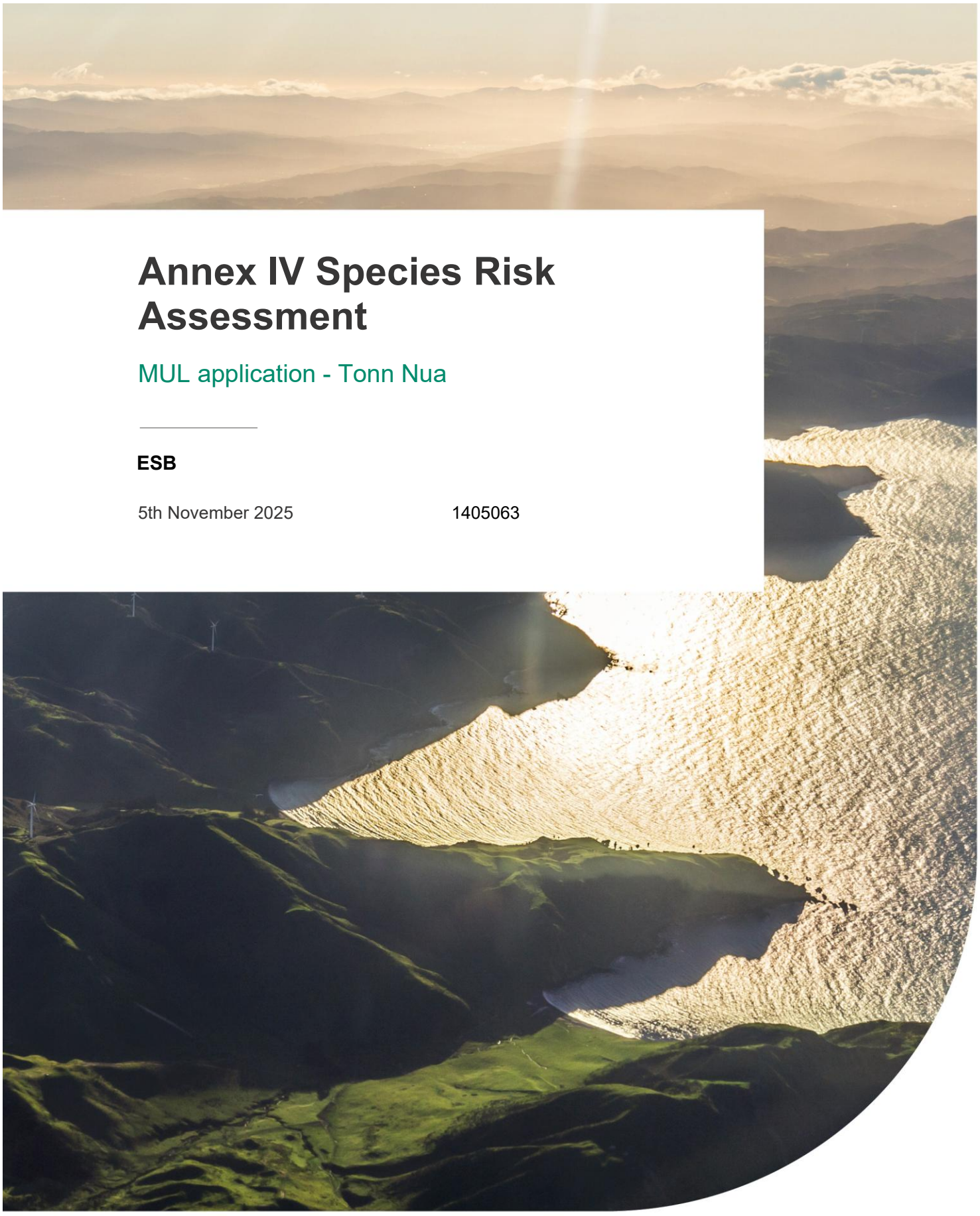

Annex IV Species Risk Assessment

MUL application - Tonn Nua

ESB

5th November 2025 1405063

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Document history

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Issue	Date	Revision Details
Final	05/11/2025	Final draft

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Contents

Abbreviations and Acronyms

Abbreviation or Acronym	Meaning
ADCP	Acoustic Doppler Current Profiler
CPT	Cone Penetration Test
DDV	Drop Down Video
DECC	Department of Energy and Climate Change
EDR	Effective Deterrence Range
ESB	Electricity Supply Board
FCS	Favourable Conservation Status
GW	Gigawatt
Helvick Head OSW DAC	Helvick Head Offshore Wind Designated Activity Company
HF	High frequency (cetacean)
IWDG	Irish Whale and Dolphin Group
LF	Low frequency (cetacean)
MARA	Maritime Area Regulatory Authority
MBES	Multibeam echosounder
MUL	Maritime Usage Licence
MW	Megawatt
NIS	Natura Impact Statement
NM	Nautical mile
NMFS	National Marine Fisheries Service
ODAS	Ocean Data Acquisition Systems
PTS	Permanent Threshold Shift
ROI	Republic of Ireland
SBP	Sub-bottom profiler
SC DMAP	South Coast Designated Maritime Area Plan
SI	Site investigation
SISAA	Supporting Information for Screening for Appropriate Assessment
SoW	Schedule of Works
SPL	Sound pressure level
SSS	Side scan sonar
TTS	Temporary Threshold Shift
UHRS	Ultra-high resolution seismic
USBL	Ultra short baseline
USV	Uncrewed surface vessels
UXO	Unexploded ordnance
VHF	Very high frequency (cetacean)

1. Introduction

1.1. The Project

Tonn Nua is located off the coast of County Waterford, Republic of Ireland (ROI), and lies wholly within Maritime Area A – Tonn Nua, as designated in the South Coast Designated Maritime Area Plan (SC DMAP). Maritime Area A has been identified by Government as suitable for plan-led development of fixed-foundation offshore wind, with an indicative potential capacity of approximately 900 megawatts (MW).

This application seeks a Maritime Usage Licence (MUL) from the Maritime Area Regulatory Authority (MARA) to undertake a programme of site investigation (SI) works within the MUL application area (Figure 1.1). The SI work is designed to gather the geophysical, geotechnical, environmental and metocean data required to inform project design, environmental assessment and future consenting. The SI works will be undertaken on a phased basis over the five-year licence period (subject to MUL approval and contractor availability). They will provide the robust technical and environmental baseline necessary to support the sustainable delivery of offshore renewable energy within the DMAP framework, in line with Ireland's legally binding climate and energy commitments.

1.2. The Developer

The applicant, Helvick Head Offshore Wind Designated Activity Company (Helvick Head OSW DAC), is a 50:50 joint venture between Electricity Supply Board (ESB) and Ørsted A/S (Ørsted). In June 2023, ESB and Ørsted formed a partnership to jointly develop a pipeline of offshore renewable energy projects off the Irish coast.

ESB is Ireland's leading energy utility and is majority state-owned. Established in 1927, ESB has a long history of delivering large-scale infrastructure projects and providing secure, reliable, and affordable electricity to Ireland. ESB has been involved in offshore wind generation since 2007 with projects spread across Ireland and the United Kingdom.

Ørsted is a global leader in developing, constructing, and operating offshore wind farms, with a core focus on Europe. With more than 30 years of experience in offshore wind, Ørsted has 10.2 GW of installed offshore capacity and 8.1 GW under construction.

By developing projects such as Tonn Nua, ESB and Ørsted in partnership will contribute directly to Ireland's energy security, decarbonisation goals, and sustainable economic growth, while supporting the wider European transition to clean energy.

1.3. Purpose and Status

This Annex IV Species Risk Assessment has been prepared by Natural Power Consultants on behalf of the applicant using the NPWS (2025) Guidance for Applicants in support of an application for a MUL for survey work within the application area.

The purpose of the assessment is to ensure compliance with Article 12 of the Habitats Directive which requires strict protection for Annex IV species (cetaceans[1] and marine turtles are relevant here). Specifically, it:

- Describes the proposed survey work;
- Describes which Annex IV species are likely to occur in the region of the MUL application area;
- Identifies and assesses any potential risks to Annex IV species from the proposed survey work;

[1] Whales, dolphins and porpoises.

- Proposes appropriate mitigation measures; and
- Assesses whether the proposed survey work will compromise the favourable conservation status (FCS) of Annex IV species.

This Risk Assessment should be read in conjunction with the Supporting Information for Screening for Appropriate Assessment (SISAA, Attachment 4.3.1), Natura Impact Statement (NIS, Attachment 4.3.2) and other relevant assessments (e.g., Water Framework Directive Assessment, Attachment 4.5), which together provide a comprehensive evaluation of ecological risks.

7°42.0'W

7°6.0'W

6°30.0'W

52°12.0'N

51°54.0'N

51°36.0'N

Project:

Tonn Nua MUL

Title:

Figure 1.1: MUL Application Area

Key

MUL Application Area

12 nautical mile (NM) Irish limit

Scale @ A3:1:400,000

Coordinate System: IRENET95 Irish Transverse Mercator
Graticules: WGS 84

0 5 10 15 20 km

N

Date: 08-10-25 | Prepared by: NN | Checked by: KG

Ref: IE211913_M_004_A

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2. Proposed Survey Work

The proposed SI works at Tonn Nua are enabling activities required to characterise the physical, biological, and environmental conditions of the site. The data collected will underpin project design, environmental assessment, and consenting, ensuring that any future offshore wind development within Maritime Area A proceeds on a robust, evidence-based foundation.

The SI works will be phased over the five-year MUL period (subject to licence grant), with campaigns scheduled according to seasonal windows, contractor availability, and environmental constraints. The surveys are designed to be temporary, small in scale, and fully reversible, with all equipment removed upon completion. This section provides a summary of the proposed survey programme; full technical detail is contained in the Schedule of Works (SoW) submitted with the application (Attachment 3.1).

2.1. Geophysical Survey

Geophysical surveys will provide detailed mapping of the seabed and shallow sub-seabed to inform design and consenting. Techniques include:

- Multibeam echosounder (MBES);
- Side scan sonar (SSS);
- Sub-bottom profiler (SBP) / Ultra-high resolution seismic (UHRS); and
- Magnetometer surveys;

This equipment will either be hull- or pole-mounted or towed behind the vessel. These are predominantly non-intrusive acoustic methods, supplemented by occasional ground-truthing through grab sampling or drop-down video. Subsurface navigation systems[2] (ultra short baseline (USBL)) will also be used.

The surveys will identify:

- Bathymetry and seabed morphology;
- Sediment distribution and shallow geology;
- Potential hazards (e.g. obstructions, unexploded ordnance (UXO), shallow gas hazards);
- Archaeological and cultural heritage features; and
- Habitat features relevant to ecological assessment.

2.2. Geotechnical Survey

Geotechnical investigations will provide data on the engineering properties of seabed sediments and underlying strata. These are intrusive surveys carried out from specialist vessels and may include:

- Cone Penetration Tests (CPTs), including seabed and downhole testing (10–40 locations);
- Sampling/ coring boreholes (5–15 locations, to depths of up to 70 m);
- Vibrocores (or piston cores; 30–60 samples, up to 6 m depth);
- In situ thermal conductivity testing; and
- Laboratory testing of recovered samples.

These works will refine a 3D ground model of the site to support foundation and cable design.

[2] Transmitter located on towed equipment, receiver mounted on vessel.

2.3. Metocean Survey

Metocean campaigns will capture long-term datasets on wind, wave, current, and water properties (all mooring systems will be temporary and fully removed at the end of deployment). This will include deployment of:

- Acoustic Doppler Current Profilers (ADCPs) for current profiling[3];
- Wave buoys for directional wave and surface current data;
- Floating LiDAR buoys for wind resource assessment (12–36 months); and
- Autonomous Floating Platform (uncrewed surface vessels (USVs)) to operate as moored Ocean Data Acquisition Systems (ODAS; metocean) buoy.

Vessels will be used to deploy the metocean monitoring equipment.

2.4. Other surveys

Vessels (and potentially remotely operated vehicles (ROVs)) will also be used during the environmental/ecological and archaeological parts of the proposed survey programme as outlined in the SoW (Attachment 3.1).

2.5. Duration and Phasing

The indicative programme is as follows:

- Geophysical surveys: 2–5 months (Commencement estimated Q2/Q3 2026–2027);
- Geotechnical surveys: 2–5 months (Commencement estimated Q2/Q3 2026–2027);
- Environmental/ecological and archaeological surveys: periodic, over 12–24 months (Commencement estimated 2026 or 2027);
- Metocean surveys: 12–36 months continuous deployment (Commencement estimated 2026, 2027 or 2028).

These durations represent active survey time only and will not be continuous across the five-year MUL period. The schedule is subject to change depending on weather, seabed conditions, and stakeholder consultation.

[3] Assessed with the geophysical survey equipment (see Section 5.1.1).

3. Legal Requirements

All species of cetacean and marine turtle fauna in waters around the British Isles are listed under Annex IV of the Habitats Directive (Council Directive 92/43/EEC) which covers animal and plant species of community interest in need of strict protection.

The Habitats Directive has been transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011).

These Regulations provide for the protection of cetacean and marine turtle fauna and as such it is an offence to:

- Deliberately capture or kill any specimen of these species in the wild;
- Deliberately disturb these species particularly during the period of breeding, rearing, hibernation and migration;
- Deliberately take or destroys eggs of those species from the wild;
- Damage or destroy a breeding site or resting place of such an animal; or
- Keep, transport, sell, exchange, offer for sale or offer for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive.

Derogation licences may be granted which allow otherwise illegal activities to go ahead provided that:

- There is no satisfactory alternative; and
- The action authorised will not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status (FCS) in their natural range.

FCS is defined in the Habitats Directive as when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable element 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. Annex IV Species in the Region of the MUL Application Area

Information on Annex IV species which are likely to occur in the region of the MUL application area is provided in the sections below. Bats and otters have been considered but will not be impacted by the work due to the offshore location of the MUL application area.

Although basking sharks (*Cetorhinus maximus*), grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) may occur in the vicinity of the MUL application area they are not Annex IV species and have not, therefore, been assessed here.

4.1. Cetaceans

More than 24 cetacean species are known to use the waters around Ireland (Wall *et al.,* 2013, O'Brien *et al*., 2009). Although many of these species are found primarily off the west coast and towards the edge of the continental shelf, five species are considered to occur regularly off the south of Ireland (Celtic Sea; Table 4-1). These species include minke whale (*Balaenoptera acutorostrata*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*) and harbour porpoise (*Phocoena phocoena*).

Fin whales (*Balaenoptera physalus*) have previously been recorded regularly off the south coast of Ireland (Nolan *et al.,* 2014; Whooley *et al*., 2011; Irish Whale and Dolphin Group (IWDG) sightings database) however the recent ObSERVE II surveys recorded low densities with only one sighting made during the two survey years (Giralt Paradell *et al.,* 2024). Fin (and humpback) whale (*Megaptera novaeangliae*) sightings in the Celtic Sea generally overlap with herring spawning (August to December; Saunders *et al*., 2010). Killer whales (*Orcinus orca*) may also occur off the south of Ireland occasionally.

Table 4-1: Regularly occurring cetacean species in and around the MUL application area. The greatest of the ObSERVE II corrected design-based density estimates (for the strata in which the application area lies (4, 6c)) have been used

Species	Density (animals per km^2)	Reference population	
		Management Unit	Abundance
Minke whale	0.06	Celtic and Greater North Seas	20,118
Bottlenose dolphin	0.194	Irish Sea and Offshore Channel, Celtic Sea and South West England	10,946
Common dolphin	2.456	Celtic and Greater North Seas	102,656
Risso's dolphin	0.046	Celtic and Greater North Seas	12,262
Harbour porpoise	0.13	Celtic and Irish Seas	62,517

Source: Giralt Paradell et al. (2024); IAMMWG (2023).

4.2. Marine Turtles

Turtles are occasional visitors to the Celtic Sea (King and Berrow, 2009; Giralt Paradell *et al.,* 2024). They (two leatherback turtles (*Dermochelys coriacea*) and one loggerhead turtle (*Caretta caretta*)) were only recorded to the west of Ireland during summer during the ObSERVE II surveys (Giralt Paradell *et al.,* 2024).

5. Risk Assessment

The potential routes to impact from the proposed survey work for Annex IV species are:

- Increased anthropogenic noise from geophysical surveys;
- Increased anthropogenic noise from geotechnical surveys; and
- Collision risk (vessels) used during all surveys.

5.1. Anthropogenic Noise-Related Risk Assessment

The following (anthropogenic noise-related) assessment has been conducted for cetaceans. Information on the generalised hearing range of the cetacean hearing groups has been taken from NMFS (2024) (see Table 5-1). The NMFS (2024) guidance identifies the received levels and auditory weighting functions, or criteria, at which individual marine mammals are predicted to experience changes in their hearing sensitivity for acute (≤ 24 hours) exposure to underwater anthropogenic sound sources. The thresholds used in this assessment (taken from NMFS, 2024) are detailed in Table 5-2 (for the onset of auditory injury[4]) and Table 5-3 (for the onset of a Temporary Threshold Shift[5] (TTS)). Use of NMFS (2024) is considered to constitute best practice because it supersedes earlier guidance from the National Marine Fisheries Service (NMFS) and publications by Brandon Southall and colleagues on this topic.

Although marine turtles have a relatively narrow, low-frequency hearing range, more research is required to determine whether they can effectively localise sounds. Furthermore, because they are occasional visitors to the area rather than occurring regularly, no density or abundance estimates are available. As such, the impact of anthropogenic noise has not been assessed quantitatively for marine turtles.

Relevant literature (underwater noise modelling studies undertaken as part of MUL applications for SI surveys off the south coast of Ireland) was reviewed to support this Risk Assessment (see Appendix A) and the findings used to infer the size of potential impact ranges from use of the equipment proposed here (Table 5-4). The type and specification of the equipment modelled is comparable to that proposed.

Table 5-1: Generalised hearing range of the cetacean hearing groups

Hearing group	Generalised hearing range (kHz)
Low frequency cetaceans (LF)	0.007 – 36
High frequency cetaceans (HF)	0.15 – 160
Very high frequency cetaceans (VHF)	0.2 – 165

Source: NMFS (2024).

[4] Defined by NMFS (2024) as damage to the inner ear that can result in destruction of tissue. Auditory injury may or may not result in a Permanent Threshold Shift (PTS). PTS (as defined by NMFS, 2024) is a permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level.

[5] Defined by NMFS (2024) as a temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level.

Table 5-2: Cetacean auditory injury onset thresholds

Hearing group	Auditory injury onset threshold (dB re. 1 µPa at 1 m)	
	Impulsive[6]	Non-impulsive[7]
Low frequency cetaceans (LF)	222	197
High frequency cetaceans (HF)	230	201
Very high frequency cetaceans (VHF)	202	181

Source: NMFS (2024).

Table 5-3: Cetacean TTS onset thresholds

Hearing group	TTS onset thresholds (dB re. 1 µPa at 1 m)	
	Impulsive	Non-impulsive
Low frequency cetaceans (LF)	216	177
High frequency cetaceans (HF)	224	181
Very high frequency cetaceans (VHF)	196	161

Source: NMFS (2024).

5.1.1. Increased Anthropogenic Noise from Geophysical Surveys

Geophysical survey and positioning equipment works by directing sound at the seabed thereby increasing anthropogenic noise in the marine environment; the resulting reflections are then analysed.

The potential effects on cetaceans from increased anthropogenic noise from geophysical surveys (including noise from the survey vessels) include:

- Auditory injury onset;
- TTS onset; and
- Disturbance.

Noise travels well underwater therefore, potential effects may occur at some distance from the sound source.

The geophysical survey of the MUL application area will use the following types of equipment which will either be hull- or pole-mounted or towed behind the vessel:

- MBES;
- SSS;
- SBP/UHRS[8]:
- Magnetometer[9]; and
- USBL.

[6] Relevant to geophysical surveys.

[7] Relevant to geotechnical surveys.

[8] Should a more detailed investigation of sub-seabed conditions be necessary, a 3D UHRS survey may be commissioned.

[9] Magnetometers do not emit sound therefore no further assessment undertaken for this equipment type.

It may also incorporate visual surveys (e.g., drop down video (DDV), ROV, remotely operated towed vehicle (ROTV) etc.) pending the development of the MUL application area's ground model and for assessment of potential hazards such as UXO.

Although part of the metocean surveys, ADCP frames (which will be deployed on the seabed at positions across the application area to collect data on water movements, current speeds and directions) have been assessed in this section.

Typical frequencies and sound pressure levels (SPLs) for each equipment type are summarised in Table 5-4.

Table 5-4: Typical frequencies and sound pressure levels for each equipment type

Equipment type	Typical frequency (kHz)	Audible?	Typical SPL (dB re 1 µPa at 1 m)	Potential for auditory injury onset?	Potential for TTS onset?
MBES	400 – 700	No	200 – 228	No	No
SSS	300 – 900	No	228	No	No
SBP – pinger/chirp	2 – 115	Yes	149 – 247	LF HF VHF	LF HF VHF
UHRS – boomer	0.0003 – 0.0025	No	212 – 215	No	No
UHRS – sparker	0.3 – 4	Yes	185 – 226	LF VHF	LF HF VHF
USBL	18 – 30	Yes	170 – 220	VHF	LF VHF
ADCP	300 – 600	No	114	No	No

Source: 'Site Investigation – Schedule of Works' (Attachment 3.1)

5.1.1.1. Assessment of Potential Effects

The MBES, SSS, UHRS (boomer) and ADCP will not be audible to cetaceans; this is because the typical frequencies (Table 5-4) are outwith the hearing range of the species groups concerned (Table 5-1). Furthermore, high frequency sound (relevant to the MBES and SSS) is likely to attenuate quickly in shallow (<200 m) water (JNCC, 2017). There is therefore no potential for effect from this equipment.

Sound emitted by the SBP, UHRS (sparker), and USBL may be audible to cetaceans; this is because the typical frequencies (Table 5-4) overlap the hearing range of the species groups concerned (Table 5-1).

5.1.1.1.1. Auditory injury onset

If operated at the greatest typical SPL value (247 dB re 1 µPa at 1 m), sound from the SBP has the potential to induce the onset of auditory injury in LF, HF and VHF; this is because the thresholds (Table 5-2) may be exceeded.

If operated at the greatest typical SPL value (226 dB re 1 µPa at 1 m), sound from the UHRS sparker has the potential to induce the onset of auditory injury in LF and VHF; this is because the thresholds (Table 5-2) may be exceeded. HF are not at risk of auditory injury onset from the UHRS sparker as the threshold is not exceeded.

If operated at the greatest typical SPL value (220 dB re 1 µPa at 1 m), sound from the USBL has the potential to induce the onset of auditory injury in VHF, this is because the threshold (Table 5-2) may be exceeded. LF and HF are not at risk of auditory injury onset from the USBL as the thresholds are not exceeded.

Even with no mitigation, potential impact ranges are likely to be small, i.e. no greater than 2.2 km for the species with the lowest thresholds, i.e. VHF cetaceans (see Appendix A). The arrival of the survey vessel will likely displace

individuals from the zone of potential effect (e.g., Benhemma-Le Gall *et al*., 2021; Fernandez-Betelu *et al*., 2024). As such the potential for auditory injury onset as a result of increased anthropogenic noise from geophysical surveys is negligible. However, standard mitigation measures (DAHG, 2014) will be implemented for the SBP, UHRS (sparker), and USBL (see Section 6).

5.1.1.1.2. TTS onset

If operated at the greatest typical SPL value (247 dB re 1 µPa at 1 m), sound from the SBP has the potential to induce the onset of TTS in LF, HF and VHF; this is because the thresholds (Table 5-3) may be exceeded.

If operated at the greatest typical SPL value (226 dB re 1 µPa at 1 m), sound from the UHRS (sparker) has the potential to induce the onset of TTS in LF, HF and VHF; this is because the thresholds (Table 5-3) may be exceeded.

If operated at the greatest typical SPL value (220 dB re 1 µPa at 1 m), sound from the USBL has the potential to induce the onset of TTS in LF and VHF; this is because the thresholds (Table 5-3) may be exceeded. HF are not at risk of TTS onset from the USBL as the threshold is not exceeded.

Even with no mitigation, potential impact ranges are likely to be small, no greater than 4.3 km for the species with the lowest threshold, i.e. VHF cetaceans. (see Appendix A). The arrival of the survey vessel will likely displace individuals from the zone of potential effect (e.g., Benhemma-Le Gall *et al*., 2021; Fernandez-Betelu *et al*., 2024). As such the potential for TTS onset as a result of increased anthropogenic noise from geophysical surveys is negligible. However, standard mitigation measures (DAHG, 2014) will be implemented for the SBP, UHRS (sparker), and USBL (see Section 6).

5.1.1.1.3. Disturbance

Sound emitted by the SBP, UHRS (sparker), and USBL may be audible to cetaceans and therefore their use may have the potential to induce behavioural responses. The most likely response will be temporary avoidance of the sound source's location (there is evidence that short-term disturbance caused by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises; Thompson *et al*., 2013).

The number of individuals of each species which may be disturbed temporarily by geophysical surveys was estimated in two ways:

- Using the 5 km Effective Deterrence Range (EDR)[10]; and
- Using the maximum daily disturbance footprint[11] (of 256 km^2) (JNCC, 2020; JNCC, 2025) (Table 5-5).

Although smaller than some of the modelled ranges (see Appendix A), static and moving source EDRs are considered to be appropriate for use in this Annex IV Species Risk Assessment.

The numbers of individuals within these zones of potential effect were estimated using the densities presented in Table 4-1. To provide context, the percentages of the appropriate reference populations these estimates represent were also estimated.

The percentage of the reference population which may be disturbed temporarily by increased anthropogenic noise from geophysical surveys was less than 1 for all species in both cases (i.e., static EDR and moving source EDR).

The potential for disturbance as a result of increased anthropogenic noise from geophysical surveys is negligible.

[10] The 5 km EDR was used to calculate the area of the zone of potential effect at a single point in time (assuming spherical spreading this = 78.5 km^2). This is termed a 'static EDR'.

[11] This represents a 'moving source EDR' i.e., accounts for the length of the survey vessel's track during a 24-hour period.

Table 5-5: An estimate of the number of individuals which may be disturbed temporarily by increased anthropogenic noise from geophysical surveys and the percentage of the reference population this represents

Species	5 km EDR		Maximum daily disturbance footprint	
	Number of individuals which may be disturbed temporarily	% of reference population	Number of individuals which may be disturbed temporarily	% of reference population
Minke whale	5	0.02	15	0.08
Bottlenose dolphin[12]	15	0.14	50	0.45
Common dolphin	193	0.19	629	0.61
Risso's dolphin	4	0.03	12	0.1
Harbour porpoise	10	0.02	33	0.05

5.1.2. Increased Anthropogenic Noise from Geotechnical Surveys

Geotechnical surveys investigate the physical properties of the seabed and subsurface soils through in situ testing, soil sampling/rock coring (to extract samples), and laboratory analysis. As such, anthropogenic noise in the marine environment may increase.

The potential effects on cetaceans from increased anthropogenic noise from geophysical surveys (including noise from the survey vessels) include:

- Auditory injury onset;
- TTS onset; and
- Disturbance.

Noise travels well underwater therefore, potential effects may occur at some distance from the sound source.

The geotechnical survey of the MUL application area will use the following techniques:

- In situ testing – seabed CPT, down the hole (cone penetration) testing; and
- Soil sampling/rock coring – boreholes, vibrocores/grabs.

Potential effects of subsurface navigation systems (USBL), which may also be used, have been assessed in Section 5.1.1.1.

Typical frequencies and SPLs for each activity are summarised in Table 5-6; indicative quantities and depths (for the preliminary geotechnical survey campaign) have also been summarised.

[12] The dolphin estimates are precautionary because assuming a uniform distribution of these highly social species (which tends to occur in groups rather than singly e.g., Cheney *et al*., 2024) is unrealistic. Rather than individuals occurring over the whole area at any given time, no individuals will be present at a particular location for the majority of the time.

Table 5-6: Typical frequencies and sound pressure levels for each activity

Activity	Typical frequency (Hz)	Audible?	Typical SPL (dB re 1 µPa at 1 m)	Potential for auditory injury onset?	Potential for TTS onset?	Indicative quantity	Depth below seabed (m)
CPT (seabed/down the hole)	20-200	Yes (LF)	118 – 166	No	No	10 – 40	Up to 70 (or refusal)
Boreholes	Maximum 600 (low frequency)	Yes (LF, HF, VHF)	145 – 190	VHF	LF HF VHF	5 – 15	Up to 70
Vibrocores Grabs	50 (low frequency)	Yes (LF)	188	No	LF	30 – 60	Up to 6 Up to 0.1

Source: 'Site Investigation – Schedule of Works' (Attachment 3.1)

5.1.2.2. Assessment of Potential Effects

CPT may be audible to LF; this is because the typical frequency (20-200 Hz; Table 5-6) overlaps the hearing range of the species group concerned (Table 5-1).

Boreholes may be audible to cetaceans (LF, HF, VHF); this is because the typical frequency (maximum 600 Hz; Table 5-6) overlaps the hearing range of the species groups concerned (Table 5-1).

Vibrocores may be audible to LF; this is because the typical frequency (50 Hz; Table 5-6) overlaps the hearing range of the species group concerned (Table 5-1).

5.1.2.2.4. Auditory injury onset

Even if the greatest typical SPL value (166 dB re 1 µPa at 1 m) is generated, sound from CPT does not have the potential to induce the onset of auditory injury; this is because the LF threshold (Table 5-2) is not exceeded.

If the greatest typical SPL value (190 dB re 1 µPa at 1 m) is generated, sound from the boreholes has the potential to induce the onset of auditory injury in VHF; this is because the threshold (Table 5-2) may be exceeded. LF and HF are not at risk of auditory injury onset from sound from the boreholes as the thresholds are not exceeded.

Even if the greatest typical SPL value (188 dB re 1 µPa at 1 m) is generated, sound from vibrocores does not have the potential to induce the onset of auditory injury; this is because the LF threshold (Table 5-2) is not exceeded.

It is very likely that this assessment is precautionary; DAHG (2014) states that sound exposure levels from such operations are thought to be below that expected to cause injury to a marine mammal. Furthermore, it is generally expected that the activity of setting up the drilling equipment will deter marine mammals from entering the immediate work area (BOEM, 2012). This is considered to be likely given the modelled potential impact ranges (≤ 0.2 km; see Appendix A). As such, the potential for auditory injury onset as a result of increased anthropogenic noise from geotechnical surveys is negligible. However, standard mitigation measures (DAHG, 2014) will be implemented for boreholes (see Section 6).

5.1.2.2.5. TTS onset

Even if the greatest typical SPL value (166 dB re 1 µPa at 1 m) is generated, sound from CPT does not have the potential to induce the onset of TTS; this is because the LF threshold (Table 5-3) is not exceeded

If the greatest typical SPL value (190 dB re 1 µPa at 1 m) is generated, sound from the boreholes has the potential to induce the onset of TTS in LF, VHF and HF; this is because the thresholds (Table 5-3) may be exceeded.

If the greatest typical SPL value (188 dB re 1 µPa at 1 m) is generated, sound from the vibrocores has the potential to induce the onset of TTS in LF; this is because the threshold (Table 5-3) may be exceeded.

It is very likely that this assessment is precautionary; DAHG (2014) states that sound exposure levels from such operations are thought to be below that expected to cause injury to a marine mammal. Furthermore, it is generally expected that the activity of setting up the drilling equipment will deter marine mammals from entering the immediate work area (BOEM, 2012). This is considered to be likely given the modelled potential impact ranges (≤ 0.2 km for LF and HF; see Appendix A). As such, the potential for TTS onset as a result of increased anthropogenic noise from geotechnical surveys is negligible. However, standard mitigation measures (DAHG, 2014) will be implemented for boreholes (see Section 6). This is deemed to be appropriate given the modelled potential impact range for VHF (≤ 3.8 km; see Appendix A).

5.1.2.2.6. Disturbance

Because sound emitted by these activities may be audible to cetaceans, geotechnical surveys may have the potential to induce behavioural responses. However, the impacts of geotechnical surveys are thought to be of low concern (JNCC *et al*., 2010). This is supported by Nedwell and Brooker's (2008) study of a similar activity (pin pile drilling) which concluded that the ranges for 'significant avoidance in the majority of individuals' and 'low likelihood of disturbance' were 1.5 m and 85 m respectively.

As such, cetaceans unlikely to be disturbed by noise from geotechnical surveys over and above that as a result of the activity of setting up the drilling equipment (BOEM, 2012).

The potential for disturbance as a result of increased anthropogenic noise from geotechnical surveys is negligible.

5.2. Collision Risk (Vessels)

Vessels may be used during all aspects of the proposed survey programme (geophysical surveys, geotechnical surveys, metocean surveys, environmental/ecological surveys, archaeological surveys; see Section 2).

Although vessel strikes are a known cause of mortality and physical injury (with potential for subsequent infection) for some large whale (Laist *et al*., 2001; Van Waerebeek *et al*., 2007) and marine turtle species (Foley *et al*., 2019), smaller cetaceans (including minke whale, the dolphin species and harbour porpoise) are agile and have been shown to avoid vessels e.g., Palka and Hammond (2001).

Due to the nature of the proposed survey work, vessels[13] (typically 15 – 100 m in length) will either be:

- Following pre-defined linear routes at low to moderate working speeds (e.g., geophysical survey);
- Stationary (e.g., geotechnical survey when sampling); or
- Transiting in a predictable manner (e.g., geotechnical survey when travelling between sampling locations).

It will therefore be easy for the cetacean species likely to occur in the area to predict their path and avoid them, which will greatly reduce the risk of collision. Watches for marine turtles will be conducted when vessels are moving at greater speeds (i.e., when transiting) to reduce the risk of collisions with these species.

Annex IV species in the area are exposed to marine traffic on a regular basis and should therefore be habituated to vessel movements. The small number of vessels that will be required for these surveys will not significantly increase

[13] Including unmanned surface vehicles (USVs) and autonomous surface vehicles (ASVs). USVs and ASVs are increasingly used to conduct marine mammal surveys (Verfuss *et al*., 2019; Rodofili *et al*., 2022; Álvarez-González *et al*., 2023). Collision risk is negligible due to their small size, slow speeds (average of 3 – 9 knots), and predictable trajectories.

vessel traffic in the area; collision risk for Annex IV species is not expected to increase as a result of the localised increase in survey vessels. As such, the potential for collision risk from the proposed survey work is negligible.

6. Proposed Mitigation

Mitigation will be applied to all marine mammal and megafauna species i.e., Annex IV species (cetaceans and marine turtles), seals, and basking sharks.

6.1. Geophysical surveys

Standard mitigation measures (for geophysical acoustic surveys; DAHG, 2014) will be implemented for the SBP, UHRS (sparker), and USBL.

Where possible the equipment will be operated such that the SPL of the sound emitted is less than 202 dB re. 1 µPa at 1 m (which is the lowest of the auditory injury onset thresholds for impulsive noise; see Table 5-2).

Where this cannot be achieved the following (as detailed in Section 4.3.4 (ii) of the DAHG (2014) guidance) will be undertaken prior to the commencement of the survey, and if there is a break in sound output for a period greater than 30 minutes:

- Pre-start monitoring (30 minutes) of a 500 m radius zone; and
- Ramp up procedure.

Where effective visual monitoring is not possible (e.g., poor conditions, during the hours of darkness), passive acoustic monitoring will be undertaken to allow the survey to proceed in a timely manner.

6.2. Geotechnical surveys

Standard mitigation measures (for drilling; DAHG, 2014) will be implemented for boreholes.

The following (as detailed in Section 4.3.2 of the DAHG (2014) guidance) will be undertaken prior to the commencement of the survey and if there is a break in sound output for a period greater than 30 minutes:

- Pre-start monitoring (30 minutes) of a 500 m radius zone.

Where effective visual monitoring is not possible (e.g., poor conditions, during the hours of darkness), passive acoustic monitoring will be undertaken to allow the survey to proceed in a timely manner.

6.3. Collision risk

Watches for marine turtles will be conducted when vessels are moving at greater speeds (i.e., when transiting).

6.4. Reporting

Full reporting on the mitigation undertaken as outlined in Appendix 6 and 7 of DAHG (2014) will be provided to the Regulatory Authority.

7. Conclusions

Five Annex IV species are considered to occur regularly in the region of the MUL application area; minke whale, bottlenose dolphin, common dolphin, Risso's dolphin and harbour porpoise (see Section 4).

The findings of this Risk Assessment are as follows:

- Geophysical surveys
  - Although the potential for auditory injury onset and TTS onset is negligible, standard mitigation measures (DAHG, 2014) will be implemented for the SBP, UHRS (sparker), and USBL (see Section 6).
  - The potential for disturbance is negligible i.e., unlikely to be detrimental to the maintenance of the populations of the species concerned at a FCS in their natural range.
- Geotechnical surveys
  - Although the potential for auditory injury onset and TTS onset is negligible, standard mitigation measures (DAHG, 2014) will be implemented for boreholes (see Section 6).
  - The potential for disturbance is negligible i.e., unlikely to be detrimental to the maintenance of the populations of the species concerned at a FCS in their natural range.
- Collision risk (vessels)
  - The potential for collisions is negligible.
  - Watches for marine turtles will be conducted when vessels are moving at greater speeds (i.e., when transiting).

In conclusion, there will be no impact to the maintenance of the populations of the species concerned at a FCS in their natural range therefore an Annex IV species derogation licence (to disturb) for the proposed survey work can be awarded should it be required.

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Appendices

A. Underwater Noise Modelling Literature Review

A.1. Introduction

In order to support this Annex IV Risk Assessment, underwater noise modelling studies undertaken as part of Maritime Usage Licence (MUL) applications for site investigation (SI) surveys off the south coast of Ireland (Table A1) were reviewed.

This literature review summarises the findings of the underwater noise modelling undertaken for the 'Department of Energy and Climate Change (DECC)' and 'EirGrid' MUL applications.

Table A1: MUL applications for geophysical and SI surveys off the south coast of Ireland which have undertaken underwater noise modelling

MUL application	'DECC'	'EirGrid'
Reference number	LIC240006	MUL240036
Location of activity	Off the coasts of counties Wexford, Waterford and Cork	South Coast of Ireland
Activity	Deployment of the Marine Institute's R.V. to undertake a geophysical survey in the South Coast DMAP to inform future offshore renewable energy development	Marine site investigation (SI) works to inform the engineering design and environmental assessments for two offshore substations (OSS) in the Tonn Nua Area A (as identified in the South Coast Designated Maritime Area Plan), potential offshore transmission cable corridors, approaches to seven potential landfall zones, and seven landfall zones
Status	Determined	Determined
Noise propagation model type	Numerical	Simple
Reference	Thomsen *et al*. (2023)	RPS (2025)

Source: MARA MUL determinations https://www.maritimeregulator.ie/our-work/maritime-usage-licences/mul-applications-determined/

A.2. DECC Underwater Noise Modelling Report (Thomsen *et al*., 2023)

DHI A/S conducted this study titled 'Noise modelling and environmental risk assessment of a geophysical survey and its impact on herring and minke whales in Irish coastal waters' on behalf of the Marine Institute. The study modelled the impact of underwater noise from geophysical surveys in the north Celtic Sea on minke whales (*Balaenoptera acutorostrata*) and Atlantic herring (*Clupea harengus*). This review will focus on the outputs for minke whale (herring is not an Annex IV species).

Outputs from the following equipment were modelled:

- UHRS sparker
  - Typical frequency 0.3 – 1.2 kHz
  - Typical source level 226 dB re 1 µPa
- Mini airgun

This application will not be using an airgun therefore these data have not been reviewed.

A.2.1. Modelling Approach

This study used:

- A numerical acoustic propagation model; and
- The thresholds set by NMFS (2018).

A.2.2. Results

The modelled ranges of effect of underwater noise generated by the UHRS sparker were small; ranges for instantaneous Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) were both 0.1 km (Table A2). The range for behavioural responses was 0.9 km.

Table A2: Average impact ranges (km) resulting from operation of the UHRS sparker

Effect	Hearing group	Average impact range (km)
Instantaneous PTS (PTS_{ss})	LF	0.1
Cumulative PTS (PTS_{cum})	LF	0.2
Instantaneous TTS (TTS_{ss})	LF	0.1
Cumulative TTS (TTS_{cum})	LF	0.9
Behavioural response	LF	0.9

Source: Thomsen et al. (2023).

A.3. EirGrid Underwater Noise Modelling Report (RPS, 2025)

EirGrid conducted this study titled 'Powering up Offshore South Coast: Subsea noise technical report'. The study modelled the impact of underwater noise from geophysical and geotechnical surveys off the south coast of Ireland on the following hearing groups: Low frequency cetaceans (LF), high frequency cetaceans (HF), very high frequency cetaceans (VHF), phocid carnivores in water and fish. This review will focus on the outputs for cetaceans (the other hearing groups do not contain Annex IV species).

Outputs from the following equipment and activities were modelled:

- Geophysical survey
  - Parametric SBP and chirper/pinger
  - Sparker and boomer
- Geotechnical survey
- ADCP

A.3.1. Modelling Approach

This study used:

- A semi-empirical model known as "Roger's" model;
- The thresholds set by NMFS (2024) for auditory injury onset and TTS onset; and
- The Level B harassment criteria (as defined by the US Marine Mammal Protection Act) for behaviour. As noted by Darias-O'Hara et al. (2025), there is very little empirical support underpinning these thresholds.

A.3.2. Results

The modelled ranges of effect of underwater noise generated by the equipment and activities were generally small; ranges for auditory injury onset for both LF and HF were < 0.1 km (Table A3). For VHF the range was greatest for 'sparker and boomer' (2.2 km). The ranges for behavioural responses were greater.

Table A3: Impact ranges (km)

Equipment or activity	Auditory injury onset			TTS onset			Behavioural response
	LF	HF	VHF	LF	HF	VHF	
Parametric SBP and chirper/pinger	< 0.1	< 0.1	0.3	0.2	0.2	4.1	16
Sparker and boomer	< 0.1	< 0.1	2.2	1.2	0.1	4.3	19
Geotechnical survey	< 0.1	< 0.1	0.2	0.2	0.1	3.8	14
ADCP	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.01

Source: RPS (2025).

A.4. Conclusions

A.4.1. Auditory Injury Onset

Modelled ranges for LF for PTS and auditory injury onset were ≤ 0.2 km in both studies.

Ranges (modelled by RPS (2025)) for auditory injury onset for HF were < 0.1 km; ranges for VHF were greater but still small (≤ 0.3 km except for the sparker and boomer).

These ranges are comparable to those used in this Annex IV Risk Assessment.

A.4.2. TTS Onset

Modelled ranges for LF for TTS onset were ≤ 1.2 km in both studies.

Ranges (modelled by RPS (2025)) for TTS onset for HF were < 0.2 km; ranges for VHF were greater but still small (≤ 4.3 km).

These ranges are comparable to those used in this Annex IV Risk Assessment.

A.4.3. Behavioural Responses

The modelled ranges for behavioural responses were variable (0.9 – 19 km).

Although smaller than some of the modelled ranges, Effective Deterrence Ranges (EDRs) are considered to be appropriate for use in this Annex IV Risk Assessment. This is because there is very little empirical support underpinning the Level B harassment criteria.

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