHz. Based on these sensitivities, shad are not sensitive to the very high frequencies associated with MBES and SSS however they will hear the low frequency noise from SBP, UHRS, drilling and vibrocoring. All proposed surveys will operate at frequencies outside of the range of young shad and therefore they will not be impacted by them.</p>
Blackwater River (Cork/Waterford) SAC (IE002170)			21km ⁸⁵ to the west of proposed survey area	Auditory Injury, Physical disturbance	No	<p>It has been suggested that the ability of the Alosids including shad to detect ultrasound evolved to assist in avoiding predation by echo-locating predators, e.g. toothed whales (Popper <i>et al.</i>, 2004⁹⁰; Teague & Clough, 2011⁸⁹). As such, underwater sound may act as an acoustic deterrent for shad and suggests that shad exhibit avoidance behaviour in response to underwater noise. It is therefore expected that twaite shad may avoid the sound source. Based on the hearing capabilities of shad and the survey sound sources (see Table 6 below), while shad will hear SBP and UHRS, the mortality/injury threshold will only be exceeded within a few 10s meters of the sound source. For the SBP and UHRS survey work, the vessel will be transiting slowly along survey lines and fish will also be in motion, therefore the zone of injury will be transient and it is unlikely that any fish will stay close to the sound source. Additionally, underwater sound from the geophysical survey equipment is targeted in relatively narrow beams towards the seabed, therefore, fish are only at risk of injury if immediately within the zone of ensonification below the sound source.</p> <p>For vibrocoring, the recoverable injury threshold will only be exceeded within 10s of meters of the source and is highly precautionary as it is based on a 48-hour continuous exposure and it is highly unlikely that a fish will stay in close proximity to a sound source for that length of time. Criteria set out by Popper <i>et al.</i> (2014)⁷⁸ indicate that shad, have low risk of mortality and potential mortal injury from continuous noise in the near, intermediate and far fields (10s, 100s and 1,000s of metres, respectively). Shad have the potential to experience recoverable injury and TTS when exposed to continuous noise at 170 dB re 1 μPa (rms) for 48 hours and 158 dB re 1 μPa (rms) for 12 hours, respectively, however, it is highly unlikely that fish would remain within the range of injury for these lengths of time. As discussed above, it is likely that sound sources will act as an acoustic deterrent for this hearing specialist species.</p> <p>In their observation, Inland Fisheries Ireland (IFI) provide useful information on the movements of twaite shad in the area. The species spawns upstream in the Rivers Barrow, Suir and Nore in mid-May to early June. Given the distance between the proposed survey location and upstream spawning areas for twaite shad, there is no route to impact for effects on spawning habitats, therefore, conservation objectives relating to spawning habitats will</p>

⁹⁰ Popper, A.N., Plachta, D.T.T., Mann, D.A. & D. Higgs. 2004. Response of clupeid fish to ultrasound: a review. *ICES J. Mar. Sci.* **6**: 1057–1061.

Natura 2000 Site	Qualifying Interest/	Conservation Objectives	Distance from Survey Site	Route to Impact	LSE?	Evidence base / Justification
						<p>be maintained. IFI raise concerns that sound emission work from April to end-of-May could impact on adult shad migrating through the area and they identify movement of adult shad between the Blackwater River and Waterford Estuary. Due to the localised and transient nature of the sound emissions, the proposed surveys do not present a barrier to movement and access to rivers from the estuaries will not be impeded as a result of the surveys. As a result, population structure and juvenile density will not be affected. The proposed surveys will have no impact on water quality.</p> <p>The underwater noise review demonstrated that the potential for injury to impairment to twaite shad is low and would be highly localised. The assessment predicted that mortality or injury would not occur for the majority of survey equipment, primarily due to the high frequency nature of the survey equipment, which are outside the range of shad hearing (and therefore also will not result in behavioural effects). It is possible that injury could occur as a result of exposure to mid frequency noise sources (e.g. pingers) or impulsive sub bottom profilers (e.g. boomer/sparker), although the range of effect will be limited to within a few 10s of metres of the survey equipment and therefore injury to migratory fish species is highly unlikely. On this basis, it can be concluded that twaite shad transiting through the survey area are unlikely to experience significant effects as a result of the underwater noise generated during the geophysical surveys and the conservation objectives of the SACs will not be undermined (i.e. access from estuary will not be compromised, age/size groups will not be compromised, the extent and distribution of spawning beds will not decrease and oxygen levels and gravel substrate will not be compromised).</p>

Table 6: Noise assessment results from comparable survey equipment⁹¹. Sound levels provided are at 1m from source. Auditory thresholds and predicted zone of impact for migratory species.

Auditory Group	Auditory Bandwidth	Mortality / Recoverable Injury Threshold (Popper et al. 2014 ⁷⁸)	MBES (200-228 dB @ 100 kHz)	SSS (210 dB @ 100 kHz)	SBP (Pinger) (214dB @ 4 kHz)	UHRS (Sparker) (219 dB @ 300 Hz – 1.2 kHz)	Drilling (boreholes) (162 dB @ variable Hz) ⁹²	Vibrocoring (187 dB @ variable Hz) ⁹³
Shad	20 Hz – 4kHz (30Hz-1KHz optimal)	207db	Inaudible	Inaudible	<50m	<10m	Threshold not exceeded	<50m
Atlantic salmon	<380Hz (160Hz optimal @ 95dB)	207db	Inaudible	Inaudible	Inaudible	<10m	Threshold not exceeded	<50m
Sea/River lamprey	<300 Hz	213 dB	Inaudible	Inaudible	Inaudible	Inaudible	Threshold not exceeded	<50m

⁹¹ Magnetometer not included as no sound is emitted from this device.

⁹² Based on 12 hour continuous operation and is therefore highly precautionary and it is highly unlikely that any fish species would stay at a stationary location or within a fixed radius of a vessel (or any other noise source) for 24-hours.

⁹³ Based on 48 hour continuous operation and is therefore highly precautionary and it is highly unlikely that any fish species would stay at a stationary location or within a fixed radius of a vessel (or any other noise source) for 24-hours.

- Which sources of potential effects from the proposed survey activities could act in-combination with other plans and projects, and whether they present sources of LSE for the sites and features identified.**

Table 7 identifies the plans/projects which have the potential to have in-combination effects with the proposed survey activities, the LSE associated with those plans/projects and the overall in-combination effects.

Table 7: In-combination Effects

Development/ Activity	Distance	Description	Potential for Overlap	LSE Identified	In-Combination Assessment
SSE Renewables Celtic Sea (FS006983)	Cable corridor overlaps with small portion of Energia survey area	Geophysical, geotechnical and environmental site investigation works off Bunmahon Bay, Co. Waterford and Bannow Bay, Co. Wexford. Licence has not yet been granted. Works to be carried out between April and October within 5 years of award of Foreshore Licence.	Potential for both spatial and temporal overlap	The LSEs assessed for both projects centred around underwater noise and disturbance due to the physical presence of survey vessels on marine mammals, birds and Annex I habitats. No residual LSE were identified for either project.	While there is potential for temporary and spatial overlap this is considered extremely unlikely as 2 vessels surveying in close proximity to each other would interfere with each other and compromise data quality and therefore where overlaps are identified, arrangements will be made to eliminate/minimise them. Given the extremely localised, temporary and short-term nature of the proposed surveys, it is considered that there are negligible in-combination effects on marine mammal, bird and Annex I habitat qualifying features of the Natura 2000 sites. Where routes for impacts were identified and a determination of no LSE made, it is considered that any potential non-LSE are so negligible in scale that no potential for in-combination effects exists which could give rise to a LSE.
DP Energy Site Investigations at Inis Ealga (FS006859)	Cable corridor overlaps with small portion of Energia survey area	Geophysical, geotechnical and environmental site investigations surveys off south coast of Ireland. Works to be carried out between April and October within 5 years of award of Foreshore Licence.	Potential for both spatial and temporal overlap	The LSEs assessed for both projects centred around underwater noise and disturbance due to the physical presence of survey vessels on marine mammals, birds and Annex I habitats. No residual LSE were identified for either project.	While there is potential for temporary and spatial overlap this is considered extremely unlikely as 2 vessels surveying in close proximity to each other would interfere with each other and compromise data quality and therefore where overlaps are identified, arrangements will be made to eliminate/minimise them. Given the extremely localised, temporary and short-term nature of the proposed surveys, it is considered that there are negligible in-combination effects on marine mammal, bird and Annex I habitat qualifying features of the Natura 2000 sites. Where routes for impacts were identified and a determination of no LSE made, it is considered that any potential non-LSE are so negligible in

Development/ Activity	Distance	Description	Potential for Overlap	LSE Identified	In-Combination Assessment
					scale that no potential for in-combination effects exists which could give rise to a LSE.
Port of Waterford Dredging (FS006684)	350m from cable corridor	Continued maintenance of the navigational and berthing areas within the harbour limits of the Port of Waterford. Disposal site used is 350m east of a potential cable corridor	Potential for temporal overlap	The LSEs assessed for the dredging and disposal works centred around sediment suspension and dispersion with no residual LSE being identified.	There is potential for temporal overlap as maintenance dredging and disposal at sea will occur annually. As there will only be negligible increases in suspended sediment levels due to the proposed survey activities there is no likelihood of LSE due to in-combination effects.
Greenlink Interconnector Wexford (FS007050)	c. 10km from survey area	Subsea and underground electricity interconnector cable between Irish and UK electricity grids.	Potential for temporal overlap	The LSEs assessed for the interconnector centred around physical disturbance to seabed, underwater noise and visual disturbance with no residual LSE being identified.	No spatial overlap. Potential for temporal overlap during construction, however, due to the location of the cable installation works it is not considered that there is any potential for in-combination effects with the proposed site investigations.
Cheekpoint Boat Owners Association Pontoon and Gangway (FS007053)	c. 15km from potential cable corridor	Application for consent for installation of a floating pontoon with a connecting wheelchair accessible gangway. Associated works include 7 x round piles (permanent), plus navigation and accessibility facilities. Total size 713m ² .	Potential for temporal overlap	The LSE's assessed centred on disturbance of habitats, water quality and noise with no residual LSE being identified.	No spatial overlap. Potential temporal overlap as licence not yet determined, however, due to nature and small scale of works at Cheekpoint, it is not considered that there is any potential for in-combination effects with the proposed site investigations.
Wexford County Council Fethard Slipway (FS007064)	c. 15km from survey area	Foreshore application for the construction of a slipway, access ramp and steps to the beach.	Potential for temporal overlap	The LSE's assessed centred on loss of habitat, noise and disturbance, invasive species and local hydrodynamics with no residual LSE being identified.	Potential temporal overlap as licence not yet determined, however, due to nature and small scale of works at Fethard, it is not considered that there is any potential for in-combination effects with the proposed site investigations.
Irish Seed Mussel Company Aquaculture Licence Applications (T04/153 to 156)	c. 1km from potential cable corridor	Aquaculture licence application to DAFM for subtidal bottom mussel culture.	Potential for temporal overlap	No LSE identified from licenced aquaculture activities in the area as they are licenced and managed so as not to significantly and adversely affect Natura 2000 sites.	Potential temporal overlap if aquaculture licence is granted in advance of site investigation works being completed. However, due to nature and small scale of the proposed aquaculture it is not considered that there is any potential for in-combination effects with the proposed site investigations.