



Marine Management Organisation

Marine Licensing
Lancaster House
Hampshire Court
Newcastle upon Tyne
NE4 7YH

T +44 (0)300 123 1032
F +44 (0)191 376 2681
www.gov.uk/mmo

Immingham Eastern Ro-Ro Terminal Case Team
Planning Inspectorate
imminghameasternroroterminal@planninginspectorate.gov.uk

(Email only)

MMO Reference: DCO/2021/00004
Planning Inspectorate Reference: TR030007

19 April 2022

Dear Sir/Madam,

Planning Act 2008: Proposed Immingham Eastern Roll on/Roll off (Ro-Ro) Terminal Development Consent Order

This document comprises the Marine Management Organisation's ("MMO") initial comments in respect of the above Development Consent Order application ("DCO Application") in the form of a relevant representation.

This is without prejudice to any future representation the MMO may make about the DCO Application throughout the examination process. This is also without prejudice to any decision the MMO may make on any associated application for consent, permission, approval or any other type of authorisation submitted to the MMO either for the works in the marine area or for any other authorisation relevant to the proposed development.

Relevant Representation

On the 09 March 2023 the MMO received notice under Section 56 of the Planning Act 2008 ("PA 2008") that the Planning Inspectorate ("PINS") had accepted an application made by Associated British Ports (the "Applicant") for a DCO Application (MMO ref: DCO/2021/00004; PINS ref: TR030007) for the Immingham Eastern Ro-Ro Terminal.



The DCO Application includes a draft development consent order (“DCO”) and an Environmental Statement (“ES”). The draft DCO includes, at Schedule 3, a draft Deemed Consent under Part 4 (Marine Licensing) of the Marine and Coastal Access Act 2009 (“Deemed Marine Licence” (DML)), this can be found in Schedule 3.

The DCO Application seeks authorisation for the construction, of a new 3-berth Roll-On/Roll-Off (Ro-Ro) terminal facility within the Port of Immingham. Greater detail on the proposals can be found in Chapter 1 of this representation.

Please find the MMO comments below.

Yours faithfully,

Jack Coe
Marine Licensing Case Officer

D +44 ([REDACTED]

E [REDACTED]

Copies provided to:

Marine Licensing Senior Case Manager – [REDACTED]

Marine Licensing Case Manager – [REDACTED]



Contents

	The MMO's role in Nationally Significant Infrastructure Projects (NSIPs).....	4
1	The Proposed Development.....	5
2	General comments.....	5
3	Development Consent Order (DCO) and Deemed Marine Licences (DMLs)	6
	3.1 MMO Comments on Schedule 3, Part 1- General.....	6
	3.2 MMO Comments on Schedule 3, Part 2- Conditions applying to all licensable activities.....	7
	3.3 MMO Comments on Schedule 3, Part 3- Procedure for the discharge of conditions....	9
	3.4 Other MMO Comments	9
4	Environmental Statement (ES)	10
	4.1 Benthic Ecology.....	10
	4.2 Fish and Shellfish Ecology	10
	4.3 Coastal Processes.....	16
	4.4 Underwater Noise.....	18
	4.5 Dredge and Disposal	23
	4.6 Shipping and Navigation.....	24
	4.7 Marine Archaeology.....	25
	4.8 Seascape, Landscape and Visual Resources	25
	4.9 Commercial Fisheries	25
5	Summary.....	25
6	References.....	26



The MMO's role in Nationally Significant Infrastructure Projects (NSIPs)

The MMO was established by the Marine and Coastal Access Act 2009 (the “2009 Act”) to make a contribution to sustainable development in the marine area and to promote clean, healthy, safe, productive and biologically diverse oceans and seas.

The responsibilities of the MMO include the licensing of construction works, deposits and removals in English inshore and offshore waters and for Northern Ireland offshore waters by way of a marine licence. Inshore waters include any area which is submerged at mean high water spring (“MHWS”) tide. They also include the waters of every estuary, river or channel where the tide flows at MHWS tide. Waters in areas which are closed permanently or intermittently by a lock or other artificial means against the regular action of the tide are included, where seawater flows into or out from the area.

In the case of NSIPs, the Planning Act 2008 (the “2008 Act”) enables DCO’s for projects which affect the marine environment to include provisions which deem marine licences. As a prescribed consultee under the 2008 Act, the MMO advises developers during pre-application on those aspects of a project that may have an impact on the marine area or those who use it. In addition to considering the impacts of any construction, deposit or removal within the marine area, this also includes assessing any risks to human health, other legitimate uses of the sea and any potential impacts on the marine environment from terrestrial works.

Where a marine licence is deemed within a DCO, the MMO is the delivery body responsible for post-consent monitoring, variation, enforcement and revocation of provisions relating to the marine environment. As such, the MMO has a keen interest in ensuring that provisions drafted in a deemed marine licence (“DML”) enable the MMO to fulfil these obligations.

Further information on licensable activities can be found on the MMO’s website [here](#). Further information on the interaction between the Planning Inspectorate and the MMO can be found in our joint advice note 11 Annex B [here](#).



1 The Proposed Development

The Immingham Eastern Ro-Ro Terminal project will comprise the construction of a new Ro-Ro terminal within the boundary of the Port of Immingham. This facility is designed to service the embarkation and disembarkation of principally commercial cargo carried either by accompanied trailer or by lorry or on unaccompanied trailers which will be collected at the port of disembarkation. In addition to this wheeled cargo, the new facility will be designed to accommodate an element of passenger use, albeit only during those periods when the demands of the Ro-Ro cargo operation allow.

The Marine works associated with this development consist of the following construction works:

- An approach jetty from the shore;
- A linkspan (a type of bridge used to allow vehicles to move on and off vessels) with bankseat (support) to provide a solid foundation;
- Two secured floating pontoons;
- Two finger piers to provide three berths (one on either side of the northern-most outer finger pier furthest from the shore, and one on the northern side of the southern-most inner finger pier) thereby enabling the vessels to berth alongside with their stern ramps resting on a floating pontoon which will match the rising and falling of the tide;
- A capital dredge of the new berth pocket;
- Disposal of dredged material at sea on the basis that no beneficial alternative use for the material has been identified; and
- Possible inclusion of vessel impact protection measures to provide protection in the unlikely event of an errant vessel contacting the Immingham Oil Terminal (IOT) trunk way.

2 General comments

- 2.1. Overall, the MMO considers this DML to be of a reasonable quality. However, we do have some comments to make, these relate mainly to Schedule 3, Part 2 'Conditions applying to all licensable activities' and Part 3 'Procedure for the discharge of conditions', however, we offer some additional comments in relation to some further sections of the DML, they are captured in the 'Other MMO Comments' section of this chapter.
- 2.2. Throughout the DML, the term 'licence holder' is referred to. The MMO has moved away from this phrase and consider that, instead, the term 'undertaker' should be used.



3 Development Consent Order (DCO) and Deemed Marine Licences (DMLs)

3.1 MMO Comments on Schedule 3, Part 1- General

1.1.1. 3.1.1 With regard to Part 1 (1) 'Interpretation' - the MMO considers the definition of 'Named Vessel' to be insufficient for the purposes of this document. The MMO would refer the Applicant to the definition of 'Vessel' as written in the 'Interpretation' section of the Sizewell C Development Consent Order as a more appropriate definition to use. The MMO has provided it below:

“vessel” means every description of vessel, however propelled or moved, and includes a non-displacement craft, a personal watercraft, a seaplane on the surface of the water, a hydrofoil vessel, a hovercraft or any other amphibious vehicle and any other thing constructed or adapted for movement through, in, on or over water and which is at the time in, on or over water;

3.1.2 With regard to Part 1 (2) 'Contacts' - the MMO has noted the inclusion of the email address [REDACTED]. The MMO has reviewed this contact information internally and can confirm it is not an MMO email address. Given that these contact details are related to the Local MMO Office in Beverley, East Riding of Yorkshire, the MMO can confirm that the correct email address is [REDACTED]. The MMO would insist that this email address is used in all communications related to this project and as its relevant MMO contact in future.

3.1.3 With regard to Part 1 (3) 'Licensed marine activities' - the MMO question whether the Applicant has included an error in formatting this provision. The MMO consider that it could be separated into two separate sections as written below:

(b) *Activities which will include works to—*

- (ii) *Temporarily remove, alter, strengthen, interfere with, occupy and use the banks, bed, foreshore, waters of the River Humber;*
- (iii) *remove, relocate or replace any work or structure;*



3.2 MMO Comments on Schedule 3, Part 2- Conditions applying to all licensable activities

- 3.2.1 **Condition 6(5)**- The MMO considers that this article requires the insertion of a time limit for this notification, so that the MMO is aware of the appropriate agent, contractor or vessel engaging in the licensed activity in question. We suggest the below wording for the Applicant in response to this:

*Any changes to details supplied under subparagraph (2) must be notified to the MMO in writing **no less than 24 hours** prior to the agent, contractor or vessel engaging in the licensed activity in question.*

- 3.2.2 **Condition 8(1)**- The MMO requests that the time restriction of this notification is amended from 'no less than seven days before the commencement of the licensed activity' to 'no less than 24 hours before the commencement of the licensed activity' so as to match with *Condition 6(2)* referenced earlier in the document.

- 3.2.3 **Condition 13(5)**- The MMO considers the usage of both the terminology "at all times" and "wherever possible" to be contradictory. The MMO advise that this is re-worded to accurately reflect how often they intend to use the Vibro-Piling methodology as is it currently unclear.

- 3.2.4 **Condition 16**- The MMO would offer a slightly revised wording of this condition so as to ensure that only the appropriate substances are used for these works and that adequate guidelines have been followed by the Applicant:

The undertaker must ensure that any coatings/treatments are suitable for use in the marine environment and are used in accordance with guidelines approved by Health and Safety Executive and the Environment Agency Pollution Prevention Control Guidelines.

- 3.2.6 **Condition 18(2)**- The MMO would ask that the Applicant replace the word 'shall' with the word 'must' in the opening line of this condition in order to ensure that it is sufficiently enforceable. Additionally, after the use of the phrase "or any other site approved in writing" we would request that the words "by the MMO" are included in order to give complete transparency as to who the regulator for the marine environment is.



3.2.7 **Condition 19(1)**- The MMO has concerns regarding the lack of a time restriction associated with this condition. At present, this condition reads that “*the licence holder must submit to the MMO for its approval a sediment sampling plan request prior to the commencement of the capital dredging activity*”. Given the vagueness of this condition, the MMO would request that a provision for a period of “at least 4 months” is added to this condition to allow the MMO the time to review the sediment sampling plan and ensure that it is appropriate for this project.

3.2.8 **Condition 19(3)**- The MMO would request a slight variation to the wording of this condition in order to align it more closely to *Article 19(1)*, the MMO requests that the Applicants adopt the below wording for this condition:

Any sediment sampling analyses undertaken by a laboratory validated by the MMO and approved by the MMO as part of the sediment sampling plan approved under sub-paragraph (1) is valid for a period of 3 years from the date when those analyses were undertaken.

3.2.9 **Condition 20**- The MMO would ask that the Applicant alter this condition to make it so that the written approval for disposal at sea is received after the relevant method statement has been approved by the MMO.

3.2.9 **Condition 22**- The MMO requests that the Applicant substitute the term ‘material’ with the term ‘deposited material’.

3.2.10 **Condition 23**- The MMO would request that this condition is updated to the following wording:

(1) The undertaker must report all dropped objects to the MMO using the dropped object procedure form as soon as reasonably practicable and in any event within 24 hours of becoming aware of an incident.

(2) On receipt of the Dropped Object Procedure Form, the MMO may require, acting reasonably, the undertaker to carry out relevant surveys. The undertaker must carry out surveys in accordance with the MMO’s reasonable requirements and must report the results of such surveys to the MMO.

(3) On receipt of such survey results, the MMO may, acting reasonably, require the undertaker to remove specific obstructions from the seabed. The undertaker must carry out removals of specific obstructions from the seabed in accordance with the MMO’s reasonable requirements and at its own expense.



3.2.11 **Condition 24-** The MMO would request that the Applicant define precisely what a 'Notice to Mariners' is as this has been omitted from the 'definitions' section. Furthermore, the condition as currently written is unclear as it is unclear as to which licenced activity is specifically being referred to. The MMO would suggest the Applicant update this condition to the following wording:

Local mariners, fishermen's organisations and the UK Hydrographic Office must be notified of any licensed activity or phase of licensed activity through a local Notice to Mariners. A Notice to Mariners must be issued at least 5 days before the commencement of each licensed activity or phase of licensed activity. The MMO and MCA must be sent a copy of the notification within 24 hours of issue. The Notice to Mariners must include—

- (a) the start and end dates for the works;*
- (b) a summary of the works to be undertaken;*
- (c) the location of the works area, including coordinates in accordance with WGS84; and*
- (d) any markings of the works area that will be put in place.*

3.3 MMO Comments on Schedule 3, Part 3- Procedure for the discharge of conditions

3.3.1 **Condition 29(1)-** The draft states that *"the MMO must give notice to the licence holder of the determination of the application as soon as reasonably practicable after the application is received by the MMO and in any event within 6 weeks of receipt of the application"*. The MMO endeavours to provide a determination on 90% of applications within 13 weeks from validation and fee estimate acceptance, however there is no guarantee that this determination when granted will be positive. The MMO requests that this statement is amended to reflect the 13 week standard KPI target

3.4 Other MMO Comments

3.4.1 **Article 8-** The MMO is reserving more complete comments on this article until it has had further time to discuss it, however, we would ask that the Applicant defines the phrase *"different significant environmental effects"* as the MMO considers this to be somewhat vague.



4 Environmental Statement (ES)

4.1 Benthic Ecology

- 4.1.1 The MMO broadly agree with the conclusions reached by the Applicant relating to this section of the ES. Regarding the scoping out of impacts to the benthic assemblage associated with the effects of piling we agree that the impact of temporary sediment suspension is extremely localised and of such a small scale that is unlikely to have significant negative effects on any benthic receptors present within the area.
- 4.1.2 Regarding the potential cumulative and inter-related impacts of the Benthic environment, the MMO considers that chapter 20 of the ES includes an adequate methodology for a cumulative (and in-combination) effects assessment and a comprehensive list of projects, developments and activities scoped in for assessment.
- 4.1.3 The MMO agree with the proposed mitigation measures which include following biosecurity management procedures to reduce the risk of introduction of Invasive Non-Native Species (INNS), environmental management best practice (to reduce the risk and consequences of accidental spillages) and the targeted disposal of dredged material (to avoid depth reductions). Regarding impacts to Benthic Ecology, the MMO has no further comments to offer on this mitigation.

4.2 Fish and Shellfish Ecology

- 4.2.1 The MMO note from Section 3.1.61 that the Applicant has presented two possible construction programme scenarios but would prefer the first of these two options, where all the marine infrastructure is constructed at the same time. In the second scenario, the Applicant asserts that the dredging schedule will not be changed, but that the construction of the various finger piers will occur in stages. The Applicant states that “*Capital dredging works would necessarily be undertaken 24 hours a day, 7 days a week, and would take around 80 days in early to mid-2024. It is estimated that piling works would be undertaken for approximately 24 weeks in total*”. An approximate timeframe for the capital dredging campaign has been given as early to mid-2024 which overlaps with the timeframe of piling works (stated as “*scheduled to commence in early 2024 on the northern (outer) finger pier*” in Section 3.1.61). In both scenarios, the approximate timeframe of the capital dredging campaign overlaps with the timeframe of piling works. The MMO has serious concerns about the impacts to migratory fish from piling and dredging works being undertaken concurrently and note that the multiple stressors to fish (increased suspended sediment concentration (SSC) in the water column and underwater



noise (UWN) disturbance and vibration) arising from these simultaneous activities have not been examined in the intra-project effects assessment.

4.2.2 It is the MMO's view that the potential impacts to fish from piling, capital dredging and dredge/disposal activities have been appropriately characterised in Table 9.21 of Section 9.8, and the Applicant has identified the following impact pathways which the MMO consider to be appropriate:

- Direct loss or changes to fish populations and habitat as a direct result of dredging and dredge disposal,
- Changes in water and sediment quality as a result of dredging and dredge disposal,
- Underwater noise and vibration during piling, capital dredging and dredge disposal.

4.2.3 However, it is noted that the Applicant is yet to assess the potential impacts to fish 'during operation' (i.e., changes to fish populations and fish habitat, changes in water and sediment quality and underwater noise and vibration) as these impacts are considered to be equivalent or lower in magnitude than those from the construction phase and existing maintenance dredging and vessel movements in the river. In reviewing previous advice given for this case it was recommended that "*habitat loss and disturbance as well as underwater noise impacts on fish during operation should be further assessed within the ES, taking into account other developments in the area (cumulative effects)*". This recommendation was made during the initial review of the Preliminary Environmental Information Report (PEIR), and in a further, additional review of the PEIR. The Applicant should acknowledge that even maintenance dredging activities, although arguably less impactful than the construction-phase dredging campaign, still have the potential to cause habitat loss and disturbance to fish, as well as generate additional noise within the river.

4.2.4 The Applicant has recognised that salmonids and migratory fish species can be sensitive to elevated SSCs, however, they state that "*Atlantic salmon and sea trout are both known to migrate through estuaries with high SSC to get to spawning areas (including the Humber Estuary which is considered one of the estuaries in the UK with the highest levels of SSCs)*". Whilst salmonids, and migratory species which inhabit estuarine environments, do have some tolerance to moderately elevated levels of SSC, given the natural fluctuations in SSC expected within estuarine environments, this does not preclude a significant impact and should be amended by the Applicant.



- 4.2.5 The MMO also has some concerns with regard to the UWN assessment. We note that the Applicant has provided an assessment which appears to have modelled a worst case-scenario based on two piling rigs installing 4 piles per day. They consider that each pile will require 5 minutes of vibro-piling and 45 minutes of percussive piling (20 minutes of vibro-piling and 180 minutes of impact piling per day in a 12-hour shift) to be successfully installed.

The likely maximum impact piling scenario is for four tubular piles to be installed each day using up to four piling rigs. However, it is unclear whether all four rigs will be in operation concurrently. Conversely, the Applicants also state that '*Piling will be undertaken simultaneously using piling rigs. Adding two identical sources (i.e. doubling the signal).*' It is therefore not clear why concurrent piling using two rigs has been modelled, if four rigs are going to be in operation concurrently. The Applicant should be specific in this regard.

The Applicant also makes references to using 'land and water-based approaches' to piling, however it is unclear whether the 'land-based approach' refers to piling above MHWS, or refers to a land-based crane being used to pile into the water. If this is the case, land-based rigs which are piling into the water are still likely to have an effect and the Applicant will need to take these into account in the noise assessment. If four piling rigs are to be operating concurrently then this should be modelled as the worst-case scenario. It would also be helpful if the locations of the rigs used in the modelling were mapped/described to ascertain whether the worst-case scenario, in terms of impact range from concurrent piling, has been suitably modelled.

- 4.2.6 The range of effect for mortal injury, recoverable injury and behavioural effects are presented in Tables 6 and 7 for percussive and vibro-piling, respectively, but the range of effect for Temporary Threshold Shift (TTS) has not been included. TTS should be modelled and presented for percussive and vibro-piling so that a range of effect can be determined.
- 4.2.7 The Applicant has also provided tables detailing the approximate distances (in metres) for fish response criteria during concurrent impact piling (Table 7) and concurrent vibro-piling (Table 8) based on two operational rigs. For impact piling, behavioural reactions are anticipated to occur across 67% width of the estuary at low water and 46% of the estuary at high water. For vibro-piling, behavioural reactions are anticipated to occur across 48% width of the estuary at low water and 33% of the estuary at high water. Initially, it appears that a sufficient portion of the estuary would remain available as an area in which fish could migrate past the site relatively undisturbed, however, it is our understanding that the modelling approach used in the ES assessment can only be used to predict magnitude of risk, rather than to determine range of impact. In addition, the MMO understands that the range of impact may be considerably higher.



4.2.8 The MMO note that the Applicant has proposed a series of ‘best practice’ mitigation measures in a bid to reduce the risk of significant impacts to fish receptors, and we agree that these are appropriate.

- I. 20-minute soft-start on commencement of piling, as per JNCC guidelines (JNCC 2010), which will allow marine receptors (e.g., marine mammals and fishes) to move away from the source of impact before full hammer levels are reached.
- II. Vibro-piling will be used (where possible) to reduce the noise levels and thus exposure to marine receptors, when compared to percussive piling which typically uses a higher hammer energy.

Furthermore, the following seasonal piling restrictions are also proposed:

- III. No percussive piling is to take place within the waterbody between 1 April and 31 May inclusive in any calendar year. This restriction does not apply to percussive piling that can be undertaken outside the waterbody at periods of low water.
- IV. The duration of percussive piling is to be restricted within the waterbody from 1 June to 30 June and 1 August to 31 October inclusive in any year to minimise the impacts on fish migrating through Humber Estuary during this period such as silver eels, river lamprey and returning adult Atlantic salmon. The maximum amount of percussive piling permitted within any 4-week period must not exceed 140 hours where a single piling rig is in operation or a total of 196 hours where two or more rigs are in operation.
- V. No percussive piling within the waterbody will be undertaken at night between 1 March to 31 March, 1 June to 30 June and 1 August to 31 October, inclusive, after sunset and before sunrise on any day. This will provide a quiet ‘window’ which is likely to be of benefit to those species that undertake nocturnal migrations e.g., European eel.

4.2.9 The MMO is generally content that the periods covered by restrictions on percussive piling activity cover the greatest number of different migratory fish in the Humber Estuary. However, we have concerns regarding the restriction described in 4.2.10 iv, as justification for the 140-hour and 196-hour timeframes has not been provided, the MMO consider that this restriction is very flexible and somewhat vague. Firstly, it remains unclear how the Applicant has determined that 140 hours of piling from a single rig, or 196 hours of piling by two or more rigs is a suitable period of activity. It has been previously highlighted that, within every 4 week-period, a 140-hour operational timeframe (taking into account daytime-only working) “could mean potentially



allowing up to 11 consecutive days of piling to occur during the migratory period of fecund salmon looking to migrate upstream to spawn". We note that justification for these time periods has been requested in prior advice. Limited justification has been provided in Table 9.7, which bases the rationale for this restriction on similar restrictions in place at the Able Marine Energy Park (AMEP), however, as far as we can reasonably determine, justification of how the 140-hour and 196-hour timeframes were decided has not been provided. It is also not clear within the wording of the restriction how the 196 operational hours will be divided between what number of rigs. For example, will two rigs operating for a total 196-hours, be operating for 98-hours each? The Applicant should seek to amend this and provide the MMO with clarity on this matter.

4.2.10 Secondly, and on this point, the use of "*two or more*" percussive piling rigs is very vague and creates too much flexibility for the Applicant to operate as many rigs as they see necessary, which would undermine the purpose of this restriction. The Applicant should commit to a defined number of rigs in operation at once and set an appropriate defined number of operational hours per rig, in order to make this restriction meaningful and enforceable. The Applicant should provide transparent justification and supporting calculations for the defined number of operational hours per rig.

4.2.11 In addition, the restriction stating that no percussive piling will take place "*after sunset and before sunrise on any day*", leaves considerable flexibility given that point of sunrise and sunset is somewhat subjective and dependent upon season (i.e., longer hours of daylight in the summer months). As such, we recommend that the restriction be amended to state that *No percussive piling within the waterbody will be undertaken between 1900 and 0700 on any day, between 1 March to 31 March, 1 June to 30 June and 1 August to 31 October, inclusive.*

Finally, in our most recent advice, the MMO stated that "*it is unclear why the proposed restriction periods are only applied to percussive piling and not vibro piling, and why restrictions are only applicable at night*". It was requested that the Applicant provide clear justification for the proposed dates of each restriction, together with an explanation of why the piling restrictions should only be applied at night and why only applied to percussive piling in respect of each species they are intended to protect. This information has not been provided within the ES and we recommend the required information be presented for review by the MMO before the ES is accepted. Without this justification, it will be necessary to recommend a precautionary approach and avoid all forms of piling (i.e., vibro and percussive) for the period of 1 April and 31 May, inclusive, and for the period of 1 June to 30 June and 1 August to 31 October, inclusive. This is consistent with recommendations made in previous advice based on remaining uncertainties.



4.2.12 In previous responses, the MMO has recommended that, even taking into account the reduced dredge footprint, mitigation measures for migratory fishes will still be required in relation to capital dredging activities. It was stated that there is “*outstanding concerns in relation to the timing of piling and dredging activities which may overlap with the sensitive seasons of migratory fish*” and that we expect the EIA to reflect the comments and recommendations made in previous advice and the meeting held on 3rd October 2022. As far as we can determine, these recommendations have not been presented within the ES and no such mitigation has been proposed. It is clear that the Applicant anticipates that capital dredging works will be undertaken 24 hours a day, 7 days a week and last for approximately 80 days in early to mid-2024. This represents a significant dredging campaign during the sensitive seasons of migratory fish, and the MMO reiterate previous recommendations that dredging activities be restricted for the same period as piling.

4.2.13 The Applicant has provided a comprehensive long and short list of developments and activities which may have cumulative effects with the Immingham Eastern Ro-Ro Terminal (IERRT), based on a zone of influence for marine ecology receptors of 20km to the west of the development and 15km east of the development. As far as the MMO can reasonably determine, a sufficiently detailed inter-project cumulative impacts assessment has been carried out and we are generally content with this. However, the Applicant has identified several projects within close (< 2.5 km) proximity to IERRT which have potential to interact cumulatively. Among these are several significant developments, including the Humber International Terminal (HIT) berth 2, the Able Marine Energy Park and the Immingham Green Energy Terminal, which are undertaking piling works and dredging campaigns. Similarly, the Applicant has identified potential cumulative effects for a number of developments taking place within the wider area (< 10 km). Given the level of development currently within the Humber Estuary, this places additional importance on applying appropriate and meaningful mitigation to the IERRT.

4.2.14 Furthermore, the MMO does not consider that the intra-project impacts to fish have been accurately characterised. In the assessment of intra-project effects on fish offered by the Applicants (Section 20.6), they have discussed potential, cumulative underwater noise effects on fish from concurrent piling and dredging. However, the Applicant has not acknowledged that increases in SSC in the water as a result of dredging during the same period in which piling (percussive and vibro) are being undertaken, within a relatively confined estuarine environment, will create multiple concurrent stressors on fish receptors. This was also highlighted in previous consultations following submission of the PEIR. In Chapter 3 of the ES (Section 3.1.61-3.1.63), early to mid-2024 is described as a period in which both piling, and capital dredging works will be undertaken. As far as we can reasonably determine, further



justification for scoping out effects from piling, dredging and disposal on fish receptors of the further assessment in the ES, has not been provided. In reviewing the ES, the MMO considers that intra-project effects on fish from concurrent piling and dredging activities should be assessed within Chapter 20 and we expect the Applicant to provide this when possible.

4.2.15 In its review of the PEIR in February 2022, the MMO noted that all potential impacts during operation (i.e., changes to fish populations and fish habitat, changes in water and sediment quality and underwater noise and vibration) have been scoped out for further assessment as these impacts are considered to be equivalent or lower in magnitude than those from the existing maintenance dredging and vessel movements. We maintain our recommendation that habitat loss and disturbance as well as underwater noise impacts on fish during operation should be further assessed within the ES, taking into account other developments in the area (cumulative effects).

4.2.16 The Applicant states in Chapter 3 of the ES, that piles will initially be driven into the ground using vibro-piling and when resistance is reached, percussive piling will be used to reach the required depth. It seems then, that for a pile to be safely and completely installed, both vibro- and percussive piling is needed. The piling restrictions provided by the Applicant in Chapter 9 have been worded to apply to percussive piling only, however, it seems impractical to carry out 5 minutes of vibro-piling during periods when percussive piling is not permitted (i.e., between 1 April and 31 May, inclusive, and at night between 1 March to 31 March, 1 June to 30 June and 1 August to 31 October, inclusive). It therefore seems somewhat redundant to exclude vibro-piling from these restrictions. It would be helpful to understand what works the Applicant hopes to achieve using vibro-piling only during these restricted periods.

4.2.17 The Applicant has scoped out commercial shellfish species and insufficient evidence has been provided to support this decision. The MMO are satisfied with the evidence provided showing there are no commercial shellfish bivalve beds in the Humber Estuary, however, would expect to see a reference to support the statement that the IERRT and the disposal site do not support other shellfish (crab, lobster, or whelk).

4.3 Coastal Processes

4.3.1 Paragraph 7.1.2 of Chapter 7 identifies receptors as Hydrodynamics, Sediment transport, Plume dispersion and Waves. It is not strictly clear what 'plume dispersion' means when defined as a receptor, but this is not a significant concern - in general the approach is one the MMO supports as the Applicant does not define a specific geomorphic entity and so the assessment



is broad enough to capture all impacts i.e., as stated in paragraph 7.1.3, consequent impacts to specific features (e.g., port infrastructure, drainage outfalls and the adjacent foreshore) are then also considered.

- 4.3.2 The cumulative assessments consider each development pairwise with the IERRT and there is no consideration of the whole system with every development acting together as an ensemble. Entry 1 in Table 20.5 of Chapter 20 identifies the impact of the development on frequency of excess SSC - *“requirements for the IERRT indicates an increase of 3-6% on the existing average annual maintenance dredge (between 2004 and 2020) rate across the existing Immingham berths (or a 2-4% increase on the average annual disposal volume at the HU060 site since 2004)”* – but the cumulative assessment simply considers that, since these dredge campaigns are unlikely to be simultaneous with other developments, there is no cumulative impact. The MMO also note that only entry 1 in Table 20.5 appears to discuss the dredge e.g., though a dredge requirement is detailed for the Able Marine Energy Park, the assessment of this development in Table 20.5 does not consider SSC, only the hydrodynamics impact.
- 4.3.3 Additionally, consideration of the marine process impacts of multiple development sites on hydrodynamics and sediment transport generally considers that that lack of direct overlap of impact zones indicates no potential for cumulative effects, but this neglects the systemic nature of the estuary and the temporal implication of ‘cumulative’.
- 4.3.4 Figure 7.6 of Chapter 7 shows both sedimentation and SSC impacts extending several kilometres up and downstream, over and across the (implied) zone of influence of multiple other developments listed in Table 20.5. The overall estuary net sediment budget is estimated in the background information (Table 7.5) but this information is not used in the assessment - no assessment is made of how this budget is affected by the 3-6% increase in maintenance dredge due to this scheme; nor of the relative contribution of this change to the overall (i.e., cumulative) changes effected by the multitude of developments affecting the Humber. The applicant has not presented background data on typical exceedance of mean background suspended sediment concentrations within the estuary.
- 4.3.5 The MMO considers that cumulative assessment requires the resulting gradual increase in temporal mean SSC of the estuary to be discussed and quantified. A version of Figure 20.1 should be produced indicating the extent of dredge disposal impacts, with an estimation of the temporal increase in SSC arising from the increased future dredge needs. This may be accompanied by an estimation of the possible sediment sinks arising from the proposed realignment schemes on the opposite bank.



4.3.6 As outlined by the Applicant in paragraph 7.6.6 of Chapter 7, estuary processes are very dynamic and interconnected so the estuary is subject to natural morphological change – and a corollary of this is that any changes that might be due to the relatively minor physical process impacts will be very difficult to identify. By the same token, however, systemic change can be precipitated by minor changes amplified by systemic feedbacks. Thus, we consider it necessary for cumulative assessments to map and quantify the extent and magnitudes of impacts over time, as a record of potential impacted zones.

4.4 Underwater Noise

- 4.4.1 The MMO notes fish and marine mammal receptors have been considered as part of the assessment. It is appropriate that the potential impact pathway of underwater noise during piling operations, and capital dredging has been considered in the assessment for marine invertebrates, fish and marine mammals – see Table 9.21 in Chapter 9. Maintenance dredge and dredge disposal, and vessel operations (during the operational phase) have been scoped out from further assessment.
- 4.4.2 Table 9.1 in Chapter 9: *Nature Conservation and Marine Ecology* states that the marine mammal species in the study area are considered to have a moderate sensitivity to the anticipated level of underwater noise generated by the IERRT project from piling and a low sensitivity to noise due to dredging activities, although the MMO do not believe this ‘low sensitivity’ is justified.
- 4.4.3 Table 1 in Appendix 9.2 *Underwater Noise Assessment* helpfully provides the consultee responses to date, and how comments (raised at PEIR) have been addressed in the ES. The MMO thanks the applicant for their responses, however, does have some further comments specifically on Appendix 9.2 which can be seen in later in this section.
- 4.4.4 It is recognised that Chapter 20 *Cumulative and In-combination Effects*, provides an assessment of the potential cumulative effects. There is a lot of other development occurring in the Humber including Immingham Green Energy Terminal development, which is in close spatial proximity to this Project, and there is the potential for the two construction programmes to overlap. The MMO encourages the Applicant to ensure any potential cumulative impacts are assessed and submitted when possible as the project continues.
- 4.4.5 The MMO is aware that the proposed mitigation is set out in section 10.1.3 of Appendix 9.2 and welcome that soft start procedures will be employed. Such measures may help to reduce the total number of dangerous exposures in terms of auditory injury. As previously advised, agreement on the proposed restrictions and way forward (especially in terms of what would be an acceptable limit of percussive piling and vibro-piling per day during the sensitive seasons if piling is



allowed) will need to be sought. We welcome the proposed restriction that no percussive piling is to take place within the waterbody between 1 April and 31 May inclusive to reduce the risk of potential impact on migratory fish species within the Humber Estuary. The table submitted highlights the migratory periods of key fish species in the Humber.

- 4.4.6 The MMO notes the Applicant also proposes that percussive piling is to be restricted within the waterbody from 1 June to 30 June and 1 August to 31 October inclusive in any year. 'The maximum amount of percussive piling permitted within any 4-week period must not exceed 140 hours where a single piling rig is in operation; or a total of 196 hours where two or more rigs are in operation'. The MMO would again reiterate that it is unsure as to where the '140' and '196 hours' have been derived from, and it would be helpful if the Applicant could please provide clarification on this point.
- 4.4.7 The species potentially affected during August – October are Atlantic salmon (adults), river lamprey and Silver eel. The MMO noted in previous advice that the Humber is a recovering salmon river and two of the main tributaries for the Humber, the rivers Ouse and Trent are also recovering salmon rivers, and it is recognised that protecting migrating salmon smolts is fundamental to conserving salmon stock. In summer/early autumn adult salmonids are known to aggregate within estuaries, especially during periods of low flow and high temperatures. It is during these months of aggregation when the adult salmonids are most fecund, that they are most exposed to anthropogenic impacts for longer durations. Assuming piling operations take place between 0700 and 1900 (acknowledging that piling will not be continuous for 12 hours), this equates to over 11 days per 4-week period of percussive piling. Thus, we are not content that the risks to migratory species have been appropriately mitigated during the summer and autumn months.
- 4.4.8 Further, it is proposed that no percussive piling is to take place within the waterbody between 1 March to 31 March, 1 June to 30 June and 1 August to 31 October inclusive after sunset and before sunrise on any day. The MMO considers that no percussive piling at night will be of benefit to those species that generally undergo nocturnal migration, such as river lamprey, (notwithstanding the fact that presumably there may still be some vibro-piling during the hours of darkness; therefore, the implications of this need to be considered). If there are some species that generally migrate during the day, then it is a question of what the potential risks and implications are, of allowing up to 3 hours 20 minutes of piling (3 hours of percussive and 20 minutes of vibro-piling; worst case assumption) per day during these months.
- 4.4.9 The MMO further note that the Applicant is proposing to use vibro-piling as much as possible (recognising that impact piling may still be required to drive the piles to the required design level) throughout these works. Assuming that only part of the estuary (width) is affected by the vibro-piling operations, it is not known for certain how fish species will respond and whether receptors would be able to continue moving past the site during piling operations utilising certain (i.e., lesser disturbed)



parts of the estuary, or whether they would be affected. A significant impact would be if noise from piling operations causes fish to change their migratory behaviour. The MMO does acknowledge however that vibro-piling will be undertaken for limited periods only (20 minutes of vibro-piling per 24 hours). Piling in the dry will greatly minimise the risk of impact on local receptors, and we would encourage ABP to undertake as much piling in the dry as possible and it should be confirmed which areas will be possible to pile in the dry.

Specific comments on Appendix 9.2 Underwater Noise Assessment:

Impact (percussive) piling and fish receptors

4.9.10 Section 6.2.8: *“The SL for the impact driving of tubular piles as part of the proposed development is assumed based on the loudest near-source (10 m from the source) sound pressure measurements (SEL, peak SPL and RMS) for the percussive piling installation of the nearest-sized 1.52 m Cast-in-Steel-Shell (CISS) steel pipe piles in a shallow water environment (Illinworth & Rodkin, Pommerenck, 2014). Back-calculating the sound pressure measurements to 1 m using the simple logarithmic spreading model (equation 1) provides an estimated SL of 203 dB re 1 $\mu\text{Pa}^2 \text{ s}$ (SEL metric), 228 dB re 1 $\mu\text{Pa m}$ (peak SPL metric) and 213 dB re 1 $\mu\text{Pa m}$ (RMS metric)”. The ‘SEL metric’ should be clarified as it is not clear what this is. For impact piling, this should be the single strike sound exposure level (SELss). Furthermore, it is not clear why the RMS source level is 10 dB higher than the SEL source level. In any case, the RMS metric is generally not appropriate for assessing impulsive sources such as impact piling, so the MMO would recommend removing this. The relevant metrics for assessing the impacts of impulsive activities are SELcum (calculated by the aggregation of SELss) and SPLpeak.*

4.9.11 Section 6.2.9: *“Piling will be undertaken simultaneously using piling rigs. Adding two identical sources (i.e. doubling the signal) will increase the received level by 3 dB. In other words, the unweighted peak SL of concurrent impact piling by more than one piling rig is assumed to be 206 dB re 1 $\mu\text{Pa}^2 \text{ s}$ (SEL metric), 231 dB re 1 $\mu\text{Pa m}$ (peak SPL metric) and 216 dB re 1 $\mu\text{Pa m}$ (RMS metric)”. It is not clear why the Applicant is adding two identical sources when they confirm earlier in the assessment (see section 6.2.2) that a total of four piling rigs may be used: “The approach jetty will be built in the same way as above where there is sufficient water depth to enable barge access Where barge access cannot be achieved due to shallow water depths, a land-based crane positioned on completed sections of the jetty will be used. The piling equipment and process will be the same as described above. Piling works will be undertaken simultaneously on two fronts (i.e., the land and water based approached described above) using up to four piling rigs and may result in cumulative piling noise”. Furthermore, simultaneous piling from multiple rigs, would likely not increase the received peak pressure levels or the single strike SEL, as the individual pulses (and their peaks) originating from distinct rigs do*



not generally overlap (due to the distinct timing of the strikes and the propagation paths). However, piling from multiple rigs would increase the total number of strikes and thus the cumulative sound exposure level (SELcum) over 24 hours.

4.9.12 Table 3: 'Fish response criteria applied in this assessment': It is appropriate that the assessment refers to noise exposure criteria from Popper et al. (2014) for fish species. However, TTS is missing from this table for piling and the MMO would expect this to be included (in addition to mortality and potential mortal injury, and recoverable injury). Popper et al. provide a TTS threshold (based in the cumulative sound exposure level, SELcum) of 186 dB re 1 $\mu\text{Pa}^2\cdot\text{s}$ for piling, for all fish species.

4.9.13 Table 7 provides the modelled predictions for fish and impact piling. Having conducted an internal sense check of these predictions and based on the modelling assumptions provided in Table 6, the MMO believe that the predictions look plausible / reasonable for mortality and recoverable injury. We note that for behaviour, the predicted effect range is 1,554 m. The report states "*behavioural reactions are anticipated to occur across 67 % width of the Humber Estuary at low water and 46 % of the estuary width at high water, therefore, potentially creating a partial temporary barrier to fish movements*". The simple modelling approach can only provide approximations (i.e., an indication of the order of magnitude) of the potential effects, rather than definitive ranges and percentages. Furthermore, using the propagation assumptions detailed in the report (i.e., $TL = 17.91 + \alpha R$), a behavioural threshold of 135 dB SELss (a conservative assumption from Hawkins et al., 2014) and a source level of 203 dB (assuming that this is SELss), then we may expect effects out to ~ 6 km. Thus, it can be concluded that there is the risk of a temporary barrier effect across part or all of the estuary.

Vibro-piling and fish receptors

4.4.14 As for percussive piling, 3 dB (assuming two identical sources) has been added to the estimated source levels for vibro-piling (which are 198 dB re 1 $\mu\text{Pa}^2\text{ s}$ (SEL metric), 213 dB re 1 $\mu\text{Pa m}$ (peak SPL metric) and 198 dB re 1 $\mu\text{Pa m}$ (RMS metric)). This therefore provides source level values of **201 dB re 1 $\mu\text{Pa}^2\text{ s}$ (SEL metric)**, **216 dB re 1 $\mu\text{Pa m}$ (peak SPL metric)** and **201 dB re 1 $\mu\text{Pa m}$ (RMS metric)**. The SPLrms is the most relevant/appropriate metric for continuous sources. The SPLrms is additive when there are two or more continuous sources. Thus, given the piling rigs should be relatively close together (within the estuary), it is reasonable to add 3dB as Applicant has been done here, for two piling rigs. Nevertheless, the Applicant should confirm that there will only be two piling rigs operating simultaneously.



4.4.15 Section 9.1.10: “The calculator developed by NMFS (2021) has been used to calculate the range at which the **instantaneous peak and cumulative SEL thresholds** for vibro driving (Popper et al., 2014) are reached. The model input values and associated assumptions for vibro piling are included in Table 8”. Presumably, the Popper et al. thresholds for impulsive noise have been used in this assessment of vibro-piling for fish. Pulse sounds such as percussive pile driving are likely to have a greater effect on fish than continuous sources at the same level (Neo et al., 2014). Thus, it is reasonable that the Popper thresholds for percussive/impact piling have been applied in the assessment of sound exposure from continuous sources (this is a precautionary approach). However, please note that the instantaneous peak is not relevant for continuous sources.

4.4.16 Section 9.1.13: “Behavioural reactions are anticipated to occur across 48% of the width of the Humber Estuary at low water and 33% of the estuary width at high water”. A simple modelling approach can only provide an order of magnitude of the potential effects, rather than definitive ranges and percentages.

Dredging and vessel movements and fish receptors

4.4.17 The Popper criteria only provide limited quantitative thresholds for continuous sources of noise, such as dredging and vessel noise (i.e., recoverable injury: 170 dB rms for 48 hours and TTS: 158 dB rms for 12 hours). These thresholds are reached at 10 m and 46 m for recoverable injury and TTS respectively, as per Table 10 in Appendix 9.2. We agree with the Applicant that instantaneous effects are unlikely.

4.4.18 As noted above, dredging operations will be undertaken for 24 hours and therefore, the cumulative sound exposure (over 24 hours) should be considered, although the MMO appreciate that there are no defined SELcum thresholds at present for continuous sources and fish. As noted above, given that pulse sounds such as percussive piling noise are likely to have a greater effect on fish than continuous sources at the same level (Neo et al., 2014), the Popper thresholds for impact piling could be applied in the assessment of cumulative sound exposure from continuous sources as a precautionary approach (as has presumably been done within this assessment for vibro-piling). The MMO agrees with the Applicant that the level of exposure will depend on the position of the fish with respect to the source, the propagation conditions and the individual’s behaviour over time. Nevertheless, given the 240 hour dredging operations, we would expect larger effects than what has been presented.



Marine mammals (general comments)

4.4.19 As noted, The MMO has no major concerns with the predictions for marine mammals for percussive/impact and vibro-piling. In general, the predictions appear to be relatively conservative in most cases. However, the predictions in Table 16 (below for reference) for dredging and vessel movements look smaller than expected and we recommend checking whether the SELcum over 24 hours has been appropriately assessed. Even if we assume a fleeing receptor then we would still expect larger TTS effect rangers (over part of the estuary) for harbour porpoise, based on a 24-hour exposure period.

Table 16. Approximate distances (metres) marine mammal response criteria are reached during dredging and vessel movements

Marine Mammal Hearing Group	PTS	TTS
High-frequency (HF) cetacean (harbour porpoise)	<1	44
Phocid pinniped (PW) (grey seal and common seal)	<1	12

4.5 Dredge and Disposal

- 4.5.1 A range of conclusions are made in Chapter 8 Water and Sediment Quality. Of the impact pathways identified, all are assessed as either insignificant or minor adverse, due to the Applicant's conclusion that levels of contaminants within the material to be dredged are sufficiently low. The argument is largely logical, and based on bespoke sediment sampling, though the Applicant could have used the effects-range approach from Gorham-Test *et al.* (1999; also in Long *et al.* 1995; 1998) to obtain a better understanding of the levels of polycyclic aromatic hydrocarbons (PAHs) within the sediment. The Gorham-Test approach is also part of the proposed Action Levels (pALs) for PAHs as detailed in Mason *et al.*, (2020) to allow interpretation of PAH concentrations in sediments. As such, this approach is not an agreed AL.
- 4.5.2 The ES refers to contaminants as being "*relatively low*" with samples being below or marginally exceeding their respective action level 1 (AL1) values. The MMO disagree that the levels of PAH are either low or marginally exceed AL1, with various PAH congeners being up to ten times over the AL1. Whilst the applicant has, as previously requested, provided the results in the MMO Results Template, this only comprises a picture copy of each tab of the template pasted into a PDF document. As such, the data must be manually transcribed to be extracted, which is laborious and increases the chance of human error. Due to time constraints for this review, it has not been possible to transcribe all of the PAH data, but, for sample 1, which has been transcribed, see the following results of the Gorham-Test approach in Table 1.



4.5.3 In the absence of an agreed AL2 value for PAHs, the Gorham-Test approach has been used, which calculates the sum total of low- (LMW) and high-molecular weight (HMW) PAH content in each sample, then compares these values to observed effect-ranges. If a sum total value is below or around the effects-range low (ERL), then the risk is likely low, whilst if a sum total value is above the effects-range medium (ERM), then the risk is higher. These can, to an extent, be interpreted similarly to Cefas Action levels, but these are not officially agreed ALs.

Table 1. PAH data for sample 1 with the Gorham-Test approach applied. Yellow cells denote a result above the ERL, red cells denote a results above the ERM.

Sample depth	Σ LMW	Σ HMW
0m	1548	1889
1m	1418	1668
2m	2885	4220
3m	3436	4787
4m	3363	5505
4.7m	4038	6826

4.5.4 Table 1 shows that all but one sample (1m) exceed the ERL for both LMW and HMW PAHs. The results depict a fairly consistent increasing trend as the depth of the samples increases, with sample 3m, 4m and 4.7m exceeding the ERM for LMW PAHs, and becoming closer to the ERM than the ERL for HMW PAHs. This indicates that the deeper material to be dredged (not including the geological material which the corer is unable to penetrate) may hold unacceptable levels of PAHs for disposal at sea. As per previous comments, we have not been able to manually transcribe all of the PAH data for this assessment, however, would be happy to if the Applicant can provide the data in an extractable excel format. Without the ability to conduct this assessment, the MMO are unable to agree with the Applicant's conclusions that the levels observed are "low".

4.5.5 For the other contaminants, the MMO do not hold the same level of concern, and broadly agree that levels of trace metals, organotins, polychlorinated biphenyls, polybrominated diphenyl ethers and organochlorine pesticides are either below or marginally above the AL1 (or, where there is no existing AL1 (such as for PBDEs) that they are below or marginally above their respective pAL1).

4.6 Shipping and Navigation

4.6.1 The MMO defers to the Maritime and Coastguard Agency and Trinity House on matters of shipping and navigation. The MMO will continue to be part of the discussions relating to securing any mitigation, monitoring or other conditions.



4.7 Marine Archaeology

4.7.1 The MMO defers to the Historic England on matters of shipping and navigation. The MMO will continue to be part of the discussions relating to securing any mitigation, monitoring or other conditions.

4.8 Seascape, Landscape and Visual Resources

4.8.1 The MMO defers to Natural England as the SNCB on matters of Seascape, Landscape and Visual Resources. The MMO will continue to be part of the discussions relating to securing any mitigation and monitoring or development of any plans/conditions on this matter. The MMO would also remind the Applicant that the National Association for Areas of Outstanding Natural Beauty should be included in conversations regarding potential impacts to Areas of Outstanding Natural Beauty (AONBs) as they are the Non-Governmental Organisation responsible for them.

4.9 Commercial Fisheries

4.9.1 The MMO defers to IFCA as the principle contact on matters related to commercial fishing operation. The MMO will continue to be part of the discussions relating to securing any mitigation related to this field.

5 Summary

We strongly recommend that the Applicant engage with the MMO throughout the process in order to ensure the assessment is as smooth as possible and agreements can be reached through a Statement of Common Ground.

Yours faithfully,

Jack Coe
Marine Licensing Case Officer
E +44 ([REDACTED]
E [REDACTED]



6 References

- Hawkins, A.D., Roberts, L. and Cheesman, S. 2014. Responses of free-living coastal pelagic fish to impulsive sounds. *J. Acoust. Soc. Am.* 135 (5), May 2014.
- Neo, Y. Y., Seitz, J., Kastelein, R. A., Winter, H. V., ten Cate, C., and Slabbekoorn, H. 2014. Temporal structure of sound affects behavioural recovery from noise impact in European seabass. *Biological Conservation*, 178: 65–73.
- Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., Coombs, S., *et al.*, 2014. ASA S3/SC1.4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards committee S3/SC1 and registered with ANSI. American National Standards Institute. 1-87 pp.
- Willstead, E., Gill, A. B., Birchenough, S. N. R., & Jude, S. 2017. Assessing the cumulative environmental effects of marine renewable energy developments: Establishing common ground. *Science of the Total Environment*, 577, 19–32.
- Gorham-Test, C., Wade, T., Engle, V., Summers, K., & Hornig, E. (1999). Regional Environmental Monitoring and Assessment Program — Galveston Bay 1993. Proceedings, Galveston Bay Estuary Program, State of the Bay Symposium IV, January 28–29, Galveston, TX, 97–109.
- Long, E.R., Field, L.J., and MacDonald, D.D. (1998). Predicting toxicity in marine sediments with numerical sediment quality guidelines. *Environmental Toxicology and Chemistry*. 17, 714-727
- Long, E.E., MacDonald, D.D., Smith, S.L., and Calder, F.D. (1995). Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental management*, 19(1):81-97
- Mason, C., Lonsdale, J., Vivian, C., Griffith, A., Warford, L., Hynes, C., Barber, J., Sheahan, D., Bersuder, P. & Bakir, A., (2020) Review of Action Levels used for assessing dredging and disposal marine licences. Report ME5226/C7590 for the Department of the Environment, Food and Rural Affairs. 113pp.

