Uig Harbour Redevelopment

Environmental Impact Assessment (EIA) Report
Volume 2b: Main Report - Chapter 11 to 15 (Biological Environment)

The Highland Council

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11. Marine Nature Conservation Areas

11.1 Introduction

11.1.1 This chapter of the Environmental Impact Assessment (EIA) Report considers the potential and scale of effects of the propose Uig Harbour Redevelopment project (hereafter referred to as the 'Proposed Development') on designated marine nature conservation sites.

11.1.2 Specifically this chapter provides information required to inform a Habitat Regulations Appraisal (HRA), to be completed by the Competent Authority, in respect of the potential for significant effect on the following Natura 2000 sites:

- Inner Hebrides and the Minches candidate Special Area for Conservation (cSAC);
- Ascrib, Isay and Dunvegan SAC; and
- Sea of Hebrides proposed Marine Protected Area (MPA).

11.1.3 Information and discussion set out within this chapter draws on technical assessments set out elsewhere within the EIA Report. Specifically this chapter should be read with reference to the underwater acoustic propagation study and anticipated effects on marine mammals as set out within **Chapter 13: Fish and Shellfish Ecology** and **Chapter 14: Marine Mammals.**

11.1.4 Note: The Annex 1 Habitats 'H1160 - Large shallow inlets and bays' and 'H1170 – Reefs' have been identified as present within the region, though specific examples of these habitats have not been designated as marine conservation sites. These are considered further in **Chapter 12: Benthic Ecology**.

11.1.5 A number of Priority Marine Features (PMFs) have also been previously recorded or identified as present during site specific survey within Loch Snizort and Uig Bay. These include the habitats 'Seapens and burrowing mega fauna in circalittoral soft mud' and 'Kelp and red seaweed on sublittoral sediments'. 'Northern seafan and sponge communities' and 'Maerl beds' have also been previously recorded close to the Ascrib Islands. No specific examples of these habitats have been designated as marine conservation sites within proximity to the Proposed Development. These are considered further in **Chapter 12: Benthic Ecology**.

11.1.6 A number of mobile PMF species have also been previously recorded within Loch Snizort and Uig Bay. These include Atlantic Salmon, Cod, Atlantic Herring and Basking Shark. These are considered further in **Chapter 13: Fish and Shellfish Ecology**.

11.2 Legislative Context

11.2.1 The Natura 2000 network is a European Union (EU) wide network of protected sites designated to ensure long-term protection of some of Europe's most valuable and threatened species and habitats. It comprises a range individual Special Areas of Conservation (SAC) and Special Protection Areas (SPA) designated under the Habitats Directive (European Council Directive 92/43/EEC) and the Bird Directive (European Council Directive 2009/147/EC).

11.2.2 In Scotland the Habitats Directive is implemented in inshore and offshore waters by the following legislation:

- The Conservation (Natural Habitats, &c.) Regulations 1994;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004;

- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- The Conservation (Natural Habitats, &c.) Amendment (No. 2) (Scotland) Regulations 2007;
- The Conservation of Habitats and Species Regulations 2010 which replace the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) in England and Wales (and to a limited degree in Scotland - as regards reserved matters); and
- The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 and associated amendments.

11.2.3 The above legislation requires that specific consideration be given to the potential effects of the Proposed Development on sites and species of international nature conservation importance within the Natura 2000 network. This consideration is required to inform a subsequent Habitat Regulations Assessment to be completed by the Competent Authority: in this case Marine Scotland. This requirement is in addition to the requirements and obligations set out under the EIA regulations, which also govern the content of this report.

11.2.4 The marine nature conservation sites considered within this chapter of the EIA comprise two SAC, protected under the EC Habitats Directive.

11.2.5 In addition consideration has also been given to potential effects on a proposed Marine Protected Area (pMPA) under the Marine (Scotland) Act 2010 or the Marine and Coastal Access Act 2009.

11.3 Assessment Methodology & Data Sources

Habitat Regulations Appraisal

11.3.1 A specific process exists for HRA. This mirrors and is supported by the detailed technical assessments completed as part of the parallel EIA process reported within the technical chapters of this EIA Report. **Figure 11-1** summarise the key stages of the HRA process which have been followed.

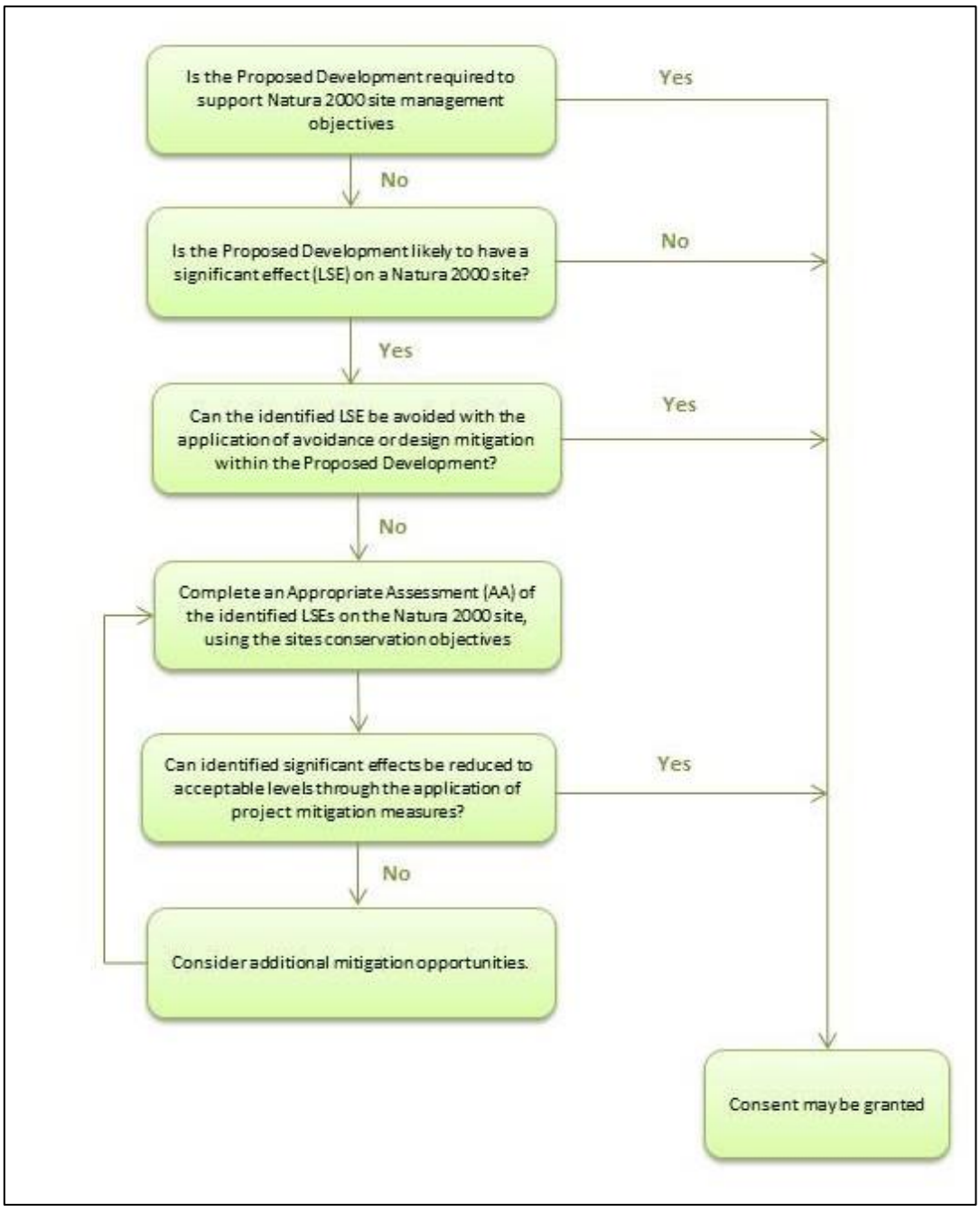

Figure 11-1: Summary of the HRA Processary of the HRA Process

11.3.2 This chapter has been prepared in accordance with the Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment (CIEEM, 2018).

11.3.3 The impact assessment has identified the major project activities with the potential to impact the qualifying features of the identified, designated marine conservation sites. This includes any vessel movement, dredging and/or piling associated with the construction works and during operations.

11.3.4 Mitigation recommendations are outlined in Section 11.8, and opportunities for ecological enhancement identified, where appropriate, in order to fulfil national policy requirements.

Summary of Consultation

11.3.5 Consultations specific to the potential for significant effects on designated sites were received from the organisations in Table 11-1 below:

Table 1-1 Marine Conservation Designations. Summary of Stakeholder Consultation Responses and Actions

Consultee	Summary Response	Comment/Action Taken
Marine Scotland	Whilst the proposed development is not located within any designated nature conservation site, it is located close to sites of conservation importance. Specifically piling, dredging and sea disposal are likely to have significant effect on harbour porpoise. Nature conservation designated areas should be scoped into the EIA process.	Potential for significant effects on nature conservation designated areas are considered within this chapter.
	EIA Report should include underwater noise and disturbance modelling, which should inform mitigations to be put in place.	Underwater noise and disturbance modelling has been carried out and is reported in **Chapters 13 and 14**, and in **Appendix 13.1**.
	EIA Report should also contain information requirement to inform HRA and possible EPS disturbance license requirements (for cetaceans and potentially for Basking Sharks).	Information required to support HRA is included in this chapter as well as in **Chapters 13 and 14,** and in **Appendix 13.1**.
	JNCC piling mitigation measures including marine mammal observers and piling soft-starts should be considered.	Proposed mitigation measures are summarised within this chapter and set out within **Chapters 13 and 14**.
Scottish Natural Heritage	Key marine natural heritage issues include: • Effects of piling noise on marine mammals, particularly cetaceans including harbour porpoise within Inner Hebrides and the Minches candidate Special Area of Conservation. Information is required to inform Habitat Regulations Appraisal and possible EPS disturbance licence.	Underwater noise and disturbance modelling has been carried out and is reported in **Chapters 13 and 14,** and in **Appendix 13.1.**
	• Consideration of dredge disposal options (location and methods) in terms of effects on Priority Marine Features (PMF) habitats, particularly some of the rare biotopes of burrowed mud.	Effects of dredging activities on benthic communities are considered within **Chapter 12: Benthic Ecology.**

Consultee	Summary Response	Comment/Action Taken
	The proposals [as defined by an approximate early scoping study area encompassing sea disposal site search area] lies approximately 5.5 km outside Ascrib Islay and Dunvegan SAC with distance between Uig pier and nearest seal haul-outs being significantly greater. At this distance, we advise that there will be no likely significant effects on seals within the SAC. Other cetacean species such as minke whale, bottlenose dolphin and short-beaked common dolphin have been recorded within and around the entrance of Uig Bay. Whilst present, SNH do not currently hold any data to suggest that Uig Bay is of particular importance for these species.	Scoping opinion confirmed that an assessment of potential effects on otters was not required.
	Comments were also received relating to potential effects on PMF species, Otter, White Tailed Eagle.	Potential for effects on white-tailed eagle are considered within **Chapter 15: Ornithology.**

11.4 Baseline Conditions

Natura 2000 Sites

11.4.1 The majority of Proposed Development is not located within the boundary of any European designated sites or any other sites of conservation importance such as Marine Conservation Zones or Voluntary Marine Reserves. However, a number of pathways for effects on the features of nearby sites, resulting from construction or operational activities generating underwater sound and changes in water quality have been identified. The sites in the vicinity of the Proposed Development are shown in Table 11-2 below.

11.4.2 Note: the Proposed Sea Disposal Site lies just within the boundary of the Inner Hebrides and the Minches cSAC.

Table 1-2 Marine Conservation Designations in the Vicinity of the Proposed Development

Site	Approx Distance from Site	Total Area (ha)	Summary of Primary Reasons for Site Selection	Summary of Qualifying Features
Inner Hebrides and the Minches Special Area of Conservation (SAC)	1 km W	1,380,199	None A 100% marine designation in the north west of Scotland which is considered to be one of the best areas in the United Kingdom for the harbour porpoise	Harbour porpoise (*Phocoena phocoena*)

Site	Approx Distance from Site	Total Area (ha)	Summary of Primary Reasons for Site Selection	Summary of Qualifying Features
Ascrib, Isay and Dunvegan SAC	8 km W	2578	The complex of skerries, islets, undisturbed mainland shores and offshore islands in north-west Skye consistently support a breeding colony of the Harbour seal *Phoca vitulina*. The site represents one of the larger discrete colonies of common seals in the UK, holding around 2% of the UK population.	Harbour seal (*Phoca vitulina*)
Sea of the Hebrides proposed MPA	25 km +	1,031,267	The proposed MPA covers the Sea of the Hebrides between the east coast of the Outer Hebrides and the west coasts of Skye, Mull and the Ardnamurchan Peninsula. The pMPA supports basking shark and minke whale.	Basking shark (Cetorhinus maximus) Minke whale (Balaeoptera acutorostrata)

11.4.3 Where there is potential for significant adverse effects on a Natura 2000 site (the collective name for European designated sites) it is a requirement of the EC Habitats Directive 1992 and the Habitats Regulations (see Box 1) that plans and projects are subject to an 'appropriate assessment'.

11.4.4 Scottish Natural Heritage was consulted as part of EIA scoping in November 2017. As a result consideration of potential effects on the Inner Hebrides and Minches candidate SAC and the Ascrib, Isay and Dunvegan SAC have been scoped into the HRA process.

Natura 2000 Sites Conservation Objectives

11.4.5 The conservation objectives for each of the Natura 2000 sites considered here, are summarised in Table 11-3 below.

Table 1-3 Conservation Objectives for Relevant Natura 2000 Sites

Site	Conservation Objectives
Inner Hebrides and the Minches Candidate Special Area of Conservation (cSAC)	To maintain site integrity and ensure the site continues to make a contribution to harbour porpoise remaining at favourable conservation status in UK waters To avoid significant killing, injury, or disturbance of harbour porpoise To maintain the habitat and prey of harbour porpoise in favourable condition

Site	Conservation Objectives
Ascrib, Isay and Dunvegan SAC	To avoid deterioration of the habitats of qualifying species (Common seal *Phoca vitulina*) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest. To ensure for the qualifying species that the following are maintained in the long-term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species

11.4.6 In addition, consideration has been given where appropriate to particular features which have been identified and which support the Marine Protected Area proposal (pMPA) covering the Sea of Hebrides. These include known presence of the mobile species: basking shark *Cetorhinus maximum* and minke whale *Balaenoptera acutorostrata*. Both these species are also designed as PMF under the terms of the Marine (Scotland) Act 2010.

11.5 Habitat Regulations Screening of Potentially Significant Effects

11.5.1 In order for a likely significant effect (LSE) to be identified during HRA screening, there must be evidence that the species under consideration is likely to be present within the zone of influence of the Proposed Development (connectivity), in sufficient numbers to warrant consideration of the potential for a significant effect on population integrity. In addition consideration of the likely sensitivity of the species under consideration to the specific mechanism of impact should also be given.

Inner Hebrides and the Minches Special Area for Conservation (SAC)

11.5.2 The baseline condition for the Inner Hebrides and Minches SAC has been obtained from the site management and conservation objectives document prepared by SNH in 2016. The SAC was submitted to the European Commission in 2016 and designated in May 2018.

11.5.3 The Inner Hebrides and Minches SAC is designated for harbour porpoise *Phocoena* and is considered to be one of the best areas for this species in the United Kingdom. The site supports approximately 31.4% of the harbour porpoise population present within the UK's part of the West Scotland management unit in depths of less than 200 m. The protected area is expected to contribute towards maintaining the favourable conservation status of harbour porpoise, by providing protection to them and their habitats in Scottish waters.

11.5.4 The SAC is the largest protected area in Europe for harbour porpoise and covers over 13,500 km^2 and supports over 5000 individuals. The site ranges from the Isle of Jura in the south to an area near the northern extent of the Isle of Lewis. The whole of the Isle of Skye is encompassed within the SAC.

11.5.5 The site has been chosen because it incorporates virtually all of the top 10% of persistent high density harbour porpoise areas identified by Henamen & Skov (2015) for the West Scotland management unit, and the top 20% of densities predicted by work derived from Booth, et al., (2013). Harbour porpoise could therefore potentially be present within any part of the site at any given time.

11.5.6 The coastal edge of the site is defined by Mean Low Water Springs (MLWS). However, sea lochs and estuaries are excluded where the width of the entrance is less than 2 km and therefore the boundary of the SAC is at the entrance to Uig Bay. Thus, the Proposed Development, with the exception of the Proposed Sea Disposal Site, is approximately 1 km from the SAC boundary. It is therefore considered that connectivity between the Proposed Development and individuals of the qualifying species of this SAC does exist.

11.5.7 The following LSE on the harbour porpoise as the designating species for this SAC have been identified:

- Impact piling is expected to result in the propagation of underwater sound into Uig Bay and Loch Snizort. Harbour porpoise are known to be sensitive to particularly high frequency, underwater sound. Consultation with SNH confirmed the potential for disturbance to occur over some distance with potential for behavioural disturbance and/or hearing loss if porpoise are too close to an intense noise source when initiated; and
- Changes to water quality resulting in increased suspended sediments or mobilisation of contamination as a result of dredge and dredge disposal activities during construction.

Ascrib, Isay and Dunvegan SAC

11.5.8 Ascrib, Isay and Dunvegan SAC and European marine site is designated solely for its common (harbour) seal *Phoca vitulina* populations, a species that is listed on Annex II of the Habitats Directive. This SAC is a composite site in North-west Skye encompassing the three main common seal haul outs in the region. The highest concentration of common seals is usually found on the complex of skerries, islets, undisturbed mainland shores at the head of Loch Dunvegan.

11.5.9 The Ascrib Islands, situated at the mouth of Loch Snizort, and the Isay island group, situated to the west of the Waternish peninsula, also hold notable numbers of common seals. The site also represents one of the larger discrete colonies of the common seal in the UK, holding around 2% of the UK population.

11.5.10 The Ascrib Islands element of this SAC is located approximately 8 km to the west of King Edward's Pier in Uig Bay. There are occasional seals observed in Uig Bay but at this distance it is considered unlikely that significant connectivity exists between the Proposed Development and the designated species of this SAC.

11.5.11 The underwater sound impacts on seals, from vibratory and impact piling have been assessed as being of negligible and minor adverse impact respectively (**Chapter 13**). There is therefore no likely impact on qualifying species for the SAC as piling will not result in significant disturbance to seals or have any impact on habitats. Thus, no likely significant effects on seals or the integrity of the SAC are expected as a result of impact piling.

11.5.12 In addition, there are seal pupping sites, for the grey seal *Halichoerus grypus* identified on the west coast of the Acrib Islands, though the location of these means they are outside any potential impacts from the Proposed Development.

11.5.13 Water quality changes, as a result of dredging and sediment disposal during the construction phase, have been shown to be short-term and highly localised resulting in negligible impacts to marine mammals (**Chapter 13**). Thus, no likely significant effects on the integrity of the SAC from these activities are expected.

11.5.14 No further consideration of potential for effects on the Ascrib, Isay and Dunvegan SAC has been included within this report.

Sea of the Hebrides proposed MPA

11.5.15 A MPA has been proposed, approximately 25 km to the south-west of Uig Bay, extending westwards from Dunvegan Head and covering much of the sea area between the western isles and the southern coast of the Isle of Mull. This has been proposed to provide protection for a potentially important breeding site for the basking shark *Cetorhinus maximus*, important areas for minke whales *Balaeoptera acutorostrata*, tidal fronts and important geological features.

11.5.16 Uig Bay and Loch Snizort lie to the north of this proposed MPA. The most recent record of basking shark presence in Uig Bay was in 2010 (Marine Scotland, 2014). Basking shark individuals, if present in the vicinity of the Proposed Development, are considered only as occasional visitors and thus in very low abundance. As an elasmobranch with no swim bladder, the basking shark is considered to have low sensitivity to underwater sound. The effect of impact piling on fish was assessed as being of low significance after standard mitigation measures for impact piling are adopted.

11.5.17 Some sightings of minke whale have been made within the Inner Hebrides area and individuals have historically been recorded within and around Uig Bay (see **Appendix 1-2)**. However, such sightings are very occasional and the observed adjusted density of minke whale in the vicinity of Uig Bay, within Loch Snizort is reported to be between 0.00 and 0.01 individuals per km^2 and between 0.01 and 0.02 individuals per km in the northern section of Loch Snizort (Paxton, Scott-Hayward, & Rexstad, 2014).

11.5.18 Consequently it is considered that there is limited connectivity between the designating species of this pMPA and the Proposed Development. No likely significant effects on basking shark or minke whale within this pMPA are expected. No further consideration of potential effects on basking shark associated with the proposed Sea of Hebrides MPA has been included within this report.

11.6 Avoidance Measures/Mitigation 'by design'

11.6.1 The Proposed Development will adopt the standard impact piling mitigation measures recommended by the JNCC (JNCC, 2010) which includes the use of marine mammal observers (MMO) and piling soft-starts prior to commencement of impact piling. These measures are designed to ensure any mobile marine receptors, that are within the vicinity of the works are able to move away before any injury could occur.

11.6.2 Notwithstanding the screening position adopted for seals associated with Ascrib Isay and Dunvegan SAC, MMOs will ensure observations seek, record and report harbour porpoise but also any other protected mobile species including common seal, basking shark and minke whale, for which the SAC and MPA above are designated.

11.6.3 The Proposed Development proposes to have up to two piling rigs on site at any one time. Therefore, it is possible that there may be periods where some simultaneous piling takes place. To minimise the impact of underwater sound on sensitive receptors, in particular the sound sensitive harbour porpoise, a key Proposed Development commitment is that no simultaneous impact piling, when the pile is in water, will take place at any time during construction.

11.7 Habitat Regulations: Predicted Effects

Noise Disturbance During Construction Phase- Impact Piling

11.7.1 During the construction phase of the Proposed Development, particularly during piling activity, underwater sound will be generated which will have the potential to impact the designating features of the Inner Hebrides and Minches SAC site in the vicinity of Uig Bay.

11.7.2 The designating species for the Inner Hebrides and Minches SAC comprises the harbour porpoise. Cetaceans, and harbour porpoise in particular, are sensitive to acoustic disturbance due to their use of underwater sound for echolocation and communication.

11.7.3 To determine the potential for effects on the designated sites it is necessary to understand the character of sound propagation underwater and the potential response of marine mammals to the sound. Underwater sound modelling calculations have been undertaken to predict how much sound could be expected from the Proposed Development construction activities, in particular during construction piling, will propagate into the surrounding underwater environment. The detailed methodology and result of the sound modelling are provided within **Appendix 13-1**. These are also discussed in detail in relation to cetaceans in **Chapter 14: Marine Mammals**.

11.7.4 A range of thresholds for injury and disturbance in marine mammals, as a result of underwater sounds, are currently in use. These include the well-established and often adopted 'Marine Mammal Noise Exposure Criteria' developed and published by Southall and others in 2007. Recent research on the impact of underwater sound on marine mammals has been reviewed by the US National Oceanic and Atmospheric Administration under the jurisdiction of the US National Marine Fisheries Service (NMFS) resulting in updated guideline thresholds for marine mammals (NMFS, 2018). This guidance is generally referred to as the 'NOAA guidance' or 'NOAA thresholds'. For both sets of criteria, threshold values are expressed as dual criteria comprising a value for sound pressure level (SPL) and a value for sound exposure level (SEL). The greatest impact distance of the two is taken as the potential impact range for consideration within the impact assessment and determination of required mitigation measures. Notably, the most recent NOAA criteria identify significantly lower threshold values for high frequency cetaceans, such as harbour porpoise, than previously identified.

11.7.5 The Proposed Development includes two different mechanisms for piling.

Vibratory Piling

11.7.6 Consideration of the sound propagation characteristics anticipated from the Proposed Development as a result of vibratory piling, indicates that the Southall et al threshold criteria for Permanent Threshold Shift (PTS) in all marine mammal groups from continuous sound sources (Southall, et al., 2007) give an impact distance of up to 10 m from the sound source.

11.7.7 The NOAA criteria (NMFS, 2018) also indicate that PTS from the continuous sound of vibratory piling is only likely to occur for a marine mammal remaining in very close proximity (within 10 m) of the piling activity. For all marine mammal groups except for high frequency cetaceans. The distances for the high frequency harbour porpoise, a species known to have particularly high sensitivity to underwater sound, are greater but are all within the 500 m standard JNCC mitigation zone.

11.7.8 Standard JNCC mitigation protocol (JNCC, 2010) will be employed. The impact of vibratory piling on designated species of the Inner Hebrides and Little Minches cSAC are considered to be of low significance. A full explanation of this assessment is included within **Chapter 14: Marine Mammals**.

11.7.9 There are therefore, no likely significant effects expected in relation to the Inner Hebrides and Minches cSAC conservation objectives nor significant disturbance to harbour porpoise from vibratory piling and underwater sound.

Impact Piling

11.7.10 On the basis of the Southall thresholds (Southall, et al., 2007) possible PTS resulting from a single strike of any of the pile types to be used in the Proposed Development, is predicted to occur in cetaceans and seals including harbour porpoise only within very close proximity to the sound source, within 10 m of the pile. This distance applies to both SPL and SEL.

11.7.11 The distance for the onset of Temporary Threshold Shift (TTS) in cetaceans as a result of a single strike is also predicted to occur only up to 10 m according to the Southall criteria.

11.7.12 Impact distances from the NOAA SPL peak criteria as a result of a single strike also indicate possible PTS is restricted to within 10 m of the sound source.

11.7.13 However, NOAA SEL thresholds are cumulative, summing the energy from successive impulsive sounds from piling over a stated period of time rather than based on the energy produced by a single strike

11.7.14 The estimated distances for PTS in harbour porpoise (high frequency cetaceans) resulting from cumulative SEL of a single rig of impact piling, based on the NOAA criteria, have been calculated to be less than 10 m (small H-piles (H1) and 1413 m (for the largest sheet piles) from the sound source. For these calculations the estimated effect distance is determined by the SEL threshold for accumulated sound energy from all piling impulses over a 15 minute period.

11.7.15 For TTS in harbour porpoise, the predicted impact zones range from 794m to 7943m depending on pile types.

11.7.16. Estimated effect distance is shown in **Figure 14-1**.

11.7.17 **Note:** The predicted impact distances are subject to a number of limitations and are considered to reflect the worst case, which could be anticipated (see chapter 14 for more detail). Consequently, the actual risk of a PTS or TTS impact within these large calculated effect zones is expected to be much smaller. PTS in harbour porpoise is realistically considered possible only much closer to the impact piling, maybe in the order of 100s of metres and likely to be within the standard JNCC marine mammal mitigation zone of 500 m from the sound source (see Section 14.6). With the standard JNCC mitigation protocols in place and with the expected low density of animals within Uig Bay, PTS is considered very unlikely to occur.

11.7.18 The worst case predicted TTS, relates to the installation of Straight Web Sheet (SWS) piles and identifies a theoretical TTS distance of over 7000 m from source. In reality this is considered to be an overestimation resulting in part from the limitations of the propagation model used (as discussed above). A review of other available acoustic models for similar activities, including those associated with development activities at the other harbours within the ‘Skye Triangle’ (Affric Ltd, 2019a) (Affric Ltd, 2019b) has also been completed to allow this parameter to be tested and corroborated. As a result more likely TTS impact distances for high frequency cetaceans such as harbour porpoise are anticipated in the region of 2000 to 3000 m from the sound source. The density of harbour porpoise in Loch Snizort (within the Inner Hebrides and Minches cSAC area) and Uig Bay is low with only a small number of individuals potential effected. These individuals would be expected to exhibit avoidance behaviour during much of the construction programme and considered likely to recover after the animals move away or piling stops. Animal presence and density is expected to return to baseline levels following completion

of construction activities. Consequently effects of impact piling on harbour porpoise population levels are not expected to be significant.

11.7.19 There are no behavioural thresholds for cetaceans provided by either Southall et al., (2007) or NMFS (2018) as a reflection of the remaining uncertainty in the science and the variability observed not just between different species but also between individuals of the same species. The context in which animals may be present in a particular area is important in determining the response and impact. For example, nursing mothers and juveniles tied to particular habitats are likely to be much more sensitive than individual adults present as transient visitors. Nevertheless, behavioural disturbance is likely to occur to any harbour porpoise within the vicinity of the impact piling works.

11.7.20 Harbour porpoises are known to have very sensitive hearing and react to underwater sound at significant distances from the sound source. Work by Lucke et al. (2009) showed that aversive behavioural reactions of a captive harbour porpoise were initiated at a received SEL of >145 dB re 1 μPa^2 s which corresponded to a distance of >10 km (146–152 dB re 1 μPa^2 s calculated SEL) and <25 km (139–145 dB re 1 μPa^2 s calculated SEL) around the pile driving site. This level of response was also evident in response to impact piling at a windfarm site in the German North Sea with observed avoidance by harbour porpoises detected up to 25 km from the pile driving operations (Dahne, 2013).

11.7.21 Aversive behavioural responses from harbour porpoise >10 km from source would include the whole of Uig Bay and much of Loch Snizort, however, this area is not an open ocean environment in which the above referenced behaviours were noted. Rather, sound propagation without and outside of Uig Bay into Loch Snizort will be constrained by the shape of the Bay, such that the predominant sound propagation will form a wedge shape, as shown in Figure 14-1. Some sound will propagate outside this area as sound reflects from surface such as the seabed and the sea surface and in reality the sound levels in the area outside the area shown on Figure 14-1 is anticipated to be much lower than modelled.

11.7.22 Disturbance to harbour porpoise, even with the standard JNCC mitigation measures in place, is expected. The density of porpoise in this region of the SAC is reported to be 0.394 animals/km^2, which equates to a total of approximately 45 individuals in the area of Loch Snizort. However, the preferred habitat in coastal waters is in areas of fast flowing waters and they are often encountered close to islands and headlands with strong tidal currents. Thus, it is likely that the density of harbour porpoise in the Loch may be lower than the 0.394/m^2 reported further north. However, inside the Bay where the impacts are likely to be greatest, the area is approximately 2 km^2 and so anticipated abundance is very low and harbour porpoise are expected to be occasional visitors only.

11.7.23 The predicted effect of PTS or TTS as a result of impact piling affecting an individual harbour porpoise would be of medium to high magnitude particularly in the near vicinity of the construction, without further mitigation. However, the density of harbour porpoise in the Bay is expected to be low, the predicted PTS and TTS impact zone is not thought to represent key habitat for important life-cycle stages in harbour porpoise and thus animals can easily move away from the sound source. In addition, the shape of Uig Bay in relation to Loch Snizort will constrain the sound propagation such that outside the line of sight to the entrance to Uig Bay the intensity of sound will be much lower. Thus, the risk of injury to hearing in harbour porpoise is considered to be low.

11.7.24 Impact piling is intermittent, with gaps in between piles and pauses during piling operations. These intervals also allow for avoidance behaviour and for recovery if any impacts such as TTS were to occur.

11.7.25 In addition, there may be behavioural disturbance to individual animals present within several kilometres of the noise source during impact piling activities. Whilst the duration of each impact piling event is short, it is likely to occur frequently and so animals may be displaced from the area in the short to medium term.

11.7.26 However, the number of individual animals likely to be affected is expected to be low with most significant impacts occurring to individuals within the Bay, where harbour porpoise are thought to be only occasional visitors. As impacts are considered to be predominantly behavioural, the magnitude of the impact to harbour porpoise is considered to be medium magnitude.

11.7.27 For a receptor of high sensitivity, but considered likely to be at low risk of being exposed to sound impact as a result of their low density within the impact zone, the impact of percussive (impact) piling is considered to be of minor/moderate adverse significance, after the recommended mitigation measures adopted by the Proposed Development to protect harbour porpoise from harm. The impact significance reflects the temporary disturbance to harbour porpoise from construction activities, possibly resulting in the avoidance of the area in the vicinity of the Proposed Development Site - Uig Bay and part of Loch Snizort - during the period when impact piling is taking place.

11.7.28 In relation to the Inner Hebrides and Minches SAC this results in disturbance to harbour porpoise in a small area of the SAC. The impact zone has been identified as being less than 1% of the designated site. The impact zone is also a part of the SAC that has a much lower density than other areas and is not a habitat of particular importance to harbour porpoise. There are no breeding or nursery sites known in the immediate vicinity of the Proposed Development and the conditions are not optimal for foraging.

11.7.29 Any displacement of animals as a result of the Proposed Development is temporary; harbour porpoise have been shown to return to noisy areas after noise generating activities have stopped. Animals will not be displaced from areas within the SAC known to be required for key life stages that could affect survival and reproduction or from optimal foraging grounds. Also, the overall area where disturbance may occur is very small in relation to the entirety of the SAC. Thus, the SAC site integrity will not be compromised and will continue to contribute to the favourable conservation status of harbour porpoise during the construction phase of the Proposed Development.

11.7.30 The magnitude of the impact on the Inner Hebrides and Minches SAC is assessed as being negligible. For a receptor of high sensitivity this results in an impact of low significance.

Changes to Water Quality (Suspended Sediments or Mobilisation of Contamination)

11.7.31 The Proposed Development requires dredging, both capital and maintenance, and the disposal of this sediment at the newly licenced, Proposed Sea Disposal Site just outside Uig Bay.

11.7.32 Increased suspended sediment concentrations (SSC) are unlikely to affect marine mammals. Many species are observed in areas with high sediment load such as estuaries, demonstrating this tolerance. Higher turbidity than usual may reduce visual foraging in seals but cetaceans are able to locate prey using sound so increased SSC is unlikely to have an impact. Also, all marine mammals can easily move away from more turbid areas if required.

11.7.33 If low level contaminants are released into the water column during dredging or disposal, they may accumulate in marine animals and plants and transfer up the food chain to marine mammals. When present in sufficient quantities, contaminants can cause morphological or reproductive disorders in mammals and other fauna (ABP Research R512 1995). However, the concentrations predicted for the

Proposed Development are lower than EQS values, indicating a low ecotoxicological risk, and considering the very short-term nature of the increases the magnitude of the effect in marine mammals has been assessed as being negligible.

11.7.34 A full explanation of this assessment is included within **Chapter 14: Marine Mammals**.

11.8 Mitigation and Monitoring

Construction

11.8.1 Mitigation measures as set out within the JNCC protocol (JNCC, 2010) will be applied and are inherent in the Proposed Development design.

11.8.2 Additional measures are also proposed in order to address the potential for possible effects associated with PTS and TTS and to minimise behavioural disturbance in marine mammals as far as possible, particularly with respect to Harbour Porpoise associated with the Inner Hebrides and the Minches cSAC. These are summarised below and discussed further in **Chapter 14: Marine Mammals.**

- The mitigation zone will be monitored by MMOs positioned at suitable vantage points to observe and monitor Uig Bay;
- A standard pre-watch period of 30 minutes will be implemented before the commencement of any piling activity. Piling will not commence if any marine mammals are detected within the mitigation zone or until 20 minutes[1] after the last visual or acoustic detection;
- The use of Passive Acoustic Monitoring (PAM) equipment positioned in a location to be agreed close to the entrance to the Bay, to monitor for harbour porpoise, will be required for any impact piling that **commences** during periods of darkness, poor weather conditions and reduced visibility of marine mammals;
- A soft-start procedure is required for all impact piling, with initial power levels to be approximately 10% of the final level; and
- Sound monitoring, including the collection of noise data from piling soft-starts, will be undertaken to monitor the effectiveness of the mitigation measures.

Operation

11.8.3 No further mitigation measures have been identified for the operational phase.

11.9 Residual Effects

11.9.1 Mitigation measures discussed above are expected to minimise the likelihood of PTS or TTS in harbour porpoise as a result of impact piling.

11.9.2 None the less some behavioural disturbance may still occur at the entrance to the Bay and into Loch Snizort in areas outwith the 500m mitigation zone, but this will be temporary and short-term although as a result of a frequently recurring noise source during construction. It is anticipated that harbour porpoise may avoid the area around Uig Bay and Loch Snizort during the construction period but available evidence indicates animals will return to baseline once operations have stopped, results in a residual impact of Minor/moderate Adverse impact significance.

[1] A 20 minute period is adopted by the JNCC seismic survey guidance. Issues of swimming speed and noise –dosage have been taken into account and it is considered that twenty minutes is a sufficient period of time to allow individuals to be at a distance where risk of injury or death is minor.

11.10 Cumulative Effects

11.10.1 HRA requires cumulative effects of the Proposed Development with other known developments within the vicinity to be considered.

11.10.2 The only other development in the vicinity of the Proposed Development is returning the Uig Bay fish farm to operational status. There are no activities associated with the Uig Bay fishfarm likely to produce underwater sound at levels that could cause disturbance to the key species, the harbour seal and the harbour porpoise, that are the designating features of the protected sites reviewed in this chapter.

11.10.3 The fish farm may attract seals increasing the density of animals in Uig Bay and hence in the vicinity of the Proposed Development. However, there is potential for the Uig Bay fish farm to use an acoustic deterrent device (ADD) to minimise any seal predation that may occur as a result of the additional farmed fish present in Uig Bay. Thus, the number of seals is not expected to increase significantly.

11.10.4 The acoustic deterrent will be underwater and has the potential to increase the underwater sound energy in the vicinity of the Proposed Development. However, the planning application states the ADD will not sound continuously as it will be triggered by fish behaviour in the event of an attack. There is also likely to be a requirement that the ADD is designed to minimise any disturbance to harbour porpoise by targeting the sound frequency to the hearing range of the harbour seal.

11.10.5 Thus, the ADD device is not anticipated to result in a significant increase in underwater sound and the cumulative impact of underwater sound from the fish farm is considered to be negligible.

11.11 Summary & Conclusion

11.11.1 No significant impacts to designated sites, as a result of the construction or operation of Uig Ferry Terminal, after control and mitigation measures, are predicted (Table 11-4).

Table 1-4 Summary of Habitat Regulations Impact Assessment for Marine Conservation Sites

Effect/ Activity	Receptor	Receptor Sensitivity	Magnitude of Event Prior to Mitigation	Impact Significance Prior to Mitigation	Mitigation Measures Adopted	Post Mitigation Impact Significance
Vibratory piling	Inner Hebrides & Minches cSAC	High	Negligible	Minor	None	Adverse Minor
Impact piling	Inner Hebrides & Minches cSAC	High	Negligible	Minor	None	Adverse Minor
Change in suspended sediments & water quality	Inner Hebrides & Minches cSAC	High	Negligible	Minor	None	Adverse Minor

12. Benthic Ecology

12.1 Introduction

12.1.1 This chapter of the EIA Report provides an assessment of the potential and scale of effects of the Uig Harbour Redevelopment project (hereafter referred to as 'The Proposed Development') on benthic ecology. Where appropriate, it provides proportionate measures to avoid, mitigation or compensate for adverse impacts.

12.1.2 **Chapter 3: Project Description** of this EIA Report provides a detailed description of the works required to implement the Proposed Development.

12.2 Legislative Context

12.2.1 The assessment has been undertaken within the context of the following relevant legislation, planning policies and guidance documents:

- Marine (Scotland) Act 2010;
- Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Harbour Works (Environmental Impact Assessment) Regulations 1999;
- Wildlife and Countryside Act, 1981;
- Conservation of Habitats and Species Regulations 2010 (commonly referred to as the Habitats Regulations);
- National Marine Plan (Scotland); and
- Marine Policy Statement (2011).

12.2.2 Further information on the above legislation and policy is given in **Appendix 4.1.**

12.3 Assessment Methodology & Data Sources

Desk Study

12.3.1 To characterise benthic habitats in the vicinity of the Proposed Development the following data sources were investigated for relevant data:

- EUSeaMap2 Broad scale predictive habitat map September 2016 data (Marine Scotland, 2018);
- Priority Marine Features (PMF) distribution data from Scotland NMPi online (Marine Scotland, 2018);
- Loch Bracadale, Skye, 1991 MNCR survey (JNCC, 2001);
- Subtidal survey data from fish farm The Highlands Council planning application documents for Rubha Riadhain (Grieg Seafood Ltd, 2015) and Ru Chorachan (Grieg Seafood Shetland Ltd, 2017) fish farms; and
- Uig Ferry Terminal Phase 1 Habitats and Otter Survey, (Tyler, 2017a).

12.3.2 Online and Web of Science searches were also made though very little additional data on benthic habitats were found.

Field Survey

12.3.3 The assessment set out within this document draws on the findings of a number of field surveys, namely:

- **Intertidal Habitat Survey:** A detailed intertidal survey was conducted by an experienced Marine Ecologist to confirm the nature and distribution of the habitats present in Uig Bay and determine the presence or absence of any habitats of conservation concern or PMFs. The survey covered approximately 1.8 km of the Bay as shown in **Figure 12-1**. The survey area reflects areas of the bay's intertidal zone considered likely to receive dredge sediments, should they be carried by water movements in the bay. The survey area was determined through consideration of available information on the predominant water currents (based on tide and wind data) as set out within **Chapters 7 and 8** of this report**.**
  - A total of 15 transects, each sampled at high, mid and low shore, were sampled with conspicuous flora and fauna abundance and coverage recorded and representative photographs taken at each station (a total of 45 stations). The nature of the habitat was assessed and each station assigned to a biotope based on the characterising physical and biological features. The full survey report can be found in **Appendix 12.1**.
  - This intertidal habitat survey has also been used to inform the assess of potential impact in the event of dredge reuse for beach recharge option (see later).
- **Geotechnical and Chemical Sample Surveys**, including sample locations within the dredge pockets**:** Sampling and analysis of subtidal sediments within the proposed dredge pockets was undertaken and reported in three separate reports to inform design development and Impact Assessment:
  - Uig Ferry Terminal Redevelopment Ground Investigation Interpretative Report ((Holequest Ltd, 2017));
  - Uig Pier, Isle of Skye. Mulitbeam and 3D Laser Scan Survey. February 2018.
  - Uig Pier, Isle of Skye. Ground Investigation Samples Chemical Analysis Report. May 2018.
- Survey data of specific relevant to the sediments within the dredge pockets was extracted from the above listed reports and is summarised in **Chapter 8**.

12.3.4 Site characterisation of the disposal site options was also required in order to determine if significant effects were likely.

- **Sediment disposal search area, Benthic Survey** (Partrac Ltd, Jan 2018) and Survey Report (AECOM, May 2018).
- A total of 12 benthic grab samples were collected from the sediment disposal search area as shown in **Figure 12-2.** Samples were collected using a 0.1 m^2 day grab at sampling locations based on a 3x4 grid (250 m x 250 m). In addition, video footage and stills were collected along five transects within the search area in order to characterise the species and habitats present. Survey method was discussed and agreed with Marine Scotland, ahead of survey completion.

Sediment Dispersion Modelling

12.3.5 Initial sediment dispersion modelling was completed (November 2017) based on early, indicative dredge activity parameters. This was completed to establish an understanding of the likely dredge sediment plume that could be expected in order to inform marine and intertidal survey design, and to provide input to design development.

12.3.6 Further sediment dispersion modelling was completed (June 2018) to verify and test the potential effects which may be anticipated from the Proposed Sea Disposal Site (see **Appendix 2.3: Disposal Site Characterisation Report** for further details).

Assessment Method

12.3.7 This chapter has been prepared in accordance with the CIEEM Guidelines for Ecological Impact Assessment (CIEEM, 2018) and represents an expanded methodology which remains in line with the core impact assessment methodology set out within **Chapter 6: Approach to EIA** of this report.

12.3.8 The principal steps are summarised below:

- Data are obtained on benthic features potentially affected, through target desk study and primary survey to determine the baseline condition (current, and where appropriate future baseline conditions);
- Determination of Value and Sensitivity of the benthic ecological features that have been identified in the baseline;
- The potential impacts of the Proposed Development that could affect benthic ecological features are described, accounting for embedded mitigation;
- The likely effects on benthic ecology receptors are assessed and if possible, quantified;
- Measures are developed to mitigate (by avoidance or reduction) or if necessary compensate, for any likely adverse effects; and
- The significance of any residual effects is reported.

12.3.9 The impact assessment gives further consideration to the activities with the potential to impact the benthic ecological features which were identified at scoping stage. This includes construction vessel movement, dredging and/or construction piling associated with the construction works.

12.3.10 Mitigation recommendations are outlined in Section 12-6 and opportunities for ecological enhancement identified, where appropriate, in order to fulfil national policy requirements

Limitations

12.3.11 There was limited specific benthic habitat data available for Uig Bay and Loch Snizort and so the broadscale habitat distribution presented comes from EUSeamap 2016 data which is a predictive habitat map. Nevertheless, specific data from key locations in and outside the Bay indicates that the broadscale habitats present are as described by the modelled data and is therefore considered robust.

Summary of Consultation

12.3.12 Consultations specific to this chapter were received from the organisations in Table 12-1 below:

Table 2-1 Summary of Stakeholder Consultation Responses and Actions

Consultee	Summary Response	Comment/Action Taken
Marine Scotland	The EIA Report should include a detailed intertidal survey to confirm nature and distribution of the habitats present in Uig Bay. Habitats of conservation concern or PMF (specifically seapens and burrowing megafauna in circalittoral fine mud) should be considered. A sediment characterisation study should be undertaken to determine the most suitable sea disposal location and methods for the dredge arisings. Consideration should be given to of the potential for significant effect as a result of the possible presence of biologically harmful levels of booster biocides within the sediments at Uig Harbour	Intertidal survey has been completed and is reported in **Appendix 12.1** of this report. Potential effects on PMFs are considered in Section 12.8 of this chapter and in **Chapter 11** of this report. Site Characterisation study for sea disposal site is reported in **Appendix 2.3** of this report. Potential effects from booster biocides are considered in Section 12.8 of this chapter.
Scottish Natural Heritage (SNH)	Consideration of dredge disposal options (location and methods) in terms of effects on PMFs, particularly some of the rare biotopes of burrowed mud, should be considered within the EIR	Potential effects on PMFs are considered in Section 12.8 of this chapter and in **Chapter 11** of this report. Site Characterisation study for sea disposal site is reported in **Appendix 2.3** of this report.

12.4 Baseline Conditions

12.4.1 Uig Harbour is located within Uig Bay, a sheltered inlet on the west coast of the Trotternish peninsula, Isle of Skye. The bathymetry of the bay gradually shallows from around 60 m depth at the entrance to 5 m at the existing berth on King Edwards Pier.

12.4.2 A marine ecology desk-based study has identified the intertidal and subtidal seabed of Uig Bay and the wider environment of Loch Snizort as dominated by sediment habitats comprising varying levels of mud and sand (EMODnet, 2016). Grab sampling of the sediment in Uig Bay indicates that the sediment composition is gravel along the eastern coast and northern edge of the bay entrance and mud within outer and northern parts of the Bay. The hydrodynamic conditions within Uig Bay are influenced by a combined action of tidal propagation and wave activity and are defined as ‘macrotidal’.

12.4.3 **Figure 12.3** shows the broadscale subtidal habitats in Uig Bay. There are some localised areas of rocky reef, particularly around the Ascrib islands in Loch Snizort, but there are also bedrock habitats present close to the north and south entrances of Uig Bay and close to the ferry terminal itself. The Annex 1 habitats ’H1160 - Large Shallow Inlets and Bays’ and ’H1170 – Reefs’ are present in this region though the specific examples of these habitats identified within Uig Bay or Loch Snizort have not been designated as conservation areas.

12.4.4 The beaches of the Bay are largely mixed sediments and algae. Two watercourses flow into the bay at Uig; the River Rha from the north and the River Conon which drains Glen Uig to the east.

Intertidal Habitats

12.4.5 The intertidal habitats in Uig Bay are largely mixed sediments with some rocky areas. Detailed intertidal habitat distribution data was unavailable through desk study, however data collected during a preliminary ecological survey undertaken in May 2017 (Tyler, 2017a) confirmed the presence of intertidal mixed sediments with fucoid algae along the shore of Uig Bay including in front of the current ferry marshalling area. The presence of rock armour was also observed to occur in the upper intertidal of this area. The algal species present, as listed below, are typical of intertidal habitats in the UK:

- Ascophylum nodosum
- Fucus vesculosis
- Pelvetia canaliculata
- Enteromorphia spp.
- Fucus spiralis

12.4.6 The intertidal walkover survey established the intertidal habitats surveyed were dominated by large boulders and cobbles with often high levels of fucoid algae coverage interspersed with occasional small patches of muddy, sandy or gravelly sediments. **Appendix 12.1** contains the intertidal walkover survey report.

12.4.7 In general, the muddy areas were observed on the lower shore where polychaete worms and other infauna were in evidence.

12.4.8 There were five biotopes (habitats) identified as described below (European Nature Information System (EUNIS) Biotope code and biotope name) and the percentage of stations at which the biotope was observed:

- A1.31 Fucoids on sheltered marine shores at 62% of stations;
- A1.21 Barnacles and fucoids on moderately exposed shores at 13% of stations;
- A2.4 Littoral mixed sediments at 11% of stations;
- A2.24 Polychaete/bivalve-dominated muddy sand shores at 11% of stations;
- A2.5 Coastal saltmarshes and saline reedbeds at <1% of stations.

12.4.9 The patches of saltmarsh present were very small, limited in extent and of generally low diversity. With the exception of the far north-east part of Uig Bay between the river mouths, this saltmarsh strip is rarely more than 2 m wide and is often fragmented. A substantial proportion of examples of saltmarsh close to the ferry terminal itself has previously been covered with dumped earth of unknown origin.

12.4.10 The marine habitats and species seen in Uig Bay are considered to be typical and representative of intertidal habitats widely distributed in Scottish coastal waters. There were no habitats or species of conservation concern, such as PMF, identified in the intertidal region of Uig Bay.

12.4.11 In 2015, two small areas of the intertidal in Uig Bay were subject to beach recharge, each of 1000 m^3 of sediment dredged from the King Edward Pier area (Marine Licence Number: 05459, 2015). These areas are shown on **Figure 12-4**. These discharge locations are outside the 2017 intertidal area.

Subtidal Habitats and Priority Marine Features (PMF)

12.4.12 Broadscale subtidal habitat data from EUSeaMap[2] shown in **Figure 12-3**, and BGS data (BGS, 1988)indicate the majority of the seabed in Uig Bay and Loch Snizort comprises mud and mixed sediment habitats with varying proportions of mud, sand and gravel.

12.4.13 A number of subtidal sediment samples were taken in Uig Bay in 2016 and 2017 to determine sediment physical and chemical characteristics (**Chapter 8**). Surface sediments from all stations, including those in the dredge pockets as well as in the wider bay, were found to be dominated by silt and sand. However, sediments obtained from below the surface (i.e. boreholes/trial pits) indicate a greater proportion of sand and gravel, and fewer fines, at Dredge Pocket 1.

12.4.14 On average sediments in dredge pocket 1 (samples BH01 and DS01) were found to be composed of 35% gravel, 55% sand and 10% silt/clay. There were also cobbles and boulders at a small number of stations and man-made debris at some places. The ferry berth sediments are regularly disturbed by maintenance dredging, which last occurred in 2015. In addition, King Edward Pier is currently used by a range of harbour users including the existing ferry service, commercial fishermen, aquaculture site operators and boat day trips. Thus, the capital dredge areas proposed as part of the Proposed Development represent areas already heavily impacted by regular disturbance.

12.4.15 The sub-tidal habitats within Loch Snizort and Uig Bay were mapped as part of the 1988 Skye Sealochs Marine Nature Conservation Review (MNCR) (JNCC, 2001). During this survey a small number of PMF habitats were reported, as described below (and shown on **Figure 12-3**):

- ‘Seapens and burrowing megafauna in circalittoral soft mud’ and also ‘Kelp and red seaweed on sublittoral sediments’ were each observed at a single station in the middle of Uig Bay. On the basis of the sediment types known to be present in the Bay and Loch these particular habitats are likely to be more widespread in this area.
- ‘Northern seafan and sponge communities’ and ‘Maerl beds’ were also observed but only close to the Ascrib islands, over 7 km away from the Proposed Development. As there is minimal presence of suitable rocky habitats in the rest of the Loch and Uig Bay these particular habitats are not anticipated to be common but may be present close to the mouth of Uig Bay.

12.4.16 In 2015, a video and grab sampling survey was undertaken in the south east of the Bay to support a licence application for the Uig Bay (Rubha Riadhain) fish farm as shown on **Figure 6-1** (Grieg Seafood Ltd, 2015). The video survey undertook three transects in water depths between 17.5 m and 48.8 m, though most of the transects were in water depths greater than 30 m. Sediment samples (3 replicate grabs at each location) were collected from seven stations, all within a 100 m radius of the centre of the fish farm footprint, using a 0.045 m^2 van Veen grab. Samples were analysed for particle size analysis (PSA), macrofauna and carbon (loss on ignition).

12.4.17 The seabed observed during the video survey was predominantly soft sandy mud. The sea potato or heart urchin, *Echinocardium cordatum*, was prolific throughout the survey. Several epifaunal and burrowing species, including *Nephrops norvegicus*, the starfish *Asterias rubens*, the squat lobster *Munida rugosa* and the sea pen *Pennatula phosphorea* were common in some sections. Also observed in the video footage were crabs, flatfish, scallops and the sea pen *Virgularia mirabilis,* though these species were not common or prolific within any section.

12.4.18 The grab sampling survey collected a total of 52 different species, with diversity and abundance dominated by polychaetes (31 taxa and a total of 200 individuals from

21 grabs) and molluscs (12 taxa and 222 individuals). Many of these species, particularly the bivalves *Abra nitida*, *Abra alba*, *Nucula nitidosa* and *Thyasira flexuosa* and the polychaetes *Notomastus* sp., *Abyssoninoe hibernica* and *Nephtys incisa* were also observed at all the stations sampled. Also found were the brittle star *Amphiura chiajei* and the burrowing urchin *Brissopsis lyrifera*, animals characteristic of some important mud biotopes.

12.4.19 The fauna observed in the video and grab samples enabled the classification of the study area for the Rubha Riadhain fish farm (**Figure 12-5)** to be identified as 'Inshore Deep Mud with Burrowing Heart Urchins' a PMF that is relatively scarce in Scotland.

12.4.20 On the basis of the sediment types known to be present in the Bay and Loch it is considered possible that this particular PMF may be widespread in this area.

King Edward Pier Dredge Pockets and Uig Bay

12.4.21 Results of the sediment characterisation studies (**Chapter 7**) indicate that surficial sediments from both dredge pockets are predominantly comprised of sand and silt material. However, sediments obtained from below the surface (i.e. borehole and trial pit samples) indicate an increased proportion of coarser material (sand and gravel) with fewer fines, particularly at Dredge Pocket 1 (DP1). In terms of anticipated dredge material, the composition from DP1 has been determined to be predominantly sand (57%), and predominantly fines (silt and clay) for DP2.

12.4.22 The samples were also analysed for concentrations of contaminants: heavy metals, TBT, PCBs and PAHs (**Chapter 8**). Sediment contamination was found to be widespread around Uig Bay, including within the two Dredge Pockets, with elevated levels of chromium and nickel above Marine Scotland (2017) Action Levels (AL) at all stations sampled.

Proposed Sediment Disposal Site

12.4.23 In February 2018, a subtidal grab and video survey was undertaken at a search area agreed with Marine Scotland as a potential site for a new licenced sediment disposal site.

12.4.24 Grab samples were taken at 12 stations, as shown in **Figure 12-2** in the search area and analysed for sediment infauna, physical and chemical characteristics.

12.4.25 Particle size analysis (PSA) of the surface sediments in the disposal site search area found that with the exception of stations GS9 and GS12 which had higher proportions of sand (in the north-east sector of the disposal site search area) the sediment was dominated by silt/clay (>80%). None of the samples included gravel fractions (>2 mm). The difference in the physical nature of the sediments at GS9 and GS12 were also evident in a lower percentage of total organic carbon as would be expected from the higher average particle size.

12.4.26 Sediment quality analysis results from the 12 stations sampled in the disposal search area are provided in **Chapter 8**. In summary, the results indicate that the surface sediments in the disposal search area are contaminated with chromium and nickel, with concentrations consistently above AL1 and above AL2 at some stations. Concentrations of copper and a small number of PAHs were slightly above AL1 but only at a very few stations. The sediments at the disposal search site are of similar poor quality to those observed in the dredge pockets and other stations in the wider bay. This suggests either a source of natural contamination or the migration of historically contaminated sediments from Uig Harbour into the wider bay.

12.4.27 Five ROV camera transects were explored across the disposal site search area to collect video footage and stills images. The water depth of the transects ranged from approximately 45 m to 67 m. The video footage indicated a fine muddy

seabed (consistent with the PSA findings) with many burrows and mounds and frequent sightings of large conspicuous fauna including seapens, both *Virgularia mirabilis* and *Pennatula phosphorea*, *Nephrops norvegicus* and starfish (**Figure 12-6** below).

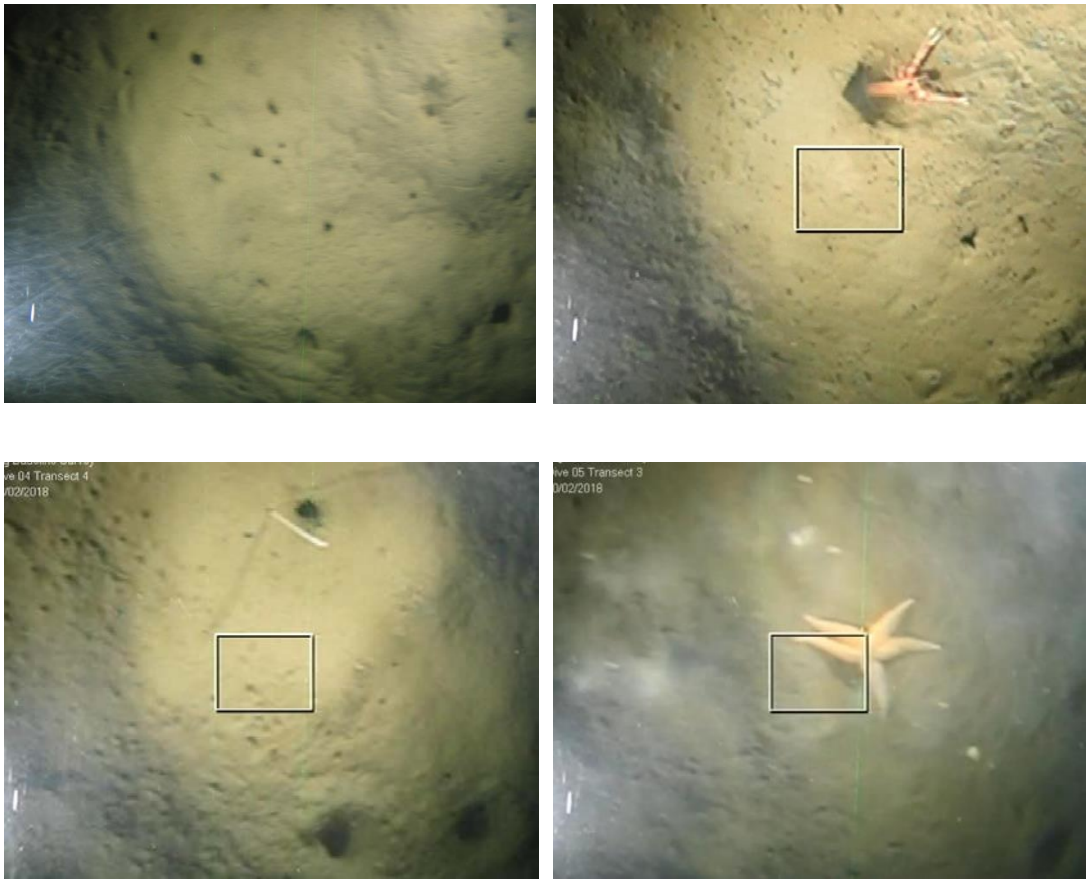

Figure 12-6: Still Images from the Proposed Disposal Site Search Area Seabed Survey

12.4.28 The dominant fauna were polychaete worms, bivalves and gastropod molluscs with burrowing megafauna such as *Nephrops norvegicus* and the burrowing shrimp *Maera loveni* and two species of seapens.

12.4.29 Grab sample results showed the sediments were dominated by the presence of *Nephtys* spp. polychaete worms but also individuals of amongst others, *Abyssoninoe Hibernica* and *Magelona minuta.* There were no heart urchins collected in the grab samples though the brittle star *Amphiura chiajei* was present in 6 of the 12 samples. Individuals of the mud burrowing amphipod *Maera loveni* were also recorded in 2 of the 12 samples.

12.4.30 An assessment of the species observed during the video footage and the animals collected in the grab samples indicates that the seabed in the search area was dominated by the biotope '*Seapens and burrowing megafauna in circalittoral fine mud*' for the following reasons: there were very regular sightings of the two species of seapen, highly abundant burrows and mounds on the seabed and the positive identification of several individuals of *Nephrops norvegicus.* This habitat is a Scottish PMF but is widespread in Scottish waters.

12.5 Value and Sensitivity

Intertidal Habitats

12.5.1 The intertidal habitats comprise littoral mixed sediments (A2.4); Polychaete/bivalve-dominated muddy sand shores (A2.24) and coastal saltmarsh and saline reedbeds (A2.5) (**Appendix 12.1**). These habitats are not subject to any level of protection, being typical of and widespread in the coastal areas of Scotland. They are of local importance and as relatively dynamic habitats are largely tolerant of changes which may be anticipated as a result of the Proposed Development, such as the loss of some algal cover, smothering disturbance to sediments, without significant detriment to the habitat character (MarLIN, 2006).

12.5.2 Thus, the intertidal habitats in Uig Bay are considered to be of Low sensitivity and/or importance.

Subtidal Habitats

12.5.3 The subtidal areas within Uig Bay, including the disposal site search area comprise muds, sands and mixed sediments with some areas of rocky reef, particularly at the northern entrance to the Bay (see **Figure 12-3).**

12.5.4 There are some PMF habitats identified as being present in Uig Bay: For example, one recording of 'Kelp and red seaweed on sublittoral sediments' biotope was observed and the burrowing mud biotopes 'Seapens and burrowing megafauna in circalittoral soft mud' and 'Burrowing heart urchins in circalittoral mud' are also present (**Figure 12-3)**. The first of these is the most widespread in Uig, based on the data available.

12.5.5 These PMF sublittoral habitats are of regional importance, being widespread across Uig Bay and around the coast of Scotland beyond. Sublittoral PMF habitats are therefore considered to have Low to Medium sensitivity/importance.

12.6 Avoidance Measures/Mitigation 'by Design'

12.6.1 Detailed consideration has been given throughout design development, to ensure that Proposed Development activities, particularly dredging and dredge disposal take due account of and seek to minimise any resultant interaction with the receiving environment. Proposals for disposal of dredge materials have been subject to a Best Practice Environmental Option (BPEO) and Waste Management Hierarchy assessment, as set out within **Appendix 2.2** and **Appendix 2.3.** Notwithstanding this, it is acknowledge that deposition of dredge material will result in changes to receiving substrate type and to the benthic habitats which are supported.

12.7 Potential Effects Scoped out of the Assessment

12.7.1 The following potential effects on benthic ecology as a result of the Proposed Development were considered and scope out of further assessment at scoping stage:

- Effects on intertidal habitat as a result of land reclamation. The extension of the terminal marshalling area by land reclamation will involve the infilling of approximately 50,000 m3 of infilling material with rock armour revetment in an area below Mean High Water Springs (MHWS). These works will result in the loss of an estimated 11,000 m2 of intertidal habitat. However, the intertidal zone in this area does not include any habitats of conservation importance and represents a small proportion of

the assumed similar habitat types present in the overall intertidal zone in Uig Bay. In this case no likely significant effects are anticipated; and

- Effects on subtidal habitat currently present within the areas to be dredged. The sediments currently within the dredge pockets have been subject to regular maintenance dredging regime, as part of existing, ongoing harbour management. Thus, habitat types present within the dredged area are regularly disturbed and are therefore expected to be of Low value. No likely significant effects on existing habitats in the dredge area are expected.
- Potential for movement of non-native species as a result of shipping construction materials to site. The majority of construction materials and construction plant is expected to be delivered to the Proposed Development site by road. It is currently anticipated that significantly sized, single construction pieces, most notably the new linkspan infrastructure may be brought to the Proposed Development site by barge. The CEMP will include appropriate measures to control and limit the risk of marine invasive non-native species following best practice (e.g. (Payne, Cook, & Macleod, 2014)), if considered necessary.

12.7.2 Refer to Section 1.7 and **Appendix 1.1** for further details.

12.8 Predicted Effects

Construction

12.8.1 Dredging is required in two defined dredge pockets as part of the Proposed Development as shown in **Figure 3.3**. These comprise:

- **Dredge Pocket 1 (DP1):** the ferry berth area where an estimated 29,642 m^3 of sediment will be removed for the enlargement of the berth area to accommodate the new vessel; and
- **Dredge Pocket 2 (DP2):** a small area alongside the pier approachway at the fishermens' compound where it is expected that a total of 1,150 m^3 of sediment will be removed.

12.8.2 Sediments from DP1 will be disposed of at the proposed new licenced Proposed Sea Disposal Site outside Uig Bay.

12.8.3 There are two options for the disposal of sediments from DP2: sediments will either be used for beach replenishment in the intertidal zone or will be deposited at the Proposed Sea Disposal Site along with DP1. Each of these options is addressed.

12.8.4 The following potential effects on benthic ecology during construction of the Proposed Development have been identified and are discussed in this chapter:

- Loss of subtidal benthic habitat and species as a result of the disposal of dredge sediments;
- Contamination of subtidal benthic habitat at the Proposed Sea Disposal Site, and the wider bay, as a result of historic chemical and/or biocide contamination mobilised from capital dredge pockets;
- Smothering of intertidal habitats during beach replenishment using dredge materials from DP2 only (fishermen's compound, see below). Whilst it has not been confirmed that this activity will be required, it has been included here for completeness. This is assessed throughout the remainder of the chapter; and

- Contamination of intertidal habitats.

Loss of Subtidal Benthic Habitats at Sea Disposal Site as a Result of Sediment Disposal

12.8.5 The seabed material removed during dredging will be transported to the Proposed Sea Disposal Site (just outside the entrance to Uig Bay) by hopper barge as the dredging operations are carried out. Up to two hopper barges could be operating at one time in order for the cutter suction dredging (CSD) to continue operating whilst dredged material is being transported to the Proposed Sea Disposal Site. At the Proposed Sea Disposal Site, large valves on the underside of the hopper barges will open, releasing the entire hopper load onto the seabed as a high density core.

12.8.6 Sediment Dispersion Modelling

12.8.7 Modelling has been carried out to predict the sediment dispersion characteristics that can be expected as a result of dredge sediment deposit at the Proposed Sea Disposal Site. The modelling has been based on the dredged sediment composition characterised as likely comprising 57% sand, 18% silt/clay and 25% gravel (see **Chapters 7 and 8 and Appendix 2.3**).

12.8.8 Sediment analysis indicates the seabed at the Proposed Sea Disposal Site is largely comprised of poorly sorted mud (see **Chapters 7 and 8, and Appendix 2.3**). Therefore, dredge disposal could be expected to result in a change in seabed sediment composition at the Proposed Sea Disposal Site because the sediments to be deposited comprise a higher proportion of coarse particles, particularly sand and gravel, than the receiving sediment.

12.8.9 The modelling, based on repeated sediment disposal events from the dredge barge at the same location, predicts that that maximum sediment thickness around the Proposed Sea Disposal Site may be up to approximately 1.8 m (**Chapter 8**). In reality, the barge is more likely to discharge the dredged sediments at different locations within the Proposed Sea Disposal Area, therefore the maximum thickness at any one point is likely to be smaller than this.

12.8.10 Nevertheless, an area of sediments within the Proposed Sea Disposal Site will be covered in coarser sediments and, there is the resultant potential for the loss of the current subtidal benthic habitats present.

12.8.11 The habitat type at the Proposed Sea Disposal Site has been identified to be 'Seapens and burrowing megafauna in circalittoral mud', a PMF habitat type which MarLIN (MarLIN, 2018) has assessed to be insensitive to smothering by covering of up to 30 cm of fine sediment in a single event.

12.8.12 The characteristic burrowing megafauna of this biotope observed at this site, *Nephrops norvegicus* and the mud burrowing shrimp *Maera loveni*, are active burrowers and able to reconstruct burrows after smothering. For example, *Nephrops norvegicus* was reported within the Garroch Head (Firth of Clyde) sludge dumping ground (Hughes, 1998) where deposited sediment occlude burrow openings, evidence was recorded of the burrows being reopened quickly. Likewise, observations from Loch Sween suggest that burrows were also re-established soon after experimental disturbance (Hughes, 1998).

12.8.13 The seapens of this biotope are found in deep, sheltered muddy habitats where the accretion rates are potentially high. Both *Pennatula phosphorea* and *Virgularia mirabilis* can burrow and move into and out of their own burrows. There may be some clogging of feeding apparatus by smothering of fine sediments. However, it has been observed that the seapen *Funiculina quadrangularis* was quick to remove any adhering mud particles by the production of copious quantities of mucus, once the source of smothering (in this case potting) was removed (Kinnear, et al., 1996). Similarly, Hiscock (1983) observed *Virgularia mirabilis t*o secrete copious amounts

of mucus, which could keep the polyps clear of silt and is also likely to be able to self-clean.

12.8.14 As discussed above, whilst the burrowing megafauna biotope can tolerate smothering by fine sediments of up to approximately 30 cm depth, the sediment for disposal is dominated by sand with some gravel and only around 18% silt/clay. Also, modelling indicates a smothering thickness significantly greater than the 30 cm threshold may occur in some areas of the Proposed Sea Disposal Site and the coarser grained sediments will rapidly settle to the seabed.

12.8.15 Therefore, whilst some animals in the burrowing mud biotope may be able to move or re-establish burrows there is expected to be some localised mortality in areas of the Proposed Sea Disposal Site that receive the heaviest deposition load where burrow openings cannot be easily re-established or where animals are damaged by settling sediments.

12.8.16 There is expected to be habitat loss within the Proposed Sea Disposal Site due to the deposition of sediments of a coarser composition. However, this change is limited in extent, only occurring in the geographically restricted Proposed Sea Disposal Site, located with an extensive area of the Bay and wider Loch that is dominated by burrowing fauna biotopes.

12.8.17 In addition, deposited sediments can be expected to become integrated into the existing seabed, to a certain degree, through the natural process of bioturbation as a result of infaunal organism activity within the surface layers of sediment. Bioturbation processes are typically limited to the first metre depth of sediment. (Gringas, Pemberton, & Smith, 2015). However, in areas where the deposited sediment thickness is tens of cms deep the process of bioturbation is expected to take many months. Seapen and burrowing megafauna biological communities may sometimes be found on sandy muds as well as fine muds (JNCC, 2014) and so there is potential for some recovery in the longer term.

12.8.18 Recovery from this initial sediment disposal event by bioturbation is considered to be possible in the medium to long-term.

12.8.19 Whilst some habitat loss is anticipated, the Proposed Sea Disposal Site has been specifically chosen for, amongst other characteristics, its water depth and retentive properties of seabed bathymetry etc (see **Appendix 2-3** Disposal Site Characterisation), the extent of anticipated habitat loss will be minimised. The magnitude of the event is therefore, considered to be **low** resulting in an effect of **minor** significance.

Contamination of Subtidal Benthic Habitats

12.8.20 Chemical analysis of sediments around Uig Pier indicated elevated levels of certain metals, in particular chromium and nickel. Subsequent analysis of sediments elsewhere in Uig bay and specifically around the Proposed Sea Disposal Site also identified similarly elevated levels, suggesting that the heavy metal contaminants are wide spread and at similar concentrations at all areas sampled in the Bay. These levels may reflect naturally occurring concentrations of heavy metals potentially due to the leaching of geological material, or water current driven distribution of historical contaminants from the harbour across the bay.

12.8.21 Whilst dredging activities have the potential for the re-distribution of these contaminants from the Proposed Sea Disposal Site into other areas of the bay during sediment disposal, it is not anticipated that this activity will introduce any new contamination into the area, or result in any increase in concentration of existing contamination. No significant impact is therefore expected.

12.8.22 After the ban on the use of the antifouling compound trybutyl tin (TBT) (a complete ban came into effect in 2008), metals, particularly copper and zinc have increasingly

been re-introduced as the main active ingredients in antifouling paint formulations. In addition other compounds known as 'booster biocides' are increasingly being used to improve the effectiveness of hull protection paints. Booster biocides can enter the environment primarily either by direct release from the painted hull of boats during normal use or during pressure hose maintenance cleaning of small boat hulls (predominantly pleasure craft) directly onto the foreshore (Thomas, McHugh, & Waldock, 2002).

12.8.23 Concerns with respect to the potential for antifouling biocides (painted onto boats), particularly in the 1,150 m^3 of dredged sediments from DP2 in the fishing boat compound, were raised by Marine Scotland. Research into the distribution of biocides indicated that there is potential for them to be present, but in low concentrations only. Whilst this area of the pier is used by small vessels that may have used the new generation of TBT free anti-fouling paints (see Section 1.7 of this report for further details) the number of vessels using the pier, and the amount of maintenance cleaning undertaken at Uig is very low. In addition, biocides are generally associated with more closed areas such as marinas.

12.8.24 Protocols for laboratory testing of sediment samples for booster biocide compounds, a very wide range of different chemicals, remain under development (personal communication from Socotec Laboratories). In addition there are currently no action levels or target concentrations set for 'safe' levels of booster biocide compounds within the marine environment in the UK.

12.8.25 Thus, the concentration of booster biocides compounds within the dredged sediment is not known.

12.8.26 Taking a precautionary approach, it has been assumed that the magnitude of any effect of sediments containing booster biocides being deposited onto the seabed at the Proposed Sea Disposal Site could be medium**.** Whilst deposition of small levels of booster biocide contamination within sediments from DP2 at the Proposed Sea Disposal Site may occur, the Proposed Sea Disposal Site has been specifically chosen for, amongst other characteristics, its water depth and retentive properties of seabed bathymetry etc, thus the extent of anticipated sediment contamination will be minimised. The magnitude of the event is therefore, considered to be low resulting in an effect of minor significance.

Loss of Intertidal Habitats (Optional)

12.8.27 An option for the disposal of 1,150 m^3 of dredged sediments from DP2 around the fisherman's compound is to distribute them onto an adjacent beach in Uig Bay (as described in **Chapter 3: Project Description**).

12.8.28 The sediment composition of the dredge material at DP2 has been characterised as comprising 30% sand, 61% silt/clay and 9% gravel (**Chapter 7**). If the spoil from DP2 is distributed in the intertidal zone this will be likely to result in a localised change in habitat type on the lower shore, but less so on the upper shore where sediments are more coarse and similar to dredge sediment characteristics. Some areas of fucoid cover may also be smothered.

12.8.29 The limited quantity of material to be deposited the footprint of the deposited sediment will be small in relation to the size of intertidal zone in the Bay. Also, it is likely that water movement from the rising and falling tide and wave action will distribute this material more widely after deposition. Thus, the smothering of intertidal habitats, particularly if the spoil is deposited on the upper shore, is considered likely to be of low magnitude. Intertidal habitats are considered to be of low sensitivity and so any resultant effect of physical habitat smothering is considered to be of negligible significance.

Contamination of Intertidal Habitats

12.8.30 The likelihood and potential characteristics of any booster biocide contamination within the dredged sediment is discussed above. Taking a precautionary approach, it has been assumed that the magnitude of any effect of sediments containing booster biocides being used for beach replenishment in the adjacent intertidal zone could be medium. For intertidal habitats assessed as having low sensitivity, this would result in an impact of minor significance.

Operation

12.8.30 The only activity that will take place in the operational phase of the ferry terminal will be maintenance dredging at the ferry berth. This will take place every 3 to 5 five years in order to maintain the dredge pocket. Significantly lower volumes of sediment will be removed for maintenance. It is assumed that the dredge spoil will be taken to the Proposed Sea Disposal Site.

12.8.31 Thus, the only predicted effect on benthic habitats to result from the operation of the ferry terminal is expected to be the smothering of benthic habitats at the Proposed Sea Disposal Site when maintenance dredging is required (estimated every 3-5 years).

12.8.32 The dredge spoil is expected to be similar to the current sediment type in the berth area, largely sand with gravel and some silt, as a result of the process of infilling from surrounding areas. Some deposition of fine sediments into the dredge pocket is expected so the silt/clay component may be higher than the original dredged sediments.

12.9 Mitigation and Monitoring

Construction

12.9.1 The following mitigation measures are recommended, in relation to impacts on benthic habitats.

Disturbance/loss of Subtidal Benthic Habitats

12.9.2 All sediments from DP1 will be disposed of in the proposed new licenced Proposed Sea Disposal Site outside Uig Bay.

Operation

12.9.3 No additional mitigation measures are required during the operation phase. Maintenance dredging will be required but will comprise small sediment volumes relative to the construction phase and will use methods adopted for previous dredge operations at the pier. All sediments will be disposed of at the licenced Proposed Sea Disposal Site and will be subject to a separate licence application at the time.

12.10 Residual Effects

Construction

12.10.1 The residual impact of construction activities is considered to be a maximum of minor significance for benthic habitats.

Permanent

12.10.2 The residual impact of the operation of the ferry terminal is considered to be a maximum of minor significance for benthic habitats.

12.11 Cumulative Effects

12.11.1 There have been two projects identified that may present cumulative effects with the Proposed Development:

- The reinstatement and construction of Uig Bay (Rubha Riadhain) finfish farm; and
- The operation of Loch Snizort East finfish farm.

12.11.2 Grieg Seafood Ltd has a licence for the reinstatement of the Uig Bay (Rubha Riadhain) finfish farm operation with the intention of production recommencing in 2019. A total of eight cages of 120 m circumference with a feed barge at the north-eastern end of the cage group will be installed at the site. The cages will be towed by sea to the Uig Bay site and anchored to the seabed. Loch Snizort East is an operational fishfarm (at the time of writing).

12.11.3 The impact of the release of solid and dissolved waste from the feeding systems used in the fish farm were assessed as part of the planning application. AutoDepomod, a computer modelling package developed for SEPA, predicted the fate of waste and the scale and severity of the impact from a proposed finfish farm was insignificant.

12.11.4 For the Loch Snizort East fish farm an area of 0.5 km^2 of Loch Snizort was predicted to receive organic waste, from fish feeding systems, greater than background levels. However, this farm is at least 1 km away from the Proposed Development and from the Proposed Sea Disposal Site.

12.11.5 The Proposed Development is unlikely to result in a significant cumulative effect on the benthos in association with these two projects given that the predicted maximum increases to suspended sediment concentration are between 2 and 6 mg/l and short-lived. Thus, any deposition to benthic habitats is expected to be minimal.

12.12 Summary & Conclusions

12.12.1 No significant impacts to benthic habitats, as a result of the construction or operation of Uig Ferry Terminal, after control and mitigation measures, are predicted.

Table 2-2 Summary of Impact Assessment for Benthic Ecology

Effect/Activity	Receptor	Receptor Sensitivity	Magnitude of Event Prior to Mitigation	Impact Significance Prior to Mitigation	Mitigation Measures Adopted	Post Mitigation Impact Significance
Habitat loss from dredge disposal	Subtidal habitats	Medium	Negligible	Minor	-	Minor
	Intertidal habitats	Low	Negligible	Negligible	-	Negligible
Habitat contamination from dredge disposal	Subtidal habitats	Medium	Negligible	Minor	-	Minor
	Intertidal habitats	Low	Medium	Minor	-	Minor

13. Fish and Shellfish Ecology

13.1 Introduction

13.1.1 This chapter of the Environmental Impact Assessment Report (EIA) provides an assessment of the potential and scale of effects of the Uig Harbour Redevelopment project (here after referred to as 'The Proposed Development') on fish and shellfish ecology. Where appropriate it provides proportionate measures to avoid, mitigate or compensate for adverse impacts.

13.1.2 **Chapter 3: Project Description** of this EIA Report provides a detailed description of the works required to implement the Proposed Development.

13.1.3 Potential effects on fish and shellfish ecology may be closely linked with potential effects on commercial fisheries. This chapter should therefore be read with reference to **Chapter 19: Commercial Fisheries**.

13.2 Legislative Context

13.2.1 The fish and shellfish assessment has been undertaken within the context of the following relevant legislation, planning policies and guidance documents:

- Marine (Scotland) Act 2010;
- Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Harbour Works (Environmental Impact Assessment) Regulations 1999;
- Wildlife and Countryside Act, 1981;
- Conservation of Habitats and Species Regulations 2010 (commonly referred to as the Habitats Regulations);
- National Marine Plan (Scotland); and
- Marine Policy Statement (2011).

13.2.2 Further information on the above legislation and policy is given in **Appendix 4.1.**

13.3 Assessment Methodology & Data Sources

Desk Study

13.3.1 Baseline conditions have been established by undertaking a desktop study of published information and through consultation with relevant bodies. The primary data sources used in the assessment of impacts on fish and shellfish are as follows:

- Marine Scotland National Marine Plan interactive (NMPi) maps;
- Fisheries sensitivity maps for UK waters (Coull, Johnstone, & Rogers, 1998) and NMPi website for 2014 updated (Marine Scotland, 2014);
- SEPA Shellfish Waters Data Sheets (SEPA, 2011);
- Uig Bay (Rubha Riadhain) Fish Farm, Uig Bay, The Highland Council, Planning Application Documents including survey reports (Grieg Seafood Ltd, 2015);
- Loch Snizort East (Ru Chorachan) Fish Farm, Loch Snizort. The Highland Council, Planning Application Documents (Grieg Seafood Shetland Ltd, 2017);
- Scottish National Marine Plan (Marine Scotland, 2014);

- EU Designated sites Standard Data Forms;
- Sea of The Hebrides MPA Proposal - Data Confidence Assessment, 2014 (SNH, 2014).

Underwater Sound Propagation Modelling

13.3.2 Underwater sound propagation modelling was completed based on indicative parameters considered representative of construction activities likely to generate underwater noise, specifically piling activities associated with construction of the Proposed Development. This was completed in order to establish an understanding of the likely sound levels and spatial extent of the marine environment in and around Uig Bay that could be expected to experience elevated noise levels during construction.

13.3.3 The outputs from this modelling exercise have been used to assess the potential significance of construction noise on sensitive marine receptors specifically including fish and shellfish, as discussed in this chapter, and also on marine mammals, as discussed in **Chapter 14**.

13.3.4 The details and full results of the Sound Propagation Modelling that has been completed is set out within **Appendix 13.1.**

Sediment Dispersion Modelling

13.3.5 Initial sediment dispersion modelling was completed (November 2017) based on early, indicative dredge activity parameters. This was completed to establish an understanding of the likely dredge sediment plume that could be expected in order to inform marine and intertidal survey design, and to provide input to design development.

13.3.6 Further sediment dispersion modelling was completed (June 2018) to verify and test the potential effects which may be anticipated from the Proposed Sea Disposal Site (see **Appendix 2.3: Disposal Site Characterisation Report** for further details).

13.3.7 The sediment dispersion modelling has been undertaken using the DHI MIKE21 PT (Particle Tracking) module, to simulate the fate of dredged sediment suspended through the disposal process. The calibrated hydrodynamic model has been used to drive the PT module with a description of water levels and flow speeds across the study area. The flow regime is then seeded with particles with defined characteristics (e.g. size, density, settling velocity etc.) which are then tracked as they are entrained within the water column.

Assessment Method

13.3.8 This chapter has been prepared in accordance with the CIEEM Guidelines for Ecological Impact Assessment ((CIEEM, 2018)) and represents an expanded methodology which remains in line with the core impact assessment methodology set out within **Chapter 6: Approach to EIA** of this report.

13.3.9 The principal steps are summarised below:

- Data are obtained on fish and shellfish communities potentially affected, through targeted desk study;
- Determining Value and Sensitivity of the identified fish and shellfish communities that have been identified;
- The potential impacts of the Proposed Development that could affect fish and shellfish communities are quantified, through interpretation of the sound propagation modelling results;
- Measures are developed to mitigation (by avoidance or reduction) or if necessary to compensate for any likely adverse effects; and

- The significance of any residual effects is reported.

13.3.10 The impact assessment gives further consideration to the major activities with the potential to impact the fish and shellfish receptors which were identified at the scoping stage. This includes piling works on site that has the potential to generate disturbance effects in response to the underwater sound generated, and dredging and sediment disposal that could result in changes to suspended sediment levels and water quality. Mitigation recommendations are outlined in Section 0 and opportunities for ecological enhancement identified, where appropriate, in order to fulfil national policy requirements.

Limitations

13.3.11 There was limited data or information found regarding fish abundance and distribution specific to Uig Bay or Loch Snizort. This is thought to be largely due to the fact that this area is of limited importance, particularly in comparison to other Scottish coastal areas, for fisheries activity, something that was confirmed during the stakeholder consultation with local fishermen.

13.3.12 Sound propagation has been determined using geometric spreading rather than full modelling. There are a number of limitations and uncertainties in the sound propagation calculations that should be recognised and taken into account during the impact assessment.

i. Propagation loss calculated on the basis of the spreading law model underestimates noise exposure close to the source, which is the region where noise levels are highest (and risk of injury and disturbance is greatest).

ii. Furthermore, noise levels are overestimated further from the source, giving the potentially misleading impression that a larger area would be affected (Farcas, Thompson, & Merchant, 2016).

iii. Spreading law calculations cannot account for the topography of the seafloor, a factor which can have a strong influence on sound propagation. This is because in shallow water, the main mechanism driving sound propagation is reflection and scattering from the sea surface and seabed boundaries. Thus, seabed sediment characteristics strongly influence the propagation of sound in shallow water. For example, more sound is scattered or absorbed into the seabed where sediments are soft, such as those comprising mud and silts, compared to areas of bedrock or coarse sand which are much more reflective. The sediments in Uig Bay largely comprise mud and silt and so propagation may be lower than estimated by the calculations. However, the sediments in the areas where the piling will be taking place contain higher elements of coarse particles, particularly sand and gravel, so any reduction in sound due to absorption of sound is not likely to occur in the immediate vicinity of the piling activities.

iv. Sound propagation modelling has assumed both a stationary receptor and a stationary sound source. Whilst the sound source is derived from a fixed piling location most fish are unlikely to remain in the same spot for very long and in the presence of underwater sound there is a high likelihood that fish will move away, reducing the sound energy experienced with distance. Thus, SELs are also overestimated.

13.3.13 In conclusion, it is considered that far field effects are likely to have been overestimated and near field effects underestimated in the geometric spreading calculations. In addition, the calculations do not account for the fact that fish are likely to move away from anthropogenic underwater sound which can reduce the impact distances calculated. These factors will be considered in the discussion of impacts in Section 13.8 of this chapter. The full sound propagation calculations can be found in **Appendix 13.1**.

Summary of Consultation

13.3.14 Consultations specific to this chapter were received from the organisations in Table 13-1 below.

Table 3-1 Summary of Stakeholder Consultation Responses with Relevance to Fish and Shellfish Ecology

Consultee	Summary Response	Comment/Action Taken
Marine Scotland	Likely effects on fish and shellfish ecology will occur from underwater sound generated from the impact piling works, and from suspended sediment and changes to water quality during dredging and sea disposal. Underwater modelling will be undertaken to determine likely level of disturbance to fish species Sediment dispersion modelling will be undertaken to determine the impact of water quality changes on fish and shellfish	Potential effects from these activities on fish and shellfish are considered in Section 13.8 of this chapter. Methodology and results from underwater sound propagation modelling is set out in **Appendix 13.1**. Methodology and results from sediment dispersion modelling is set out in **Chapter 7.**
Scottish Natural Heritage (SNH)	SNH identified potential for effects of piling noise on marine mammals. No specific reference is made to fish and shellfish as noise receptors. The review of existing marine data should identify any PMF which may be affect by the proposals.	Effects of piling noise on fish and shellfish ecology is considered in Section 13.8 of this chapter. A number of fish species are listed as mobile PMF species. These include, but are not limited to the marine part of the life-cycle of Atlantic Salmon *Salmo salar.* Potential effects on Atlantic Salmon are considered in Section 13.8 of this chapter.
Uig Harbour Master	During the fisheries stakeholder consultation process it was reported there are no important fishing grounds in the vicinity of Uig.	Data included in baseline characterisation in the fish & shellfish and the fisheries chapters.

13.4 Baseline Conditions

13.4.1 A desk based study of available data sources has been carried out to characterise, where possible, the fish communities which may be anticipated to be present within Uig Bay, Loch Snizort and the Minches. Historically the inshore coastal waters in this wider area have supported extensive populations of cod, ling and herring amongst others (Martin, 1716); (Comhairle nan Eilean Siar, 1997). Extensive fishing practices through the 20 h Century have however significantly depleted these stocks (Darling, 1955) although fishing limits and prohibitions where they have been

implemented have allowed some species populations, e.g. herring to recover somewhat (Nicolson, 1990).

Commercial Fish Species

13.4.2 Uig Bay and Loch Snizort are located within International Council for Exploration of the Sea (ICES) rectangle 44E3 (see **Figure 19-1**) as well as 'the Minches and Western Scotland' subregion defined to support the management of UK Biodiversity indicators as defined under the UK's participation in the Convention on Biological Diversity (CBD).

13.4.3 UK fleet landings data by ICES rectangle ((Scottish Government, 2017) and (MMO, 2016)) indicate low/no catch data for rectangle 44E3 for demersal and pelagic species, suggesting catches being landed into Uig Harbour are not caught in the vicinity of the Proposed Development. This indicates the abundance of commercially important demersal and pelagic fish species in Uig Bay and Loch Snizort is low in comparison to other coastal areas of Scotland.

13.4.4 The key species captured in the wider area around Skye (ICES rectangles 43E3 and E4 and 44E3 and E4 as shown in **Figure 19.1)** were *Nephrops*, sprat, scallops, crab and lobster.

13.4.5 Fishing effort in the waters of Loch Snizort was rated at a score of 2 out of 5 in the 1998 fisheries sensitivity analysis (Coull, Johnstone, & Rogers, 1998) also indicating the abundance of fish in this region is not high. Stakeholder consultation also confirmed the area is not particularly important for fisheries (Table 13-1).

13.4.6 Annual fisheries management surveys over the last decade (to 2017) indicate an overall improvement in the composition structure and functioning of the demersal fish community in the Minches and Western Scotland sub region (Greenstreet, Fraser, Cotter, & Pinnegar, 2017)

13.4.7 Further information on catch data is included in **Chapter 19: Commercial Fisheries**.

13.4.8 Spawning areas of whiting, sand eel, sprat and the Dublin Bay prawn, *Nephrops norvegicus,* are known to include the northern waters of the Isle of Skye (Coull et al, 1998; and 2014), indicating there is potential for these species to be present in the vicinity of the Proposed Development at key life stages. The most important commercial fish species, such as cod and herring, spawn to the north and/or west of Loch Snizort.

13.4.9 The wider region of the waters off the west of Scotland, that includes Loch Snizort, also provides nursery habitat for herring, cod, sand eel and *Nephrops* (**Figure 13-1)**. There were no data available on herring larvae or eggs from the ICES data portal (ICES, 2018).

13.4.10 Modelled data analysed a maximum probability of 33% of there being high abundances of 0-group fish (fish in the first year of their life) that are sensitive to sound.

13.4.11 There is also aquaculture of Atlantic salmon and wrasse at Loch Snizort East finfish farm (FS1309), approximately 4 km south of Uig Harbour and just outside the Bay and Uig Bay finfish farm (FS0881) in the south east of Uig Bay is awaiting issue of a Marine Licence to restart production of Atlantic salmon.

Shellfish Species

13.4.12 The shellfish ecology of the area is unknown although Loch Snizort has been designated as an area of Shellfish Growing Waters (SGW) since 2000. This designation was for the production of the common periwinkle (*Littorina littorea*) and the common cockle (*Cerastoderma edule*). There are also mussels present in Uig Bay (a SEPA sampling point at NG 39209 63623). These are shown in **Figure 13.2.**

13.4.13 *Nephrops* (langoustine), crabs and scallops, reported as being landed into Uig in 2015, may also be present. However, fishing stakeholder consultation confirmed that whilst scallops and prawns are landed in Uig these are generally caught in the Uists.

13.4.14 The National Marine Plan Interactive (Marine Scotland, 2014) indicates a low (1-3) number of scallop diving vessels operating in the inshore waters along the west coast of Skye, including Uig Bay. This is supported by shellfish landings data for rectangle 44E3 which indicates an annual landing of between 1000 and 1500 tonnes per annum.

13.4.15 The information available indicates that fish and shellfish productivity in the areas around Uig and Loch Snizort is relatively low, compared to other coastal waters in Scotland, and so the waters around the Proposed Development do not represent important fishing grounds.

Recreational Fish Species

13.4.16 A number of species are the subject of sea angling that takes place in many areas around the Isle of Skye. This includes typical coastal species such as pollock, wrasse, flat fish, rays and dogfish, that are likely to be present in the vicinity of the Proposed Development Site, albeit in relatively low numbers.

13.4.17 Stakeholder consultation with local fishing groups was undertaken as part of the data gathering exercise for the EIA. The western region inshore fisheries group in Scotland reported that there are local fishing grounds adjacent to Uig in Loch Snizort. However, they advised that most of the landings in Uig are from other areas such as Rodel and the Shiants.

Salmonids

13.4.18 The River Snizort is a recognised salmon and trout fishing river so salmonids will be moving through the Loch during upstream migration between late June/early July and October. However, the migration route to the river is not anticipated to include any significant movement into Uig Bay and so the abundance of these species in the near location of the works, during the migration season, is expected to be low.

Elasmobranchs

13.4.19 Basking sharks are known to be common in the waters around the Inner Hebrides and may be found in the vicinity of the Proposed Development. However, data presented in support of the Sea of the Hebrides proposed MPA indicates that the abundance of basking shark in the inner reaches of Loch Snizort, near Uig, is very low (<0.1 individuals/km^2 recorded for the period 2000-2012) (SNH, 2014).

13.4.20 According to data accessed via Marine Scotland's National Marine Plan Interactive, there have been sightings of basking sharks in Uig Bay. However, these records are for sightings made between 2005 and 2010 and no more recent observations were found. Thus, basking shark individuals are likely to be present in the vicinity of construction activities only as occasional visitors and thus in very low abundance. As an elasmobranch with no swim bladder, the basking shark is considered to have low sensitivity to underwater sound.

13.5 Value and Sensitivity of Receptor

13.5.1 Drawing on the information set out above, there may be some highly sound sensitive fish, such as herring, present in the Proposed Development vicinity, but available data suggests Uig Bay and the surrounding area is not particularly important for these species and abundance is expected to be low. Data also indicate the area is not important for spawning fish. Moderately sound sensitive

salmon will be migrating in the vicinity of the Proposed Development, at least 1 km away as they travel through Loch Snizort to their natal river, during late summer and autumn months. There may be occasional basking shark in Uig Bay and the wider Loch though in low abundance.

13.5.2 There are several fish species within the vicinity of the Proposed Development that are of conservation importance (Table 13-2). These include the migratory (diadromous) Atlantic salmon, protected under Annex II of the Habitats Directive, and several species protected under Section 41 of the NERC Act (2006) including cod, herring and basking shark. The basking shark is also afforded protection under the Wildlife and Countryside Act 1981 (as Amended by the Nature Conservation (Scotland) Act 2004).

13.5.3 To reflect the protected status of a number of fish species that may be present in the vicinity of the Proposed Development Site the sensitivity of fish is considered to be High.

13.5.4 There are no shellfish species of conservation importance known to be present in the vicinity of the Proposed Development.

Table 3-2 Sensitivity of Fish and Shellfish with Potential Presence in the Vicinity of the Proposed Development Site

Receptor	Description	Sensitivity/ Value of Receptor
Atlantic salmon	There is potential for migratory species, in particular salmon, in the Proposed Development vicinity, that are protected under Annex II of the Habitats Directive. Salmon are also a Scottish Marine Priority Feature (PMF) species.	High
Cod, herring, mackerel, whiting and other commercial fish	There are several commercial fish species protected within the UK as priority species listed in Section 41 of the NERC Act (2006). Several species, including cod and Atlantic herring are also listed as Scottish PMFs.	High
Basking shark	Protected under Section 41 of the NERC Act (2006) and Schedule 5 of the 1998 listing on the Wildlife and Countryside Act (1981). Basking shark are also a Scottish PMF species.	High
Shellfish species	No indication of important shellfish areas and no species of conservation concern have been identified.	Low

13.6 Avoidance Measures/Mitigation ‘by design’

13.6.1 The Proposed Development design has minimised the use of impact piling, using vibratory piling where possible, in order to minimise as far as is practicable, the intensity of underwater sound generated by construction activities. However, ground conditions on site mean that impact piling will be required to drive the final sections of many of the piles. The Proposed Development will adopt, as a minimum, the 2010 JNCC protocol for the mitigation of potential underwater noise impacts arising from pile driving during marine construction activities (JNCC, 2010). Whilst the guidance was originally intended for offshore wind farm construction impacts in cetaceans the guidance is now industry best practice for other construction activities.

13.6.2 The application of the protocol also acts to minimise sound impacts on fish because of the adoption of a soft-start to all impact piling. The soft-start or 'ramp-up' is a 20 minute gradual increase in the power of the piling hammer so that sound levels increase gradually, allowing any fish in the vicinity of the impact piling to move away before any permanent or temporary injury is likely to occur. A full description of the JNCC mitigation measure protocol is available from the JNCC website.

13.6.3 The Proposed Development proposes to have no more than 2 piling rigs on site at any one time. Therefore, it is possible that there may be periods where some simultaneous piling takes place. To minimise the impact of underwater sound in sensitive receptors (in particular harbour porpoise – see **Chapter 14: Marine Mammals**) a key Proposed Development commitment is that no simultaneous impact piling, when the pile is in water, will take place at any time during construction. The potential for impact piling and vibratory piling to take place simultaneously has been assessed.

13.6.4 Where vibratory piling is combined with impact piling, the sound pressure noise level is dominated by the impact piling – the SSL data shows SPLs for vibratory-piling are between 20 and 30 dBs below the highest sound level (see **Appendix 13.1** for SSLs for piling) - effectively masking the vibratory piling sound. Since a decrease in SSL of 3 dB represents a halving of the sound level a reduction of 20-30 dB shows vibratory piling is significantly less noisy. However, SEL are increased by simultaneous piling. Sound propagation for impact piling and vibratory piling, individually and in combination, have been calculated (**Appendix 13.1**).

13.7 Potential Effects Scoped out of the Assessment

13.7.1 There were no potential effects on fish and shellfish that were scoped out of the assessment.

13.8 Predicted Effects

13.8.1 The following potential effects on fish and shellfish during construction of the Proposed Development have been identified and are discussed in this chapter:

- Disturbance from underwater sound produced during pile driving construction activities; and
- Suspended sediment and changes to water quality.

Predicted Effects I - Disturbance from Underwater Sound Produced During Pile Driving

13.8.2 Construction works required for the Proposed Development include in-water impact piling at several different locations including the marshalling area, the approachway and around the ferry berth. Pile driving activities can generate very high SPLs that are relatively broad-band in frequency (20 Hz to >20 kHz) (Nedwell & Howell, 2004) which can be detected by many groups of marine fauna including fish and marine mammals.

13.8.3 Sound plays a major role in the lives of fish and may be used to communicate, locate prey, and avoid predators (e.g., (Zelick, Mann, & Popper, 1999); (Fay & Popper, 2000)).

13.8.4 Sound is perceived by fish through the ears and the lateral line (the acoustico-lateralis system) which is sensitive to vibration. The impact of sound on fish is, to a large extent, determined by the physiology of fish, particularly the presence or absence of a swim bladder and the potential for the swim bladder to improve the hearing sensitivity and range of hearing (Popper & et al., 2014).

13.8.5 Thus, the underwater sound generation by piling during the Proposed Development construction programme has the potential to cause injury or disturbance to fish in the vicinity of the works.

13.8.6 The morphological features have been used to develop categories of fish depending on how they might be affected by sounds and these are used when assessing impacts. Fish have been grouped into the following three categories of sensitivity to underwater sound (on the basis of the morphological features referred to above) (Popper & et al., 2014):

- **Low hearing sensitivity** - fish with no swim bladder or other gas chamber (e.g., elasmobranchs and flatfish). These species are less susceptible to barotrauma and only detect particle motion, not sound pressure. However, some barotrauma may result from exposure to sound pressure. This group includes the basking shark.
- **Moderate hearing sensitivity** – these are fish with swim bladders in which hearing does not involve the swim bladder or other gas volume (e.g., Atlantic salmon). These species are susceptible to barotrauma although hearing only involves particle motion, not sound pressure.
- **High hearing sensitivity** - fish in which hearing involves a swim bladder or other gas volume (e.g. Atlantic cod, herring and relatives, Otophysi). These species are susceptible to barotrauma and detect sound pressure as well as particle motion.

13.8.7 These categories are used when assessing the impact of underwater sound on the different fish species that may be present in the Proposed Development Site.

13.8.8 There is very limited information on the impact of underwater sound in marine invertebrates, including shellfish, although they are believed to respond to the particle motion elements of sound, including seabed vibration.

13.8.9 Many aquatic invertebrates appear to use hydrodynamic receptors to detect, localize and identify predators, prey and conspecifics and several crustaceans appear to be especially sensitive to sound transmitted through the seabed substratum (Hawkins & Popper, 2016).

13.8.10 It is estimated that many invertebrates are likely to perceive sound at very close range (up to 20 metres) to high intensity sounds (like seismic sound sources) via mechano-receptors ((Hirst & Rodhouse, 2000); (Macauley, et al., 2001); (McCauley, 1994)).

13.8.11 Crustaceans, for example, are believed to detect the particle motion component of sound (Lovell, Findlay, Moate, & Yan, 2005) and the prevalence of sounds from aquatic crustaceans suggests that sounds are important for communication between individuals (Spiga, et al., 2012). However, a study of the impact of seismic sound on a shrimp fishery in Brazil suggested that shrimp stocks were resilient to the disturbance by air-guns with a sound source level (SSL) of 196 dB re 1µPa (Andrietto-Filho, Ostrensky, Pie, Silva, & Boeger, 2005).

13.8.12 There are no underwater sound thresholds currently available for invertebrates but based on current evidence significant impacts are expected only in very close proximity to any sound sources.

13.8.13 Sound at very high intensities may have a diverse range of effects on marine receptors. These are generally grouped into three broad categories as summarised below (see (Popper & et al., 2014) for a fuller description of sound effects in fish):

- **Death and injury** - can result from exposure to very high amplitude sounds. In addition, the effects of changes in pressure (barotrauma) must also be considered, especially for impulsive sounds.

- **Effects on hearing** - hearing loss can be permanent or temporary. Permanent loss of hearing may be a consequence of the death of the sensory hair cells in the ear, damage to the auditory nerve fibres or other tissues in the auditory pathway such as the swim bladder. TTS is a temporary reduction in hearing sensitivity caused by exposure to intense sound. TTS has been demonstrated in some fishes, and its extent is of variable duration and magnitude.
- **Effects on behaviour** – there are possible effects of sound upon behaviour, including communication between conspecifics and detection of predators and prey. Any sound becomes biologically significant to an individual animal when it interferes with normal behaviour and activity, or affects the animal's ability to grow, survive, and reproduce and such effects may have consequences at the population-level and may affect the viability of the species.

Underwater Sound Modelling

13.8.14 The objective of the sound modelling calculations is to predict how much sound from the project activities, in particular construction piling, will propagate into the surrounding underwater environment. The detailed methodology and results of the sound modelling are provided in **Appendix 13.1**. More formally, the aim is to model the received noise level (RL) at a given point (or points), based on the SSL of the different project activities, and the amount of sound energy which is lost (propagation loss; PL) as the sound wave propagates from the sound source to the receiver (such as a fish or invertebrate).

Sound Source Levels (SSL)

13.8.15 The determination of SSL was based on the technical details of the piling equipment expected to be used in the Proposed Development (both piles and piling hammer) and associated measured real world project data (CDOT, 2007).

13.8.16 The maximum SSL values (as SPL and SEL) produced across the whole Proposed Development for both impact and vibratory piling are shown in Table 13-3 below (see **Appendix 13.1** for a detailed breakdown of the SSL and sound propagation for every pile type included in the construction programme).

Table 3-3 SSLs for Piling Activities

Piling type	SPL dB re 1µPa	SEL dB re 1 µPa^{2}s
Impact piling	205	180
Vibratory piling	180	170

Sound Impact Thresholds

13.8.17 The most up-to-date thresholds for fish come from the 2014 ANSI standards (Popper & et al., 2014). There are separate thresholds for impulsive sound (impact piling) and continuous sound (vibratory piling).

13.8.18 For impulsive sound the injury threshold criteria are expressed as dual criteria of a single strike peak SPL and cumulative SEL and propagation calculations were based on 960 sound events at 1.2 second intervals (i.e. almost 20 minutes of intensive impact piling). These thresholds also reflect the hearing sensitivity classification of the fish from low to high (Table 13-4).

13.8.19 The thresholds cover two types of injury in fish; mortality or mortal injury and recoverable injury. A short- or long-term change in hearing sensitivity that may or may not reduce fitness, known as TTS, is also provided as a single value for all fish groups. This value has been estimated from studies of the impact of sound from seismic surveys, another impulsive sound source commonly produced in the marine environment.

13.8.20 The ANSI guidance provides no thresholds for behavioural disturbance from multiple pulses in fish due to lack of, and contradictory, evidence on behavioural responses. The NMFS currently uses a criterion for behavioural response of 150 dB re 1 µPa (Stadler & Woodbury, 2009), but it is not clear whether this is a peak or rms level. Also, as pointed out by (Hastings, 2008), no one is sure of the origin of this number, and it is not clear if it has any scientific validity. Moreover, this behavioural criterion does not specify a particular behaviour, but simply assumes there is the potential to experience a behavioural response which could be as simple as a small movement when the sound becomes audible.

13.8.21 These shortcomings notwithstanding, the distance at which this behavioural threshold (using dB_{rms}) is met has been calculated and whilst the results are necessarily uncertain this value has been taken to represent a 'may affect' threshold to inform the impact assessment for behavioural responses.

13.8.22 Most of the piling activity during the construction programme is vibratory in nature, producing sound of a continuous nature. The thresholds for continuous sound are quantitative only for the highest hearing sensitivity fish (the herring family) in relation to recoverable injury and TTS. The thresholds for low or medium sensitivity fish, are relative, providing likely risk levels for injury, threshold shift or behavioural disturbance in medium or low hearing sensitivity fish (Table 13-4). The risk of mortal injury in fish, from continuous activities like vibratory piling is low, even in close proximity to the sound generating activity, is low.

Table 3-4 Injury and Disturbance Thresholds for Fish

Receptor Group	Mortality/mortal injury	Recoverable injury	TTS	Low level disturbance
Impulsive sound (impact piling)				
Low sensitivity fish	213 dB_{peak}	213 dB_{peak}	186 dB SEL_{cum}	150 dB_{rms}
	219 dB SEL_{cum}	216 dB SEL_{cum}		
Medium sensitivity fish	207 dB_{peak}	207 dB_{peak}		
	210 dB SEL_{cum}	203 dB SEL_{cum}		
High sensitivity fish	207 dB_{peak}	207 dB_{peak}		
	207 dB SEL_{cum}	203 dB SEL_{cum}		
Eggs & larvae	207 dB_{peak}	-		
	210 dB SEL_{cum}	-		
Continuous sound (vibratory piling)*				
Low & medium sensitivity fish	(N/I/F) Low	(N/I/F) Low	(N) Moderate; (I/F) Low	(N/I) Moderate (F) Low
High sensitivity fish	(N/I/F) Low	170 dB_{rms} for 48 hours	150 dB_{rms} for 12 hours	(N) High (I) Moderate (F) Low

** Relative risk (high, moderate, low) is given for fish at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).*

Magnitude of Effect – Underwater Sound

13.8.23 The magnitude of potential effects on environmental baseline conditions is identified through consideration of the Proposed Development taking into account the scale or degree of change from the existing situation as a result of the effect as described below as well as consideration of relevant legislative or policy standards or guidelines:

- Nature of the impact and its reversibility;
- Duration and frequency of an impact;
- Extent of the change; and
- Potential for cumulative impacts.

13.8.24 Table 13-5 below provides the definitions of the magnitude criteria in relation to the impact of underwater sound on fish and shellfish.

Table 3-5 Criteria Used to Define the Magnitude of Effect of an Increase in Underwater Sound

Magnitude Criteria	Description
High	Total loss or major alteration to key elements/features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed. An increase in sound levels associated with death or permanent injury (e.g. PTS exceedance) or significant disturbance at large (kms) distances from the sound source such that even short-term sound may have long-term effects on species populations.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed. Short-term or localised decrease in the availability or quality of a resource, likely to be noticed by users. An increase in sound associated with temporary injury (TTS) or long-term behavioural disturbance that may have short-term effects (months) on species populations.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material. Short-term or localised decrease in the availability or quality of a resource, likely to be noticed by users. A short-term detectable increase in underwater sound over a large area (10s of km^2) or a longer term increase but in a small area. Sound levels return to baseline condition and responses are behavioural only, are temporary and do not have any effect on species populations.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation. Short-term or localised decrease in the availability or quality of a resource, not effecting usage. For underwater sound this equates to sound levels marginally above ambient sound levels for a long period of time or increased sound levels for a very short period of time/single occurrence in a small area, rapidly returning to background levels. Minor behavioural disturbance immediately returning to normal after cessation of the sound source.

Duration of Effect

13.8.25 The duration of each type of piling activity depends on the construction programme adopted. Two construction scenarios have been proposed (see **Chapter 3** for a full description of the construction programme for each of the scenarios) as follows:

- **Scenario 1:** a continuous construction programme running over a 24 month period; or
- **Scenario 2**: a phased construction programme, with time intervals between phases, running over a 40 month period.

13.8.26 An estimated programme of piling times has been calculated based on the schedule of construction activities provided in **Chapter 3: Project Description** and the estimated piling times for each of the different construction activities. The pile type, the depth to which it needs to be driven, and the time needed for each of the two piling methods (vibratory and impact) have been estimated for each construction activity, for each of the two construction scenarios by an experienced engineer (see **Appendix 13.1)**. The resulting calculated schedule of vibratory and impact piling times and average hours per day for each of the two construction scenarios are shown in Table 13.6 below.

13.8.27 The hours calculated are based on the commitment that piling works will only take place in daylight hours and that working takes place from Monday to Saturday. Proposed working hours are 0700 to 1900 Monday to Friday and 0700 to 1300 on Saturday. This equates to a period of 25 working days per month.

13.8.28 The calculations **(Appendix 13.1)** show that Scenario 2 would result in longer durations of impact piling, estimated as a monthly or daily average, for the first 8 months at the start of the construction programme. In contrast, the longer impact piling takes place in months 9 to 14 for Scenario 1. However, the differences are small and apart from the timing, and the piling free period of 3 months in Scenario 2, before Phase II starts, there is only a small difference in the piling schedules between the two construction scenarios.

Table 3-6 Estimated Average Daily Piling during Uig Construction Programme

Construction Scenario	Type of Piling	Average Daily Total Piling Duration (hours)			
		Months 1-8	Months 9-15	Months 16-24	
1 (24 month programme)	Impact	0.5	0.8	0.2	
	Vibratory	5.7	0.4	0.3	
Construction Scenario	**Type of Piling**	**Average Daily Total Piling Duration (hours)**			
		Months 1-8	**Months 9-15**	**Months 16-18**	**Months 19-26**
2 (40 month programme)	Impact	0.9	0.2	0	0.2
	Vibratory	4.3	0.3	0	1.7

13.8.29 To conclude, whilst the construction programme is scheduled to last many months, either 24 or 40 depending on the programme adopted, the duration of piling, particularly impact piling, expressed as an average number of hours per day, is low, estimated to be a maximum of 0.9 hours per day but only for a period of 7-8 months. Thus, the duration of the effect of impact piling is considered to be low.

13.8.30 The duration of vibratory piling is higher, particularly in the first 8 months of the programme (regardless of scenario) with a daily average of 4.3 to 5.7 hours per

day. In subsequent stages of the construction programmes the duration is very low, between 0.2 and 1.7 hours per day on average. Thus, the duration of the effect of vibratory piling is considered to be low to medium.

Extent of Effect from Vibratory Piling

13.8.31 The latest qualitative underwater sound thresholds for fish (Popper et al., 2014) indicate that the risk of mortality or mortal injury from vibratory piling (continuous sound), for all hearing categories of fish at all distances, even in close proximity, from the activity, is low (Table 13-4). In addition, the adoption of a piling soft-start means that any fish really close to the vibro-piling activity will move away before full power is reached. Thus, the risk of significant harm in fish of all sensitivities from vibratory piling is considered to be negligible.

31.8.32 Recoverable injury is also considered to be of low risk for low and medium hearing sensitivity fish. This includes all elasmobranchs (sharks and rays) and fish such as cod and salmon.

13.8.33 For high sensitivity hearing fish, the herring family primarily, the threshold for recoverable injury from vibratory piling is from a SSL, at the receiver, that exceeds 170 dB_{rms} for a period more than 48 hours (see Table 13.4). None of the piles to be driven by vibratory piling will produce a SSL that exceeds 170dB_{rms} (at a distance of 10 m from the source) (**Appendix 13.1**) and only the sheet piles (pile type SP) need to be vibropiled for a period greater than an hour (160 minutes estimated) (Table 13.6). In all cases, the duration of continuous piling is expected to be lower than the values estimated as breaks in deep vibro-piling are normally adopted to check tolerances during piling operations.

13.8.34 The threshold for TTS for high sensitivity fish is 150 dB_{rms} and is estimated to be met up to a distance of 100 m from the SSL (see **Appendix 13.1**), but only if the sound occurs continuously at this level for 12 hours for the very largest piles. The maximum continuous period of vibro-piling will be 160 minutes and mostly less than this, therefore, the risk of any fish experiencing TTS from the short durations of vibratory piling is very low. Thus, the risk of TTS in the lower hearing sensitivity fish (low or moderate) is expected to be low.

13.8.35 Some behavioural responses to vibratory piling are likely however. There is a moderate risk for low and medium sensitivity fish in the near and intermediate distance (probably between 10s to 100s of metres from the sound source) and a high risk in high sensitivity fish in the near (10s of metres) distance for behavioural responses. These are likely to include swimming away and a change of swimming direction, orientation or position in the water column, but the risk of the low intensity sound from vibratory piling resulting in more significant responses such as startle reactions is low.

13.8.35 There is a higher risk of high hearing sensitivity species, such as herring, exhibiting greater behavioural reactions but these will be short-term are not expected to have any effect on fish populations. In addition, the evidence indicates Uig Bay and Loch Snizort are not areas with notable densities of high hearing sensitive species.

13.8.36 As soon as the sound source stops, fish may return to areas around the pier. Fish are also known to habituate to sound over time minimising any behavioural responses. Thus, the nature of the effect is completely reversible and the potential for cumulative impacts are also low because piling sound will be of short discrete time periods with intervals between for recovery.

13.8.37 To conclude, the SSL and sound propagation from vibratory piling will be of short duration, of limited extent and only temporary in nature resulting in some minor behavioural disturbance only. Thus, the underwater sound produced by vibratory piling activities is considered to be of negligible magnitude.

13.8.38 Therefore, for fish of high sensitivity the impact from vibratory piling is of low significance before mitigation.

Extent of Effect from Impact Piling

13.8.39 Underwater sound resulting from impact piling has the potential to injure or disturb any fish in the vicinity of the works. The results of the sound modelling have been compared to the underwater sound thresholds for fish to show the estimated distance from the sound source at which the different impact categories may occur (Table 13-7).

Table 3-7 Distance (m) from Impact Piling Sound Source at which Threshold Criteria is Met

Fish Sensitivity	Threshold	Pile Type (see Appendix 13.1 for full description)					
		SP	HP1	HP2	TP1	FP	SWS
Mortality/Mortal Injury							
Low	213 dB_{peak}	<10	<10	<10	<10	<10	<10
	219 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
Medium/Eggs & Larvae	207 dB_{peak}	<10	<10	<10	<10	<10	<10
	210 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
High	207 dB_{peak}	<10	<10	<10	<10	<10	<10
	207 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
Recoverable Injury							
Low	213 dB_{peak}	<10	<10	<10	<10	<10	<10
	216 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
Medium	207 dB_{peak}	<10	<10	<10	<10	<10	<10
	203 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
High	207 dB_{peak}	<10	<10	<10	<10	<10	<10
	203 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
TTS							
All fish	186 dB SEL_{cum}	40	10	13	20	28	40
Low Level Behavioural Disturbance							
All fish	150 dB_{rms}	1,000	178	447	501	1,000	1,000

Sound Propagation Contours

13.8.40 Underwater sound modelling indicates that mortal or recoverable injury in fish from impact pile driving is possible, but only in very close proximity to the works, up to a maximum distance of 10 m from the sound source (Table 13-7).

13.8.41 TTS, a temporary impairment in the hearing of all fish species, is predicted up to a maximum distance of 40 m from the sound source depending on the pile type. (Table 13-7).

13.8.42 The standard mitigation measures for impact piling, as described in the JNCC (JNCC, 2010) guidelines will be adopted. Thus, a soft-start or slow ramp-up of piling

hammer power will be employed at the commencement of any impact piling activity. This will ensure sound levels increase only gradually, and any fish in the immediate vicinity of the piling can move away, beyond the estimated maximum impact range of 40 m, before any permanent injury is likely to occur.

13.8.43 Thus, any injury or impairment to hearing, either permanent or temporary, is unlikely to occur in any fish species, even the most hearing sensitive herring species. Although fish are known to congregate around artificial structures the number of sensitive fish present within 40 m of the pier is not expected to be high.

13.8.44 However, some disturbance of fish is likely to occur in response to impact piling, particularly in areas closest to the sound source. Behavioural responses can range from startle reactions and sudden fleeing to a slight alteration in swimming orientation or position in the water column. Sound can also cause changes in schooling patterns and distribution (Pearson, Skalalski, & Malme, 1992), particularly if the sound production is long-term. However, fish are known to rapidly habituate to repeated presentations of the same sound, minimising behavioural responses.

13.8.45 The highly uncertain 150 dB_{rms} 'may affect' threshold for behaviour indicates possible responses at distances up to 1,000 m for all piling types (Table 13-7). However, at these far-field distances any behavioural response is expected to be very minor.

13.8.46 The greatest behavioural responses will be near the pier and within the Bay but as there will be a soft-start no panic reactions are expected.

13.8.47 For salmon caged in fish farms there is no opportunity to move away from the sound. The closest fish farm, Uig Bay (also known as Rubha Riadhain), is just over 1 km away from the source of the impact And therefore a behavioural response in caged salmon may occur but at this distance reactions are expected to be low level and no more than a change in swimming orientation or water depth. Such behavioural responses are of very short duration because impact piling durations are very short, and caged fish will also rapidly habituate to an increase in sound.

13.8.48 In the very near vicinity of impact piling behavioural responses such as startle and sudden fleeing from the sound may occur, particularly in species such as herring and cod that have high hearing sensitivity. These species may be present at some times of the year but on the basis of fish data the abundance in Uig Bay, where the sound level will be highest, is not expected to be high. Also, Uig Bay is not considered to be of particular importance for any key life stages, such as spawning adults or juveniles that may be more closely tied to particular habitats.

13.8.49 Salmon will be moving through Loch Snizort during summer and autumn months on seasonal migrations to the River Snizort (**Figure 13-2**). However, at a distance of over 1000 m away, there are not expected to be any behavioural responses in the migrating fish and it is assumed that any migrating fish are unlikely to travel into the Bay. At this distance the SEL experienced by an individual fish, which is not moving away from the sound (an assumption of the sound exposure calculations), is below the TTS threshold even for the largest noisiest piles.

13.8.50 Impact piling is predicted to take place, on average for less than an hour a day. Thus, any behavioural impact on individual fish, including protected species such as salmon and basking shark, the salmon in fish farm cages, and species of the herring family that have the most sensitive hearing will be short-term and low level. As soon as the sound source stops fish may return to areas around the pier. Fish are also known to habituate to sound over time minimising any behavioural responses. Thus, the nature of the effect is completely reversible and the potential for cumulative impacts are also low because piling sound will be of short discrete time periods with intervals between for recovery.

13.8.51 In addition, the adoption of a soft-start minimises the likelihood of a panic response in all fish groups, and any movement away from the sound source as it gradually increase will be similar to normal swimming in response to changing prey density and other environmental conditions. Fish will also be habituated to some anthropogenic sound in the form of the regular ferry vessel movements to and from the pier. Thus, behavioural responses such as startle or panic reactions are not expected, even in salmon in the local fish farms.

13.8.52 Significant effects such as long-term changes in behaviour and distribution, such as moving from preferred sites for feeding and reproduction, or alteration of migration patterns are not anticipated. No population effects will result from these relatively low level behavioural impacts.

13.8.53 To conclude, the SSL and sound propagation from impact piling will be of short duration (an estimated maximum of 0.9 hours per day on average), of limited extent and only temporary in nature resulting in some minor behavioural disturbance only. Thus, the underwater sound produced by impact piling activities in relation to fish is considered to be of negligible magnitude.

13.8.54 Therefore, for all fish the impact from impact piling is of low significance before mitigation.

Extent of Effect from Combined Impact and Vibratory Piling

13.8.55 There will be two piling rigs on site during the construction programme but simultaneous piling activities are only allowed for impact and vibratory piling occurring at the same time. At no point will there be two impact hammers driving piles at the same time.

13.8.56 Therefore, sound propagation calculations have been undertaken to determine the likely impact of simultaneous impact and vibratory piling for the noisiest piles. As expected, the overall sound scape is dominated by the much higher intensity sound of the impact piling, effectively masking the sound of the vibratory piling.

13.8.57 Thus, the distances at which the SPL (dB_{peak}) and SEL metrics are met for the simultaneous piling are very similar, up to 20 m (see **Appendix 13.1**) to those for impact piling alone.

13.8.58 However, there is additional energy released into the water column by combined piling and so there are increases in the predicted distances at which the SEL_{cum} thresholds are met. The impact distances for mortal or recoverable injury are still low however, up to 20 m in the highest sensitivity fish. However, the impact distance at which TTS may be experienced in all fish is estimated to be at 1000 m from the sound source.

13.8.59 As a soft-start will be deployed prior to any impact piling (the main driver of the sound impacts) any fish in the area, with the exception of the caged salmon, can easily move away from the sound source before any TTS is experienced. Fish roam to search for prey and mates and escape predators, and as there are no species present at key life stages, such as spawning that would restrict their ability to move away, impact piling with a soft-start (the main driver of the sound impacts), will result in only minor behavioural changes in some individuals. There is not anticipated to be any impact on survival rates, population structure or success in reproductive capability of any fish, including protected species such as salmon and basking shark.

13.8.60 For caged salmon at the Uig Bay fish farm [due for restocking some time in 2019), these fish are over 1 km away from the sound source. On the basis of the short duration of impact piling and recovery times between periods of impact piling the impact on caged salmon is expected to be behavioural only and no permanent or temporary injury is expected.

13.8.61 To conclude, the SSL and sound propagation from simultaneous impact and vibratory piling will be of short duration (an estimated maximum of 0.9 hours per day on average), of limited extent and only temporary in nature resulting in some behavioural disturbance only. Thus, the underwater sound produced by simultaneous piling activities in relation to fish is considered to be of negligible magnitude. Therefore, for fish of high sensitivity the impact from impact piling is of low significance before mitigation.

Invertebrates

13.8.62 The sensitivity of marine invertebrates to active acoustic sound sources has not been well studied to-date, probably because most lack specialist sensory organs that can perceive sound pressure. However, many species have tactile hairs or limited sensory organs that may be sensitive to underwater sound and there are a small number of studies indicating there is some potential for injury in adult or developmental stages of individual invertebrates. It is estimated that many invertebrates are likely to perceive sound at very close range from the seismic sound source (up to 20 meters) via mechano-receptors (e.g. see (McCauley, et al., 2000)).

13.8.63 In general, studies examining effects of sound on invertebrate species recorded effects at sound levels in excess of 217 dB re 1µPa on marine invertebrates (crustaceans and molluscs; (Macauley, et al., 2001). This SSL is significantly higher than those produced by impact piling so any significant harm to shellfish is unlikely.

13.8.64 Thus, the magnitude of the impact on shellfish is considered to be negligible. For a receptor of low sensitivity this results in an impact of negligible significance.

Table 3-8 Impact Significance Summary for Underwater Sound Impacts in Fish

Activity	Receptor	Receptor Sensitivity	Magnitude of Event Prior to Mitigation	Impact Significance Prior to Mitigation	Mitigation Measure Adopted	Post Mitigation Impact Significance
Vibratory Piling	All fish including salmon and basking shark	High	Negligible	Minor	Soft-start	Negligible
	Shellfish/ invertebrates	Low	Negligible	Negligible	-	Negligible
Impact Piling	All fish including salmon and basking shark	High	Negligible	Minor	Soft-start	Negligible
	Shellfish/ invertebrates	Low	Negligible	Negligible	-	Negligible

Predicted Effects II – Suspended Sediment and Changes to Water Quality

13.8.65 The Proposed Development includes dredging, both capital and maintenance, followed by sediment disposal at a newly licenced Proposed Sea Disposal Site just outside Uig Bay (**Figure 3.7**). These activities have the potential to increase suspended and dispersed sediments, sediment deposition, and the release of any associated sediment contaminants into the water column and to the seabed.

138.66 There are two dredge pockets in the Proposed Development Site (**Figure 3.3**) with an estimated total volume of 27,992 m^3 of dredged sediment for disposal.

13.8.67 The main Dredge Pocket (DP1) is at the ferry berthing area, where the current dredged pocket needs to be deepened to accommodate the new larger CFL ferry. The capital dredge at DP1 will be carried out to minus 5.9 mCD (including 300 mm over dredge) consisting of approximately 29,642 m^3 of sediment.

13.8.68 A smaller dredge pocket (DP2) is at a section in front of the fisherman's compound, which will be dredged to a depth of 1.3 mCD (including 300 mm over dredge). The estimated volume from DP2 is consisting of a volume of sediment of approximately 1,150 m^3

13.8.69 The dredging methodology will be confirmed once the dredging contractor has been appointed. However, for the purpose of undertaking this EIA, it is has been assumed that a cutter suction dredger (CSD) will be deployed to undertake the dredging required for the Proposed Development. During CSD the dredged material is drawn up through the cutterhead and suction pipe and discharged in a hopper barge (self-propelled vessel) for transport to the Proposed Sea Disposal Site. Overflowing will not be allowed from the hopper barges during dredging operations.

13.8.70 Alternatively a backhoe dredger could be used but given the hard ground conditions on site the CSD method is considered the most likely option. The CSD method is also considered to be the worst-case option of the two and has therefore been used to undertake the assessment.

13.8.71 It is anticipated that maintenance dredging will be required every 3-5 years to ensure safe operation of the ferry service. Maintenance dredging will likely use backhoe, grab and/or plough methods which have previously been used at Uig Harbour.

13.8.72 Results of the sediment characterisation and dispersion studies (see **Chapter 7: Marine Physical Environment**) indicate that surficial sediments from both dredge pockets are predominantly comprised of sand and silt material. However, sediments obtained from below the surface (i.e. borehole and trial pit samples) indicate an increased proportion of coarser material (sand and gravel) with fewer fines, particularly at Dredge Pocket 1 (DP1). In terms of anticipated dredge material, the composition from DP1 has been determined to be predominantly sand (57%), and predominantly fines (silt and clay) for DP2.

13.8.73 The samples were also analysed for concentrations of contaminants: heavy metals, TBT, PCBs and PAHs (**Chapters 7 and 8**). Sediment contamination was found to be widespread around Uig Bay, including within the two Dredge Pockets and the Proposed Sea Sediment Disposal Site, with elevated levels of chromium and nickel above (Marine Scotland, 2017) Action Levels (AL) at all stations sampled.

Magnitude of Effect

13.8.74 The magnitude of potential effects on environmental baseline conditions is identified through consideration of the Proposed Development taking into account the scale or degree of change from the existing situation as a result of the effect; the duration and reversibility of the effect as well as consideration of relevant legislative or policy standards or guidelines.

13.8.75 The magnitude criteria are defined in Table 13-9 below.

Table 3-9 Approach to EIA - Criteria used to Define the Magnitude of Effects

Magnitude Criteria	Description
High	Total loss or major alteration to key elements/features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed. Long-term and widespread changes in water quality above the range of natural variability.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed. Medium term and widespread changes in water quality.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of the baseline condition will be similar to the pre-development situation. Short-term and localised change in water quality above natural variability.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation. Water quality changes are short-term and within the range of natural variability such as storm driven changes.

Changes in Suspended Sediment Concentration

13.8.76 Increased SSC can affect filter feeding organisms, such as fish and shellfish, through clogging and damaging feeding and breathing equipment. According to (Widdows, Fieth, & Worral, 1979) the growth of filter-feeding bivalves may be impaired at SPM concentrations greater than 250 mg/l. Similarly, the functioning of gills of fish may be impaired due to clogging and young fish can be damaged if suspended sediments become trapped in their gills. Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging sites, unless food supplies are increased as a result of increases in organic material.

13.8.77 Areas of turbid water are a quite frequent phenomenon in coastal waters, in particular in shallow soft bottom coasts and at the mouths of rivers, estuaries and bays. There is no background data for suspended sediment load in the waters of Uig Bay. However, naturally occurring turbid water is known to occur (observations of water colour and clarity), such as can be induced by vertical exchange processes with the muddy sediment seabed in shallow waters due to currents and waves. In the North Sea SSC in coastal waters have been observed to be as high as 30 mg/l and such levels may occur at times in Uig Bay.

13.8.78 Marine flora and fauna living in areas where the waters are normally clear may be especially vulnerable to the effects of increased suspended sediments. However in areas subject to periodic or permanently elevated suspended sediments, such as muddy bays, the marine life present is much better able to tolerate these conditions.

13.8.79 Changes in SSC as a result of dredging and dredge spoil disposal have been modelled and the impact assessed has been described in full in **Chapter 7: Marine Physical Environment**. The following summarised the key findings of particular relevance to the impact on fish and shellfish.

13.8.80 The dredging at the dredge pockets results in significant increases in suspended sediments but these are very short-lived (the sediments settle to the seabed within minutes after dredging) and are highly localised to the area where the dredge equipment comes into contact with the seabed. This area is subject to regular maintenance dredging to maintain ferry access and so the area around the

Proposed Development is already subject to intermittent increases in SSC from dredging.

13.8.81 In the region of the Uig Bay fish farm (to the south-east of Uig Bay) increases in SSCs due to dredging are very low and well within the range of natural variability (such as the resuspension of sediments that occurs during storm events). In the vicinity of Uig Bay fish farm predicted maximum increases to SSC are less than 2 mg/l across much of the site, with a slightly larger increase of 6.2 mg/l predicted at the point closest to the Proposed Development. The increases in this area are also short-lived with predicted increases only lasting minutes to hours.

13.8.82 For sediment disposal at the proposed new dredge disposal predicted increases to surface SSC are around 50 to 100 mg/l at the instant of release, dropping to around 20 to 30 mg/l as the plume starts to disperse and material settles through the water column (see **Chapter 7**, Section 7.5.4 onwards).

13.8.83 Thus, only short-term increases in SSCs, at levels likely to be observed to occur naturally, are predicted and assessed to be of negligible significance. In relation to fish and shellfish the negligible increases in SSCs are not anticipated to result in detrimental impacts such as clogging of feeding apparatus. Increases in sediments may result in temporary movements away from the zone of influence or short-term cleaning of gills or similar structures. Thus, the magnitude of the effect is negligible, leading to an assessed significance of minor for SSCs.

Changes in Water Quality

13.8.84 The release of sediments into the water column via dredging and disposal has the potential to affect water quality indicators such as dissolved oxygen (DO), biological and chemical oxygen demand and the concentration of in-water pollutant concentrations.

13.8.85 An increase in chemical and biological oxygen demand, associated with elevated SSCs in the water column can reduce DO concentrations. However, the dredged material is coarse in nature and so potential magnitude of the change in DO in the water column has been assessed as negligible (**Chapter 8**).

13.8.86 However, the sediments in Uig Bay are known to be contaminated, particularly with the heavy metals chromium and nickel, and to some extent copper. The maximum dissolved fraction of these metals in the water column has been calculated, based on recognised sediment-water partition coefficients. This analysis, described in full in **Chapter 8**, indicates that dredging and disposal will result in increases in the concentration of these metals in the water but they will be very localised, largely restricted to the areas in which the activities occur, and they will be short-lived because of the rapid settlement of sediments, the partition to which they are mostly bound. The calculations also indicate that the EQS (Environmental Quality Standard) values are exceeded. Thus, the magnitude of the effect of project activities on water quality has been assessed as low.

13.8.87 If low level contaminants are released into the water column during dredging or disposal, they may accumulate in marine animals and plants and transfer up the food chain to fish and sea mammals. When present in sufficient quantities, contaminants may cause morphological or reproductive disorders in shellfish, fish and mammals (ABP Research, 1995). However, the concentrations predicted for the project are lower than EQS values, indicating a low ecotoxicological risk, and considering the very short-term nature of the increases the magnitude of the effect in fish and shellfish has been assessed as being negligible. For fish, a receptor of high sensitivity this results in an impact of low significance. For invertebrate shellfish, a receptor of low sensitivity this results in an impact of negligible significance.

13.9 Mitigation & Monitoring

Construction

13.9.1 To minimise the impact of underwater sound generated during construction the statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010)will be followed. Whilst the protocol is designed with marine mammals in mind, the adoption of a soft-start prior to impact piling will also have the effect of helping to minimise the impact of underwater sound on fish.

13.9.2 A soft-start, to commence at the start of all impact piling and after any break longer than 10 minutes, will be adopted at all stages of the construction schedule. The soft-start is a gradual increase in impact power and thereby a slow increase in underwater sound allowing any fish in the vicinity of the pier to move away before sound levels become injurious or result in a startle response.

13.9.3 Thus, after mitigation the impact is considered to be low significance for all groups of fish.

Operation

13.9.4 No mitigation measures are required for the operational phase of the project as this comprises the continuation of the current level of vessel activity in and out of Uig Bay via Loch Snizort, an activity to which any resident fish or marine mammals are habituated to.

13.9.5 To maintain operational water depths at the ferry berth maintenance dredging will take place, in a small dredge pocket alongside the ferry terminal, on a regular basis estimated to be between 3 and 5 years.

13.10 Residual Effects

Construction

13.10.1 The residual impact of construction activities is considered to be low significance for all groups of fish and negligible for invertebrates.

Operation

13.10.2 The residual impact of the operational activities is also considered to be low significance for all groups of fish and negligible for invertebrates.

13.11 Cumulative Effects

13.11.1 There have been two projects identified that may present cumulative effects with the Proposed Development:

- The reinstatement and construction of Uig Bay (Rubha Riadhain) finfish farm; and
- The operation of Loch Snizort East finfish farm.

13.11.2 Grieg Seafood Ltd has a licence for the reinstatement of the Uig Bay (Rubha Riadhain) finfish farm operation with the intention of production recommencing in 2019. A total of eight cages of 120 m circumference with a feed barge at the north-eastern end of the cage group will be installed. The cages will be towed by sea to the Uig Bay site and anchored to the seabed.

13.11.3 Loch Snizort East is an operational fishfarm (at the time of writing).

13.11.4 The likely effects from the fishfarms that could interact with the Proposed Development are:

- Increase in underwater sound due to installation and operation of the fish farm; and
- Changes in water quality due to fish food released into the water column.
- Increase in underwater sound during construction and operation.

13.11.5 Planning application documentation for the Uig Bay fish farm shows that none of the receptors identified during screening and scoping will experience a perceptible change in noise level due to the installation of the fish farm. A perceptible change in noise level will be experienced within a circa 300 m radius of the proposed site. However, this is not anticipated to result in a significant increase in underwater sound and the cumulative impact of underwater sound from the fish farm is considered to be negligible.

Changes in Water Quality due to Fish Food Released into the Water Column

13.11.6 A nutrient enrichment model, developed by Marine Scotland Science, was used to calculate the nutrient enrichment from the nitrogen contained within waste feed and faeces at the Uig Bay fish farm. The level of nutrient enrichment due to reinstating the Uig Bay site was found to be slight and not sufficient to cause significant impacts on water quality. Neither SEPA nor Scottish Water raised any issues about water quality at the proposed fish farm site during the planning application (Grieg Seafood Shetland Ltd, 2017).

13.11.7 The Proposed Development is unlikely to result in a significant cumulative effect in association with these two projects given the predicted maximum increases to SSC at the finfish farm locations (less than 2 mg/l across much of the Uig Bay finfish farm, with a slightly larger increase of 6.2 mg/l predicted at the point closest to the Proposed Development; less than 2 mg/l at the Loch Snizort East finfish farm).

13.12 Summary & Conclusion

13.12.1 No significant impacts to fish or shellfish, as a result of the construction or operation of the Uig Ferry Terminal, after control and mitigation measures, are predicted.

Table 3-10 Summary of Impact Assessment for Fish and Shellfish

Effect/ Activity	Receptor	Receptor Sensitivity	Magnitude of Event Prior to Mitigation	Impact Significance Prior to Mitigation	Mitigation Measure Adopted	Post Mitigation Impact Significance
Increase in underwater sound from vibratory Piling	All fish including salmon and basking shark	High	Negligible	Minor	Soft-start	Negligible
	Shellfish/ invertebrates	Low	Negligible	Negligible	-	Negligible
Increase in underwater sound from impact Piling	All fish including salmon and basking shark	High	Negligible	Moderate	Soft-start	Negligible
	Shellfish/ invertebrates	Low	Negligible	Negligible	-	Negligible
Changes in water quality due to sediment dredging and disposal	All fish including salmon and basking shark	High	Negligible	Low	-	Low
	Shellfish/ invertebrates	Low	Negligible	Negligible	-	Negligible

14. Marine Mammals

14.1 Introduction

14.1.1 This chapter of the Environmental Impact Assessment (EIA) Report provides an assessment of the potential and scale of effects of the Uig Harbour Redevelopment project (here after referred to as 'The Proposed Development' on marine mammals. Where appropriate it provides proportionate measures to avoid, mitigate or compensate for adverse impacts.

14.1.2 **Chapter 3: Project Description** of this EIA Report provides a detailed description of the works required to implement the Proposed Development.

14.2 Legislative Context

14.2.1 The fish and shellfish assessment has been undertaken within the context of the following relevant legislation, planning policies and guidance documents:

- Marine (Scotland) Act 2010
- Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Harbour Works (Environmental Impact Assessment) Regulations 1999;
- Wildlife and Countryside Act, 1981;
- Conservation of Habitats and Species Regulations 2010 (commonly referred to as the Habitats Regulations);
- National Marine Plan (Scotland); and
- Marine Policy Statement (2011).

4.1.2 Further information on the above legislation and policy is given in **Appendix 4.1.**

14.3 Assessment Methodology & Data Sources

Desk Study

14.3.1 Baseline conditions have been established by undertaking a desktop study of published information and through consultation with relevant bodies. The primary data sources used in the assessment of impacts on marine mammals are as follows:

- Reports and academic papers;
- Marine Scotland National Marine Plan interactive (NMPi) maps;
- Data from the Small Cetaceans in the European Atlantic and North Sea (SCANS) projects ((Hammond, et al., 2017); (SCANS, 1995); (SCANS, 2008));
- EU Designated sites Standard Data Forms;
- Sea Of The Hebrides MPA Proposal - Data Confidence Assessment, (SNH, 2014)

Underwater Sound Propagation Modelling

14.3.2 Underwater sound propagation modelling was completed based on indicative parameters considered representative of construction activities likely to generate underwater noise; specifically piling activities associated with construction of the Proposed Development. This was completed in order to establish an understanding

of the likely sound levels and the spatial extent of the marine environment in and around Uig Bay that could be expected to experience elevated noise levels during construction.

14.3.3 The outputs from this modelling exercise have been used to assess the potential significance of construction noise on marine mammals.

14.3.4 The details and full results of the Sound Propagation Modelling that has been completed are set out within **Appendix 13.1.**

Sediment Dispersion Modelling

14.3.5 Initial sediment dispersion modelling was completed (November 2017) based on early, indicative dredge activity parameters. This was completed to establish an understanding of the likely dredge sediment plume that could be expected in order to inform marine and intertidal survey design, and to provide input to design development.

14.3.6 Further sediment dispersion modelling was completed (June 2018) to verify and test the potential effects which may be anticipated from the Proposed Sea Disposal Site (see **Appendix 2.3: Disposal Site Characterisation Report** for further details).

14.3.7 The sediment dispersion modelling has been undertaken using the DHI MIKE21 PT (Particle Tracking) module, to simulate the fate of dredged sediment suspended through the disposal process. The calibrated hydrodynamic model has been used to drive the PT module with a description of water levels and flow speeds across the study area. The flow regime is then seeded with particles with defined characteristics (e.g. size, density, settling velocity etc.) which are then tracked as they are entrained within the water column.

Assessment Method

14.3.8 This chapter has been prepared in accordance with the CIEEM Guidelines for Ecological Impact Assessment (CIEEM, 2018) and represents an expanded methodology which remains in line with the core impact assessment methodology set out within **Chapter 6: Approach to EIA** of this report**.**

14.3.9 The principal steps are summarised below:

- Obtaining data on marine mammal populations potentially affected, through targeted desk study;
- Determining Value and Sensitivity of the identified marine mammals that have been identified as present;
- The potential impacts of the project that could affect marine mammals are quantified, through interpretation of the sound propagation modelling results;
- Measures are developed to mitigation (by avoidance or reduction) or if necessary to compensate for any likely adverse effects; and
- The significance of any residual effects is reported.

14.3.10 The impact assessment gives further consideration to the major activities with the potential to impact marine mammal receptors which were identified at the scoping stage. This includes piling works on site that has the potential to generate disturbance effects in response to the underwater sound generated, and dredging and sediment disposal that could result in changes to suspended sediment levels and water quality. Mitigation recommendations are outlined in Section 14.9.

Limitations

14.3.11 Sound propagation has been determined using geometric spreading numerical modelling. There are a number of limitations and uncertainties in the sound propagation calculations that have been recognised and taken into account during the impact assessment.

- PL calculated on the basis of the spreading law model may underestimate noise exposure close to the source, which is the region where noise levels are highest (and risk of injury and disturbance is greatest).
- Furthermore, noise levels may be overestimated further from the source, identifying a conservatively large area which could be affected (Farcas, Thompson, & Merchant, 2016)).
- Spreading law calculations does not account for the topography of the seafloor, a factor which can have a strong influence on sound propagation. This is because in shallow water, the main mechanism driving sound propagation is reflection and scattering from the sea surface and seabed boundaries. Thus, seabed sediment characteristics strongly influence the propagation of sound in shallow water. For example, more sound is scattered or absorbed into the seabed where sediments are soft, such as those comprising mud and silts, compared to areas of bedrock or coarse sand which are much more reflective. The sediments in Uig Bay largely comprise mud and silt and so propagation may be lower than estimated by the calculations. However, the sediments in the areas where the piling will be taking place contain higher elements of coarse particles, particularly sand and gravel, so any reduction in sound due to absorption of sound is not likely to occur in the immediate vicinity of the piling activities.
- Sound propagation modelling has assumed both a stationary receptor and a stationary sound source. Whilst the sound source is derived from a fixed piling location individual marine mammals and fish are unlikely to remain in the same spot for very long and in the presence of underwater sound there is a high likelihood that they will move away, reducing the sound energy experienced with distance. Thus, SELs are also overestimated.

14.3.12 In conclusion, it is considered that far field effects are likely to have been overestimated and near field effects underestimated in the geometric spreading calculations. In addition, the calculations do not account for the fact that animals are likely to move away from anthropogenic underwater sound which can reduce the impact distances calculated. These factors will be considered in the discussion of impacts in Section 14.8 of this chapter. The full sound propagation calculations can be found in **Appendix 13.1**.

Summary of Consultation

14.3.13 Consultations specific to this chapter were received from the organisations in Table 14-1 below.

Table 4-1 Summary of Stakeholder Consultation Responses Relevant to Marine Mammals

Consultee	Summary Response	Comment/Action Taken
Scottish Natural Heritage (SNH)	SNH identified potential for effects of piling, dredging and dredge disposal on marine mammals, particularly cetaceans including harbour porpoise. Other cetacean species, such as minke whale, bottlenose dolphin and short-beaked common dolphin have been recorded in Uig Bay and Loch Snizort. Disturbance should also be assessed despite the lack of commonly agreed threshold criteria. A possible EPS licence application may also be required. Though the seals from the SAC population have been screened out of the assessment there may be occasional visitors to Uig Bay that require protection from project activities.	The effect of piling noise and the processes associated with dredging on marine mammals are considered in Section 14.9 of this chapter. The effects considered include injury and behavioural responses. The risk to visiting seals will also be considered in the chapter.
The Highland Council	Impacts on the Inner Hebrides and Minches candidate SAC will be appropriately considered by Marine Scotland and should include cumulative and in-combination effects.	Impacts on marine mammals are discussed in this chapter. Impact to designated sites are further considered within **Chapter 11.**
Whale and Dolphin Conservation	WDC highlighted concerns about the close proximity of the proposed development to the Inner Hebrides and Minches cSAC for harbour porpoise. Sound propagation will be needed and further mitigation measures, such as bubble curtains, may be required. An EPS licence will be required.	Impacts on marine mammals are discussed in this chapter**.** Impact to designated sites are further considered in **Chapter 11.** Sound propagation calculations are provided in **Appendix 13.1.** Information required for an EPS licence application is provided in Section 14.12 of the chapter.

14.4 Baseline Conditions

14.4.1 A desk based study of available data sources has been carried out to characterise, where possible, the marine mammal populations which may be anticipated to be present within Uig Bay, Loch Snizort and the Minches.

14.4.2 The Inner Hebrides, including the Isle of Skye, are known to support a number of marine mammal species designated under Annex II of the EC Habitats Directive. These include the harbour porpoise, as well as dolphins and whale species such as the minke whale.

14.4.3 The area is also important for seals, which are protected under The Marine (Scotland) Act 2010 which replaced the Conservation of Seals Act 1970. The

distribution and abundance of each of the species known to be present around the Isle of Skye is considered below.

Harbour Porpoise

14.4.4 The harbour porpoise *Phocoena phocoena* is the smallest marine mammal in Scottish waters and the only species of porpoise found in the UK. The west coast of Scotland is a European stronghold for this species and it is therefore, the most important cetacean species around Uig and Loch Snizort.

14.4.5 The importance of this area of Scotland for harbour porpoise is recognised through the designation of the Inner Hebrides and Minches (IHM) Special Area of Conservation (SAC) which encompasses the islands of Skye, Mull, Lismore, the group of small islands within the Firth of Lorn, and Colonsay. This designation is specifically for this species.

14.4.6 The SAC comprises an area of 13,539.77 km^2 and the site supports approximately 31.4% of the harbour porpoise population present within the UK's part of the West Scotland management unit (Clarke, Dolman, & Hoyt, 2010).

14.4.7 The density of harbour porpoises was found to be highest, at 1.071 animals per km^2, in the Inner Hebrides which includes the southern region of the Isle of Skye.

14.4.8 For the sea areas in the north of Skye, including Loch Snizort, the density of harbour porpoise was found to be lower, at 0.394 animals per km^2 (Clarke, Dolman, & Hoyt, 2010). Although the SAC has been identified in the area around the west of Skye (which includes Uig Bay and Loch Snizort) using summer modelled data, harbour porpoise are present throughout the year and thus the designation applies year round.

14.4.9 Harbour porpoise have an active lifestyle and a high energy demand. Being small mammals they are not able to store a lot of energy in their bodies and so must feed frequently. Harbour porpoise have a varied diet, exploiting seasonally abundant prey from both pelagic and demersal habitats. Small schooling fish including herring and sprat (Clupeidae), sandeel (Ammodytidae) and members of the cod family (Gadidae) are important food sources in UK and Irish waters (Pierpoint, 2008)).

14.4.10 Concentrations of prey including sandeels and herring are found in the relatively shallow, cold, fast flowing waters above the diverse sea bed of the Inner Hebrides and the Minches SAC. Harbour porpoise can dive to depths of more than 200 metres and hold their breath for up to six minutes.

14.4.11 Booth (2010) and Booth et, al., (2013) noted that higher densities of harbour porpoise were consistently associated with depths of between 50 m and 150 m across the various models constructed.

14.4.12 In coastal waters, they are often encountered close to islands and headlands with strong tidal currents (Evans, Anderwald, & Baines, 2003). Porpoise mating occurs around October with births (usually a single calf) from March to August with the highest number of births reported to occur in June and July.

Dolphins

14.4.13 Small numbers of bottlenose dolphin, at an estimated density of 0.008 - 0.100 animals per km^2, have been observed during the SCANS surveys around the Isle of Skye including waters in the north of the island ((SCANS, 2008) & (Hammond, et al., 2017)).

14.4.14 Other dolphin species, such as short-beaked common dolphin have been recorded within and around the entrance to Uig Bay, as well as more widely in Loch Snizort (pers. comm. SNH). For example, a dead short-beaked common dolphin was found in Uig Bay in 2014. Around the Isle of Skye the density of short-beaked common

dolphin is recorded as being between 0.00 and 0.381 individuals per km^2. No sightings records for Uig Bay or Loch Snizort were found.

Minke whale

14.4.15 The minke whale is widely distributed along the Atlantic seaboard of Britain and Ireland and also throughout the northern and central North Sea. Sightings are most frequent on the west and east coasts of Scotland (Reid, Evans, & Northridge, 2003).

14.4.16 Minke whale are mostly observed between May and October with the most frequent sightings during July when they migrate into British waters to feed during the summer months, before moving south for the winter to breed (Reid, Evans, & Northridge, 2003).

14.4.17 Some sightings of minke and killer whale have also been made in the Inner Hebrides and minke whale were reported to have been observed within and around the entrance of Uig Bay (Table 14-1: SNH scoping response) though specific sightings data could not be found for the waters of Loch Snizort and the north of Skye. However, such sightings are very occasional and the observed adjusted density of minke whale in the vicinity of Uig Bay, within Loch Snizort is reported to be between 0.00 and 0.01 individuals per km^2 and between 0.01 and 0.02 individuals per km in the northern section of Loch Snizort (Paxton, Scott-Hayward, & Rexstad, 2014) Thus, density is very low but the occasional visit in the region of the project may occur.

14.4.18 The SCANS II and SCANS III density data for marine mammals in the west of Scotland in the aerial observations blocks that include the Isle of Skye (Blocks N and I respectively) is summarised in Table 14-2 below.

Table 4-2 Aerial Survey Estimates of Marine Mammal Abundance (Individuals per km^2) and 95% Confidence Value (CV) Around the Isle of Skye

Species	Scans II		Scans III	
	Abundance	CV	Abundance	CV
Harbour porpoise	0.394	0.43	0.397	-
Bottlenose dolphin	0.008	1.05	0.100	-
White beaked dolphin	0.105	0.77	0.000	-
Common dolphin	0.072	0.60	0.000	-
Minke whale	0.000	0.00	0.020	-

Seals

14.4.19 The nearest designated seal haul out sites to Uig Bay are on the island of Fladda-chuain and associated rocky outcrops off north Skye (designated site number WSC-008), over 18 kilometres away from the Proposed Development.

14.4.20 However, the Ascrib, Isay and Dunvegan SAC boundary, designated specifically for the presence of the common or harbour seal (*Phoca vitulina*), is approximately 5.5 km from the mouth of Uig Bay and the islands themselves, where seals may be found hauled out, are about 7 km away.

14.4.21 There is also a grey seal pupping site on the Ascrib Islands though this is on the western coast of the island and outwith any potential impacts from the Proposed Development.

14.4.22 The Sea Mammal Research Unit compiled a 12-year data set demonstrating consistent use of the Ascrib, Isay and Dunvegan SAC site by around 600 common seals, equating to around 2% of the UK population (SNH, 2006).

14.4.23 Seals are also occasionally seen in Uig Bay. For example, during intertidal surveys in the Bay in late 2017 a single seal was observed. However, numbers in the Bay are expected to be low generally, and any animals present will be occasional visitors and will be highly mobile. There are no breeding or haul out areas in Uig Bay.

14.4.24 The finfish farms in and outside the Bay are reported to attract seals though they are also reported to use acoustic deterrent devices (with conditions and design to minimise impacts on harbour porpoise).

14.5 Value and Sensitivity of Receptor

14.5.1 All cetacean species found in Scottish territorial waters are European protected species (EPS). They are given protection under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Thus, all cetacean species are of international importance and are therefore, considered to be a receptor of high value/sensitivity.

14.5.2 Seals are protected by national legislation under the Marine (Scotland) Act 2010 (the Act). Seals are therefore also considered to be of high value/sensitivity.

Table 4-3 Summary of Sensitivity Rating for Marine Mammals

Species name	Description	Sensitivity or Value of Receptor
Cetaceans	All cetacean species found in Scottish territorial waters are classed as European protected species. They are given protection under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)). Cetaceans in waters more than 12 nautical miles from land are protected under the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007.	High
Seals	All seals are protected by national legislation.	Moderate

14.6 Avoidance Measures/Mitigation 'by design'

14.6.1 The most direct and comprehensive way to minimise sound impacts on marine receptors is to reduce the amount of sound produced at source. The Proposed Development requires the installation of piles in most areas. The project design has minimised the use of impact piling, using vibratory piling methods where possible, in order to minimise as far as is practicable, the intensity of underwater sound generated by construction activities. Thus, most of the estimated piling time, almost 80%, will be vibratory piling. However, ground conditions on site mean that impact piling will be required to drive the final sections of many of the piles.

14.6.2 The project will adopt, as a minimum, the 2010 JNCC standard protocol as the minimum level of good practice to mitigate the potential for causing injury or death to marine mammals in close proximity to piling operations (JNCC, 2010). Whilst the guidance was originally intended for offshore wind farm construction impacts in cetaceans the guidance is now industry best practice for other construction activities.

14.6.3 The protocol recommends the following mitigation measures which will be adopted as standard during the periods of impact piling:

- **Marine mammal observation**: piling activities will be monitored by suitable qualified and experience MMOs and PAM operatives whose primary role is to detect marine mammals and to potentially recommend a delay in the commencement of piling activity if any marine mammals are detected;
- **Mitigation zone**: the extent of this zone represents the area in which a marine mammal could be exposed to sound that could cause injury and will be no less than 500 metres with the project specific extent of this zone defined and agreed with the regulatory authority; and
- **Soft-Start of pile driver:** a gradual ramping up of piling power, incrementally over a set time period, of not less than 20 minutes. It is believed that by initiating piling at a lower power this will allow for any marine mammals to move away from the noise source, and reduce the likelihood of exposing the animal to sounds which can cause injury. It is believed that by initiating piling at a lower power this will allow for any marine mammals to move away from the noise source, and reduce the likelihood of exposing any animals to injurious sound levels.

14.6.4 The mitigation measures that will be adopted will be provided in a Marine Mammal Management Plan (MMMP). The piling contractor/s will be required to comply with the MMMP.

14.6.5 However, where any significant impacts on marine mammals are identified, even in the presence of this standard mitigation, further measures may be required.

14.6.6 The project proposes to have no more than 2 piling rigs on site at any one time. Therefore, it is possible that some simultaneous piling may occur at times. The Proposed Development has made a commitment that no simultaneous impact piling of the noisiest when the pile is in water, at any time during construction. The potential for impact piling and vibratory piling to take place simultaneously has been assessed.

14.6.7 However, where at least one of two piling locations is exposed at low tide simultaneous impact piling of these sheet piles can be undertaken but only when one pile is not submerged. This is because minimal underwater sound propagation will take place when piling is done out of the water. (in air impacts associated with piling noise are considered in **Chapter 17**). Whilst it is recognised that some sound propagation to water can take place through sediments this is considered to be minimal, particularly if in-water impact piling is taking place at the same time.

14.7 Potential Effects Scoped out of the Assessment

14.7.1 The potential for sound impacts as a result of the new ferry operations was considered during EIA Scoping, in discussion with key stakeholders. The new ferry is expected to have an operating noise profile no greater than the current ferry vessel and will operate on the same, or very similar, timetable to the current ferry. Therefore no significant change to the operating noise profile, over and above the baseline condition is anticipated.

14.8 Predicted Effects

Construction

17.8.1 This section details the key significant impact pathways for the construction phase of the Proposed Development. The key impact pathways relating to marine mammals are:

- Disturbance from underwater sound produced during pile driving construction activities; and
- Disturbance or toxicity from increases in suspended sediment and changes to water quality.

Predicted Effects I - Disturbance from Underwater Sound Produced During Pile Driving

14.8.2 Construction works required for the Proposed Development include in-water impact piling at several different locations including the marshalling area, the approachway and around the ferry berth. Pile driving activities can generate very high SPLs that are relatively broad-band in frequency (20 Hz to >20 kHz) ((Nedwell & Howell, 2004), which can be detected by many groups of marine fauna, particularly marine mammals.

14.8.3 The installation of driven piles in the marine environment without mitigation is likely to produce noise levels capable of causing disturbance, and possibly injury, to marine mammals.

14.8.4 Sound from anthropogenic activities can negatively impact marine mammals as it influences their ability to echolocate, communicate and it can cause physical harm (through disorientation leading to beaching, and in extreme cases, trauma to the auditory apparatus). Sound can cause certain cetacean species to change their behaviour and can result in increased alertness, modification of vocalisations, interruption or cessation of feeding or social interactions, alteration of movement or diving behaviour, and temporary or permanent habitat abandonment. In severe cases, animal responses may include panic, flight, stampede, or stranding, which could sometimes result in indirect injury or death.

14.8.5 Cetaceans produce and receive sound over a great range of frequencies for use in communication, orientation, predator avoidance and foraging (Tyack 1998). As sound production in marine mammals is integral to a range of important behaviours, any interference with these communicative functions has the potential for adverse effects.

14.8.6 Seals (and other pinnipeds) also produce a diversity of sounds, though generally over a lower and more restricted bandwidth (generally from 100 Hz to several tens of kHz). Their sounds are used primarily in social and reproductive interaction, both in water and air (Southall, et al., 2007).

14.8.7 To reflect the different hearing sensitivities of marine mammal species, (Southall, et al., 2007) classified marine mammals into functional hearing groups as discussed below. There is the potential for the presence of species in each of the following categories to be present in the vicinity of the Proposed Development:

- **Low frequency cetaceans** - baleen whales including the minke whale that may be occasionally present in the vicinity of the Proposed Development;
- **Mid frequency cetaceans** - the toothed whales and dolphins including the bottlenose dolphin, a species that has been observed in Loch Snizort;
- **High frequency cetaceans** – including the harbour porpoise for which the nearby SAC is designated; and

- **Pinnipeds** – earless or 'true' seals including the harbour seal which hauls out on the Ascrib Islands and is occasionally observed in Uig Bay.

14.8.8 Anthropogenic sound may have a diverse range of effects on marine receptors from injury to minor behavioural responses. The potential impacts on marine mammals are generally split into the following levels:

- **Physical injury** – could result from exposure to very high amplitude sounds such as that generated by underwater explosions;
- **Effects on hearing -** a consequence of damage to the inner ear of marine mammals, the organ system most directly sensitive to sound exposure and, thus, the most susceptible to sound-derived damage (Southall, et al., 2007). Hearing loss or a shift in hearing thresholds can be permanent or temporary:
  - PTS - is a permanent elevation in hearing threshold (i.e., an unrecoverable reduction in hearing sensitivity). PTS can occur from a variety of causes, but it is most often the result of intense and/or repeated noise exposures; and
  - TTS - is an elevation in hearing threshold (i.e., a non-permanent reduction in hearing sensitivity) most commonly resulting from noise exposure.
- **Behavioural responses** – are highly variable and context-specific ranging from increased alertness, altering vocal behaviour, interruption to feeding or social interaction, alteration of movement or diving behaviour, temporary or permanent habitat abandonment and in severe cases, panic, flight, stampede, or stranding, sometimes resulting in indirect injury or death. Minor or temporary behavioural responses are often simply evidence that an animal has heard a sound;
- **Masking** – anthropogenic underwater sound may partially or entirely reduce the audibility of signals such as those used for communication and prey detection; and
- **Detection** – the limit of hearing. Marine mammals generally have high sensitivity to sound pressure (low detection thresholds) and can hear across a broad range of bandwidths.

14.8.9 There is no evidence in the literature to suggest physical injury is likely to occur as a result of impact piling but other impacts, such as PTS, TTS and behavioural responses, are possible. The level of impact will depend on the SSL generated during piling, the duration of piling activities and the distance of the marine mammal receptor to the sound source.

14.8.10 The impact assessment set out within this section has assumed that piling mitigation measures for marine mammals, as set out within (JNCC, 2010) will be applied and are inherent to the project design.

14.8.11 To determine the potential effect of underwater sound produced by piling during the construction phase it is necessary to understand the character of sound propagation underwater and the potential response of marine mammals to the sound. These are discussed below.

Underwater Sound Modelling

14.8.12 The objective of the sound modelling calculations is to predict how much sound from the project activities, in particular construction piling, will propagate into the surrounding underwater environment. The methodology and results of the sound modelling are provided in **Appendix 13.1**. Specifically, the aim is to model the RL at

a given point (or points), based on the SSL of the different project activities, and the amount of sound energy which is lost as the sound wave propagates from the source to the receiver (PL).

SSLs

14.8.13 The piling during the construction period includes both vibratory and impact piling. Vibratory piling is a continuous sound source, of much lower intensity - generally between 20 and 30 dBs below the sound levels generated by impact piling. In contrast impact piling is an impulsive sound source. The threshold criteria for the different piling types are therefore different.

14.8.14 The determination of SSL was based on the technical details of the piling equipment expected to be used in the Proposed Development (including the shape and size of the pile, the type of piling and the power level of the piling hammer for impact piling) and associated measured real world project data (CDOT, 2007).

14.8.15 The maximum SSL values (as SPL and SEL) produced across the whole Proposed Development for both impact and vibratory piling are shown in Table 14-4 below (see **Appendix 13.1** for a detailed breakdown of the SSL and sound propagation for every pile type included in the construction programme).

Table 4-4 SSLs for Piling Activities

Piling type	SPL dB re 1µPa	SEL dB re 1 μPa^2s
Impact piling	205	180
Vibratory piling	180	170

Sound Impact Thresholds

Southall et al. 2007

14.8.16 A number of thresholds for injury and disturbance in marine mammals, as a result of underwater sounds, are currently in use. These include the well-established and often adopted ‘Marine Mammal Noise Exposure Criteria’ developed and published by Southall and others in 2007.

National Oceanic and Atmospheric Administration (NOAA) Guidance (NMFS, 2018)

14.8.17 Recent research on the impact of underwater sound on marine mammals has been reviewed by the US National Oceanic and Atmospheric Administration under the jurisdiction of the NMFS (2018) resulting in updated guideline thresholds for marine mammals. This guidance is generally referred to as the ‘NOAA guidance’ or ‘NOAA thresholds’.

14.8.18 The NOAA thresholds reflect up-to-date research findings indicating a greater impact of underwater sound on marine mammals than previously thought, particularly for high frequency cetaceans which includes the harbour porpoise. As requested by Marine Scotland during the scoping phase both the Southall (2007) and the NOAA thresholds (NMFS, 2018) for impact piling have been considered in the impact assessment.

Dual Criteria: Sound Pressure Level (SPL) and Sound Exposure Level (SEL)

14.8.19 For both sets of criteria, threshold values are expressed as dual criteria comprising a value for SPL and a value for SEL. The greatest impact distance of the two is taken as the potential impact range for consideration of the impact assessment and determination of required mitigation measures.

14.8.20 For impulsive sound, thresholds for permanent and temporary hearing threshold shifts (PTS and TTS respectively) resulting from multiple pulses (such as resulting from impact piling) are provided by Southall and by NOAA (Table 14-5**).** As discussed above the most significant difference between the two sets of thresholds is the significantly lower threshold values for high frequency cetaceans in the more recent NOAA criteria.

14.8.21 There are no behavioural thresholds for either multiple impulsive or continuous sound sources. The NOAA guidance concerns auditory impacts only (i.e. PTS and TTS). Southall reported the available data on marine mammal behavioural responses to multiple pulse and non-pulse sounds were too variable and context-specific to justify proposing single disturbance criteria for broad categories of taxa and of sounds. Instead a ranking of behavioural response severity was defined to provide a rudimentary framework that emphasizes that 'disturbance' is a graduated, rather than a 'yes-or-no', phenomenon and that some noise-induced changes in behaviour are more significant than others.

14.8.22 There is however, a threshold for a behavioural response to a single pulse and this has been included for indicative purposes only.

Table 4-5 Injury and Disturbance Thresholds for Marine Mammals

Receptor Group	PTS (multiple pulses)	TTS (multiple pulses)	Behavioural Response (single pulse)	Threshold Source
Impulsive Sound (Impact Piling)				
All cetaceans	230 dB_{peak} SPL 198 dB SEL	224 dB_{peak} SPL 183 dB SEL	224 dB_{peak} SPL 183 dB SEL	Southall et al., 2007
Pinnipeds in water	218 dB_{peak} SPL 186 dB SEL	212 dB_{peak} SPL 171 dB SEL	212 dB_{peak} SPL 171 dB SEL	
Low Frequency Cetaceans	219 dB_{peak} SPL 183 dB SEL_{cum}	213 dB_{peak} SPL 168 dB SEL_{cum}		NMFS, 2018
Mid Frequency Cetaceans	230 dB_{peak} SPL 185 dB SEL_{cum}	224 dB_{peak} SPL 170 dB SEL_{cum}		
High Frequency Cetaceans	202 dB_{peak} SPL 155 dB SEL_{cum}	196 dB_{peak} SPL 140 dB SEL_{cum}		
Phocid Pinniped	218 dB_{peak} SPL 185 dB SEL_{cum}	212 dB_{peak} SPL 170 dB SEL_{cum}		
Continuous Sound (Vibratory Piling)				
All cetaceans	230 dB_{peak} SPL 215 dB SEL	n/a		Southall et al., 2007
Pinnipeds in water	218 dB_{peak} SPL 203 dB SEL	n/a		
Low Frequency Cetaceans	199 dB SEL_{cum}	179 dB SEL_{cum}		NMFS, 2018
Mid Frequency Cetaceans	198 dB SEL_{cum}	178 dB SEL_{cum}		
High Frequency Cetaceans	173 dB SEL_{cum}	153 dB SEL_{cum}		
Phocid Pinniped	201 dB SEL_{cum}	181 dB SEL_{cum}		

Magnitude of Effect – Underwater Sound

14.8.23 The magnitude of potential effects on environmental baseline conditions is identified through consideration of the Proposed Development taking into account the scale or degree of change from the existing situation as a result of the effect as described below as well as consideration of relevant legislative or policy standards or guidelines:

14.8.24 Nature of the impact and its reversibility;

14.8.25 Duration and frequency of an impact;

14.8.26 Extent of the change; and

14.8.27 Potential for cumulative impacts.

14.8.28 Table 14-6 below provides the definitions of the magnitude criteria in relation to the impact of underwater sound on fish and shellfish.

Table 4-6 Criteria used to Define the Magnitude of Effect of an Increase in Underwater Sound on Marine Mammals

Magnitude Criteria	Description
High	Total loss or major alteration to key elements/features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed. A temporary increase in SSLs associated with death or permanent injury (such as Permanent Threshold Shift) or significant disturbance at large distances from the sound source that may have long-term effects on species populations.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed. Short-term or localised decrease in the availability or quality of a resource, likely to be noticed by users A medium-term (months) increase in underwater sound associated with temporary injury (such as TTS) over a greater than local area or a significant disruption to key behavioural stages such as breeding activity. Sound levels return to baseline conditions after cessation of the activity.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material. Short-term or localised decrease in the availability or quality of a resource, likely to be noticed by users. A short-term detectable increase in underwater sound or a longer term change in a local area resulting in changes in normal behaviour but not affecting key life-cycle phases such as breeding. Sound levels return to baseline condition.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation. Short-term or localised decrease in the availability or quality of a resource, not effecting usage. For underwater sound this equates to long-term sound levels marginally above ambient sound levels or a greater increase for a very short period of time or a single occurrence in a small area. Results in very minor behavioural responses such as a reorientation of swimming direction. Sound levels rapidly returning to background levels.

Duration of Effect

14.8.29 The duration of each type of piling activity depends on the construction programme adopted. Two construction scenarios have been considered as described in **Chapter 3: Project Description** as summarised below:

- **Scenario 1:** a continuous construction programme running over a 24 month period; or
- **Scenario 2**: a phased construction programme, with time intervals between phases, running over a 40 month period.

14.8.30 An estimated programme of piling times has been calculated based on the schedules of construction activities for each construction scenario and the estimated piling times for each of the different construction activities). The resulting estimated schedule of vibratory and impact piling times and average hours per day for each of the two scenarios are shown in Table 14-7 below.

14.8.31 The estimated piling hours calculated are based on working hours of 0700 to 1900 Monday to Friday and 0700 to 1300 on Saturday.

14.8.32 The calculations **(Appendix 13.1)** indicate that Construction Scenario 2 (**Chapter 3: Project Description)** would result in longer durations of impact piling, estimated as a monthly or daily average, for the first 8 months at the start of the construction programme. In contrast, for Scenario 1 the maximum periods of impact piling takes place in months 9 to 14. However, the differences are small and apart from the timing, and the piling free period of 3 months in Scenario 2, before Phase II starts, there is only a small difference in the piling schedules between the two construction scenarios (Table 14-7).

Table 4-7 Estimated Average Daily Piling Duration During Construction

Construction Scenario	Type of Piling	Average Daily Total Piling Duration (hours)			
		Months 1-8	Months 9-15	Months 16-24	
1 (24 month programme)	Impact	0.5	0.8	0.2	
	Vibratory	5.7	0.4	0.3	
Construction Scenario	**Type of Piling**	**Average Daily Total Piling Duration (hours)**			
		Months 1-8	**Months 9-15**	**Months 16-18**	**Months 19-26**
2 (40 month programme)	Impact	0.9	0.2	0	0.2
	Vibratory	4.3	0.3	0	1.7

14.8.33 To conclude, whilst the construction programme is scheduled to last many months, either 24 or 40 depending on the programme adopted, the duration of piling, expressed as an average number of hours per day is mostly less than one. Thus, the duration of the effect of either impact or vibratory piling is considered to be low**.**

Extent of Effect from Vibratory Piling

14.8.34 The distances at which the sound calculations estimate the threshold criteria to be met for the continuous sound from vibratory piling are shown in Table 14-8 below.

Table 4-8 Distance (m) from Vibratory Piling Sound Source at which Threshold Criteria are Met (15 Minute Accumulation Time)

Sensitivity	Threshold	Pile Type (see Table 14-X for Full Description)					
		SP	HP1	HP2	TP1	TP2	SWS
Southall Criteria PTS							
All cetaceans PTS	230 dB_{peak} SPL	10	10	10	10	10	10
	215 dB SEL	10	10	10	10	10	10
Pinnipeds in water PTS	218 dB_{peak} SPL	10	10	10	10	10	10
	203 dB SEL	10	10	10	10	10	10
NOAA Criteria PTS							
LF Cetaceans PTS	199 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
MF Cetaceans PTS	198 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
HF Cetaceans PTS	173 dB SEL_{cum}	71	22	22	40	224	71
Phocid Pinnipeds PTS	201 dB SEL_{cum}	<10	<10	<10	<10	<10	<10
NOAA Criteria TTS							
LF Cetaceans TTS	179 dB SEL_{cum}	35	11	11	20	112	35
MF Cetaceans TTS	178 dB SELcum	40	13	13	22	126	40
HF Cetaceans TTS	153 dB SEL_{cum}	708	224	224	398	2239	708
Phocid Pinnipeds TTS	181 dB SEL_{cum}	<10	<10	<10	<10	<10	<10

14.8.35 The (Southall, et al., 2007) threshold criteria for PTS in all marine mammal groups from continuous sound sources give an impact distance of up to 10 m from the sound source.

14.8.36 The NOAA criteria (NMFS, 2018) also indicate that PTS from the continuous sound of vibratory piling is only likely to occur for a marine mammal remaining in very close proximity (within 10 m) of the piling activity for all marine mammal groups except for high frequency cetaceans. The distances for the high frequency harbour porpoise, a species known to have particularly high sensitivity to underwater sound, are greater but are all within the 500 m standard JNCC mitigation zone.

14.8.37 Therefore, with the application of standard JNCC protocol for minimising impacts of piling on marine mammals that will be adopted by the Proposed Development as standard, no cetaceans or seals are likely to be within 500 m of operations before any piling starts. as a result it is highly unlikely, even for very small cetaceans like harbour porpoise, that any injury as a result of a PTS would occur as a result of vibratory piling.

14.8.38 When considering the potential for TTS, Southall uses a threshold value 20dB lower than the PTS threshold. Results of the acoustic modelling indicate that the Southall et al, TTS threshold for harbour porpoise will also met at distances less than 10 m. Consequently, using the Southall criteria there are no predicted permanent or temporary effects of vibratory piling on any marine mammal, unless an animal is within a few metres of the sound source.

14.8.39 The NOAA thresholds for TTS also indicate no impact any further than the standard 500 m mitigation zone around the sound source for all vibratory piling, with the except the largest proposed piles (sheet piles SP, tubular piles TP2 and straight web sheet piles SWS) in relation to harbour porpoise (high frequency cetaceans).

For these large pile types, the TTS threshold distance for harbour porpoise has been calculated to be met up to 708 m for the SP and SWS piles, and up to 2239 m for the TP2 piles. There will be a maximum of 20 of the TP2 piles so the large predicted TTS distance applies for a very short period of time. Also, the calculations assume animals remain within this distance from impact piling for more than 15 minutes.

14.8.40 With the adoption of the standard JNCC mitigation protocol of MMOs including a 'soft-start' for piling (see section 14.6) the risk of presence of any marine mammals remaining within an area of elevated sound for a full 15 minutes of vibratory piling of the larger piles is very low. In addition the total duration of vibratory piling of these noisiest piles is very short (estimated to be less than an average of 10 minutes per day (see **Appendix 13.1),** therefore the likelihood of TTS occurring as a result of vibratory piling is considered to be low.

14.8.41 The TTS threshold also indicates that some behavioural response to vibratory piling associated with the large piles could occur, if any marine mammals were present beyond the 500 m mitigation zone. However, marine mammals are likely to move away from sound sources at uncomfortable levels and the soft-start ensures sound levels increase only gradually minimising any panic behavioural reaction.

14.8.42 In addition the duration of vibratory piling that could cause TTS or behavioural responses in harbour porpoise beyond the mitigation zone is very short. Thus, the effect of vibratory piling in all marine mammals, including harbour porpoise and harbour seal, is considered to be of negligible magnitude. For harbour porpoise, a receptor of high sensitivity the impact of vibratory piling is considered to be of low significance and for seals, a receptor of moderate sensitivity the impact is of negligible significance.

Extent of Effect from Impact Piling

14.8.43 The distances at which the sound calculations estimate the threshold criteria for the impulsive sound of impact piling to be met are shown in Table 14-9 below.

Table 4-9 Distance (m) from Impact Piling at which Sound Threshold is Met

		Pile Type					
Sensitivity	**Threshold**	**SP**	**HP1**	**HP2**	**TP1**	**TP2**	**SWS**
Southhall Criteria							
All cetaceans PTS	230 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	198 dB SEL	<10	<10	<10	<10	<10	<10
All cetaceans TTS	224 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	183 dB SEL	<10	<10	<10	<10	<10	<10
Pinnipeds in water PTS	218 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	186 dB SEL	<10	<10	<10	<10	<10	<10
Pinnipeds in water TTS	212 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	171 dB SEL	28	<10	<10	14	20	28
NOAA Criteria							

		Pile Type					
Sensitivity	**Threshold**	**SP**	**HP1**	**HP2**	**TP1**	**TP2**	**SWS**
LF Cetaceans PTS	219 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	183 dB SEL_{cum}	560	<10	318	28	40	560
MF Cetaceans PTS	230 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	185 dB SEL_{cum}	45	<10	14	22	32	45
HF Cetaceans PTS	202 dB_{peak} SPL	140	<10	<10	<10	11	14
	155 dB SEL_{cum}	1413	141	447	708	1,000	1413
Phocid Pinnipeds PTS	218 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	185 dB SEL_{cum}	45	<10	14	22	32	45
LF Cetaceans TTS	213 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	168 dB SEL_{cum}	316	32	1,00	158	224	316
MF Cetaceans TTS	224 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	170 dB SEL_{cum}	251	25	79	126	178	251
HF Cetaceans TTS	196 dB_{peak} SPL	28	<10	<10	16	22	28
	140 dB SEL_{cum}	793	794	2512	3891	5623	7943
Phocid Pinnipeds TTS	212 dB_{peak} SPL	<10	<10	<10	<10	<10	<10
	170 dB SEL_{cum}	251	25	79	126	178	251

14.8.44 The SEL accumulation time to estimate impact distances for impact piling that has been used is 15 minutes[2].

14.8.45 Sound propagation has been estimated for all pile types in order to represent differences in SSLs as a result of variations in pile shape and size. The sound propagation has been calculated based on the highest level of sound propagation

[2] Whilst the duration of impact piling for some of the driven piles may be longer this accumulation time has been selected for a number of reasons: there will be breaks in impact piling as tolerances etc. need to be checked during piling operations; the calculated impact distances do not allow for the marine mammal observation zone meaning animals will already be a significant distance (at least 500 m) from the sound source when it starts, but importantly the short accumulation time accounts for the fact that marine mammals will be at least 500 m away before any soft-start begins and animals are thought highly likely to move away from any sound sources but the propagation calculations assume a receptor is stationary. However, converting impact distances for a higher accumulation time is a simple calculation. For example, for a doubling of the accumulation time the SEL impact distances will also double.

into the Bay and beyond that could occur and does not allow for a series of potential, but as yet undefined project specific factors, which may in reality provide a degree of mitigation. These mitigating factors may include:

- Many of the piles are in the intertidal zone therefore some piling is likely to occur when the pile is not submerged (see Chapter 17);
- Many of the piles are in very shallow water which may also serve to minimise sound propagation;
- The impact piling on the pier approachway, which involves impact piling of the large tubular piles (TP), takes place on the shoreward side of the pier and is therefore screened from the marine environment behind a solid wall or an existing wall of sheet piling. This is likely to significantly reduce the sound propagation from the approachway works (comprising an estimated total of 82 tubular piles).

14.8.46 The estimated duration of impact piling across the Proposed Development is a total of 270 hours split across a range of different stages of the construction programme, for both the 24 and the 42 months programmes, considerably less than the duration of the much less impactful vibratory piling. The average daily duration of impact piling, based on the proposed working hours, is less than an hour a day (Table 14-7). If the approachway piles are excluded from the estimated sound propagation from impact piling is only 30 minutes per day on average. Impact piling is anticipated therefore to be very short-term but frequent.

Harbour Porpoise

PTS and TTS impact Evaluation, Based on Southall et al., (2007)

14.8.47 On the basis of the Southall thresholds (2007) possible permanent injury to hearing - PTS – resulting from a single strike of any of the pile types to be used in the Proposed Development, is predicted to occur in cetaceans and seals, including harbour porpoise only within very close proximity to the sound source, within 10 m of the pile. This distance applies to both SPL and SEL.

14.8.48 The distance for the onset of TTS in cetaceans including harbour porpoise as a result of a single strike is also predicted to occur only up to 10 m, based on the Southall criteria.

PTS and TTS impact Evaluation, Based on NOAA Criteria (NMFS, 2018)

14.8.49 Impact distances from the NOAA SPL peak criteria as a result of a single strike also indicate possible PTS is restricted to within 10 m of the sound source.

14.8.50 However, NOAA SEL thresholds are cumulative, summing the energy from successive impulsive sounds from piling over a stated period of time rather than based on the energy produced by a single strike. As discussed above and drawing on previous relevant experience a period of 15 minutes was adopted as the accumulation time.

14.8.51 When considered cumulatively, the impact distances for cumulative sound exposure from multiple pulses are significantly greater than for a single strike.

14.8.52 In addition, NOAA threshold criteria for cumulative SELs are also lower than previous values (i.e. impact is anticipated to occur at lower sound levels than was previously thought). This reflects additional and most recent research on marine mammal responses to underwater sound and specifically applies to harbour porpoise as this species have been observed to be particularly sensitive to underwater sound from activities such as impact piling and seismic surveys.

14.8.53 The estimated distances for PTS in harbour porpoise (high frequency cetaceans) resulting from cumulative SEL of a single rig of impact piling, based on the NOAA criteria, have been calculated to be less than 10 m (small H-piles (H1) and 1413 m (for the largest sheet piles) from the sound source. For these calculations the estimated effect distance is determined by the SEL threshold for accumulated sound energy from all piling impulses over a 15 minute period.

14.8.54 For TTS in harbour porpoise, the predicted impact zones range from 794 m to 7943 m depending on pile types.

14.8.55 **Note:** The predicted impact distances are subject to a number of limitations and are considered to reflect the worst case, which could be anticipated. Consequently, the actual risk of a PTS or TTS impact within these large calculated effect zones is expected to be much smaller[3]. PTS in harbour porpoise is realistically considered possible only much closer to the impact piling, maybe in the order of 100s of metres and likely to be within the standard JNCC marine mammal mitigation zone of 500 m from the sound source (see Section 14.6). With the standard JNCC mitigation protocols in place and with the expected low density of animals within Uig Bay, PTS is considered very unlikely to occur.

14.8.56 The worst case predicted TTS as set out within Table 4-9 above, relates to the installation of Straight Web Sheet (SWS) piles and identifies a theoretical TTS distance of over 7000 m from source. In reality this is considered to be an overestimation resulting in part from the limitations of the propagation model used (as discussed above). A review of other available acoustic models for similar activities, including those associated with development activities at the other harbours within the 'Skye Triangle' (Affric Ltd, 2019a) (Affric Ltd, 2019b)] has also been completed to allow this parameter to be tested and corroborated. As a result more likely TTS impact distances for high frequency cetaceans such as harbour porpoise are anticipated in the region of 2000 to 3000 m from the sound source. The density of harbour porpoise in Loch Snizort (within the Inner Hebrides and Minches cSAC area) and Uig Bay is low with only a small number of individuals potential effected. These individuals would be expected to exhibit avoidance behaviour during much of the construction programme and considered likely to recover after the animals move away or piling stops. Animal presence and density is expected to return to baseline levels following completion of construction activities. Consequently effects of impact piling on harbour porpoise population levels are not expected to be significant.

Behavioural Response Impact Evaluation

14.8.57 There are no behavioural thresholds for cetaceans provided by either (Southall, et al., 2007) or (NMFS, 2018) as a reflection of the remaining uncertainty in the science and the variability observed not just between different species but also between individuals of the same species. The context in which animals may be present in a particular area is important in determining the response and impact. For example, nursing mothers and juveniles tied to particular habitats are likely to

[3] - There are limitations in the sound modelling calculations, as previously mentioned, such that far-field effects are likely to have been over-estimated;
- The SEL threshold is based on the assumption of a stationary sound source and a stationary receptor. Harbour porpoise are highly mobile animals and able to easily move away from any uncomfortable sound levels. They can also easily move beyond the entrance to the Bay into Loch Snizort and out of the 'direct line of sight' of the propagating sound further limiting sound exposure;
- At the time of writing there are no factors that would provide particular motivation for harbour porpoise to remain within the Bay. There will be fish prey present within the Bay but the lack of fishing that takes place in the local area indicates there are better foraging grounds elsewhere;
- The SEL experienced by harbour porpoise will be limited by several other factors in addition to the simple ability to move away. In particular, porpoises are very unlikely to be within the standard JNCC observation zone of 500 m, where sound levels are highest, when impact piling commences and there will be a 20 minute soft-start before impact piling is operating at full power. Thus, the distance to which PTS and TTS could be experienced is likely to be further reduced.

be much more sensitive than individual adults present as transient visitors. Nevertheless, behavioural disturbance is likely to occur to any harbour porpoise within the vicinity of the piling works.

14.8.58 Harbour porpoise are known to have very sensitive hearing and react to underwater sound at significant distances from the sound source. Work by Lucke et al. (2009) showed that aversive behavioural reactions of a captive harbour porpoise were initiated at a received SEL of >145 dB re 1 μPa^2 s which corresponded to a distance of >10 km (146–152 dB re 1 μPa^2 s calculated SEL) and <25 km (139–145 dB re 1 μPa^2 s calculated SEL) around the pile driving site. This level of response was also evident in response to impact piling at a windfarm site in the German North Sea with observed avoidance by harbour porpoises detected up to 25 km from the pile driving operations (Dahne, 2013).

14.8.59 Aversive behavioural responses from harbour porpoise >10 km from source would include the whole of Uig Bay and much of Loch Snizort, however, this area is not an open ocean environment in which the above referenced behaviours were noted. Rather, sound propagation without and outside of Uig Bay into Loch Snizort will be constrained by the shape of the Bay, such that the predominant sound propagation will form a wedge shape, as shown in **Figure 14-1**. Some sound will propagate outside this area as sound reflects from surface such as the seabed and the sea surface and in reality the sound levels in the area outside the area shown on **Figure 14-1** is anticipated to be much lower than modelled.

Summary of Impact Evaluation on Harbour Porpoise

14.8.60 Disturbance to harbour porpoise, even with the standard JNCC mitigation measures in place, is expected. The density of porpoise in this region of the SAC is reported to be 0.394 animals/km^2 which equates to a total of approximately 45 individuals in the area of Loch Snizort. However, the preferred habitat in coastal waters is in areas of fast flowing waters and they are often encountered close to islands and headlands with strong tidal currents. Thus, it is likely that the density of harbour porpoise in the Loch may be lower than the 0.394/m^2 reported further north. However, inside the Bay where the impacts are likely to be greatest, the area is approximately 2 km^2 and so anticipated abundance is very low and harbour porpoise are expected to be occasional visitors only.

14.8.61 The predicted effect of PTS or TTS as a result of impact piling affecting an individual harbour porpoise would be of medium to high magnitude particularly in the near vicinity of the construction, without further mitigation. However, the density of harbour porpoise in the Bay is expected to be low, the predicted PTS and TTS impact zone is not thought to represent key habitat for important life-cycle stages in harbour porpoise and thus animals can easily move away from the sound source. In addition, the shape of Uig Bay in relation to Loch Snizort will constrain the sound propagation such that outside the line of sight to the entrance to Uig Bay the intensity of sound will be much lower. Thus, the risk of injury to hearing in harbour porpoise is considered to be low.

14.8.62 Impact piling is intermittent, with gaps in between piles and pauses during piling operations. These intervals also allow for avoidance behaviour and for recovery if any impacts such as TTS were to occur.

14.8.63 In addition, there is highly likely to be behavioural disturbance to individual animals present within several kilometres of the noise source during impact piling activities. Whilst the duration of each impact piling event is short, it is likely to occur frequently and so animals may be displaced from the area in the short to medium term.

14.8.64 However, the number of individual animals likely to be affected is expected to be low with most significant impacts occurring to individuals within the Bay, where harbour porpoise are thought to be only occasional visitors. As impacts are

considered to be predominantly behavioural, the magnitude of the impact is considered to be medium magnitude.

14.8.65 For a receptor of high sensitivity, but considered likely to be at low risk of being exposed to sound impact as a result of their low density within the impact zone, the impact of percussive (impact) piling is considered to be of moderate adverse significance, without further mitigation.

Other Cetaceans

14.8.66 Whilst present in low density other species of cetacean, including dolphin and minke whale, may occasionally be present in Loch Snizort or Uig Bay.

14.8.67 The estimated distances for PTS in low and mid frequency cetaceans resulting from sound exposure are low, up to a maximum of 56 m. Since these distances are within the standard JNCC mitigation zone of 500 m PTS in any non-porpoise species of cetacean is not anticipated.

14.8.68 The TTS impact distances range from <10 m to 316 m, depending on the pile type. These distances are also within the standard JNCC mitigation zone of 500 m and therefore TTS in any non-porpoise species of cetacean is not anticipated. The standard mitigation measures mean highly mobile cetaceans can easily move away when the soft-start begins. Responses are expected to be largely behavioural, such as a change in swimming direction to move away from noisy construction. Impacts relate to individuals only and population effects are not anticipated.

14.8.69 The magnitude of the effect is considered to be negligible because there is only the occasional presence of low or mid-frequency cetaceans and with the standard mitigation measures effects will be behavioural. For a receptor of High sensitivity this results in an impact significance of minor adverse.

Seals

PTS and TTS Impact Evaluation

14.8.70 The maximum predicted distance to which permanent hearing threshold shift (PTS), is estimated to occur in seals is up to 10 m (Southall, et al., 2007) and 45 m (NMFS, 2018) (Table 14-9). For TTS the NOAA thresholds (NMFS, 2018) estimates possible temporary hearing damage at a range of distances, depending on pile type, from less than 10 m for small H piles, to 251 m for the larger tubular and sheet piles. These distances cover both SPL and cumulative SELs.

14.8.71 Therefore the maximum PTS and TTS impact distance for seals, for any of the impact piling is within the standard 500 m mitigation zone, where a qualified marine mammal observer (MMO) must confirm there has been a period of 20 minutes with no animals observed before a soft-start can begin (JNCC, 2010). Permanent or temporary hearing injury to seals as a result of impact piling is considered to be highly unlikely.

Behavioural Response Impact Evaluation

14.8.72 There are no specific thresholds for behavioural responses but they are likely at distances within and beyond the distance at which TTS could occur, possibly in the order of kilometres from the sound source. For example in other studies disturbance of seals was observed several kilometres away from impact piling (Madsen, Wahlberg, Tougaard, Lucke, & Tyack, 2006). However, in these studies seal numbers recovery rapidly after piling ceased. With the adoption of a soft-start (estimated to have a SSL approximately 12-13 dB lower that of full power) and a standard 500 m marine mammal mitigation zone no seals are likely to be startled by impact piling at a level which would be expected to cause a panic reactions

14.8.73 Impacts on the haul-out behaviour of harbour seals have also been observed in response to impact piling. For example, a 3 month study during impact piling at an offshore windfarm in the Baltic showed a 10% to 60% reduction in the number of seals hauled-out on a sand bank approximately 10 km away (Edren, Teilmann, Dietz, & Carstensen, 2004). However, this response was short-term as long-term surveys showed there was no decrease in the general abundance of seals during the construction period as a whole (Teilmann, Carstensen, Dietz, & Edren, 2004).

14.8.74 Also, due to the location of the impact piling within the Bay and the shape of the Bay in relation to the wider Loch the propagation of sound towards the seal haul-out locations on the Ascrib Island approximately 7 km away, no disturbance is expected.

14.8.75 Within Uig Bay the abundance of seals is low, largely restricted to occasional visits, possibly on foraging expeditions.

14.8.76 With the adoption of the standard mitigation measures comprising marine mammal observations, a marine mammal mitigation zone and a soft-start, the effect of impact piling is expected to be largely restricted to behavioural disturbance. Behavioural responses are expected to be limited to avoidance measures including swimming away, rather than a rapid panic response.

14.8.77 Thus, the magnitude of the impact of impact piling on seals is considered to be Low as it is likely to produce behavioural responses predominantly. For a receptor of Medium sensitivity this results in an impact significance of minor adverse.

Extent of Effect from Simultaneous Piling

14.8.78 The Proposed Development proposes to have up to two piling rigs on site at any one time. Therefore, it is possible that there may be periods where some simultaneous piling takes place. To minimise the impact of underwater sound on sensitive receptors, in particular the sound sensitive harbour porpoise, a key commitment is that no simultaneous impact piling, when the pile is in water, will take place at any time during construction .

14.8.79 Where vibratory piling is combined with impact piling, the sound pressure noise level is dominated by the impact piling - the SSL data shows SPLs for vibratory-piling are between 20 and 30 dBs below the highest sound level (see **Appendix 13.1** for SSLs for piling) - effectively masking the vibratory piling sound. Since a decrease in SSL of 3 dB represents a halving of the sound level a reduction of 20-30 dB shows vibratory piling is significantly less noisy.

14.8.80 However, SEL and cumulative SELs are increased by simultaneous piling. Sound propagation distances for impact piling and vibratory piling in combination have been calculated (**Appendix 13.1**).

14.8.81 Impact distances on the basis of SPL thresholds, the instantaneous (single strike) pressure level, are unchanged, at <10 m for all cetaceans for PTS and TTS. Thus, only an animal in very close proximity to the impact piling would suffer permanent or temporary hearing injury from the first strike of the impact hammer. Since the Proposed Development will be adopting soft-starts sound levels at the start of piling will be lower than the full power level and the observation period and mitigation zone minimises the chance of marine mammals being within this impact distance.

14.8.82 However, distances relating to the NOAA SEL criteria extend beyond the distance for the single piling rig, further than 10 km, but at these distances the propagation curves are only marginally different. As with a single piling rig the most likely area in which injury would occur is in much closer proximity to the sound source, particularly if animals are not able to move away.

14.8.83 Previous projects have demonstrated that harbour porpoise will avoid underwater sound pollution and so animals are unlikely to remain for long enough for PTS or

TTS to occur. There will however, be disturbance responses but only to relatively small numbers of animals as the density of harbour porpoise in this region is low. With the standard 2010 JNCC piling mitigation, animals can easily move away. In particular, the soft-start ensures that the likelihood of a panic response in an individual animal is minimised, and animals can swim away.

14.8.85 The number of individual animals likely to be affected is expected to be low with most significant impacts occurring to individuals within the Bay, where harbour porpoise are thought to be only occasional visitors. As impacts are considered to be predominantly behavioural, with PTS or TTS possible only very occasionally, the impact is considered to be of medium magnitude.

14.8.86 For a receptor of high sensitivity, but considered likely to be at low risk of being exposed to sound impact as a result of their low density within the impact zone, the impact of percussive (impact) piling is considered to be of moderate/major adverse significance**,** without further mitigation.

Mitigation Measures and Monitoring Requirements

14.8.87 The following mitigation measures detailed below are in addition to the standard 2010 JNCC requirements of (JNCC, 2010) and are proposed in order to address the potential for possible effects associated with PTS and TTS and to minimise behavioural disturbance in marine mammals as far as possible, particularly with respect to Harbour Porpoise associated with the Inner Hebrides and the Minches cSAC.

14.8.88 The additional mitigation measures to be adopted by the Proposed Development are as follows:

- The mitigation zone will be monitored by Marine Mammal Observers (MMOs) positioned at suitable vantage points to observe and monitor Uig Bay. The number and location of MMOs required to enable the mitigation zone to be observed will be determined and agreed within the MMMP, before construction starts;
- A standard pre-watch period of 30 minutes will be implemented before the commencement of any piling activity. Piling will not commence if any marine mammals are detected within the mitigation zone or until 20 minutes[4] after the last visual or acoustic detection. The MMO (and PAM operative when deployed) will track any marine mammals detected and ensure they are satisfied the animals have left the mitigation zone before they advise the crew to commence piling activities. Harbour porpoise dive for short periods only, and the density of harbour porpoise in this area is expected to be low so a longer observation period is not considered necessary;
- The use of PAM equipment positioned at a location to be agreed, close to the entrance to the Bay, to monitor for harbour porpoise, will be required for any impact piling that **commences** during periods of darkness, poor weather conditions and reduced visibility of marine mammals. The exact location of the PAM operator will be determined before construction commences but may require deployment of monitoring equipment from a boat;

[4] A 20 minute period is adopted by the JNCC seismic survey guidance. Issues of swimming speed and noise dosage are considered in the Thame Developer report - it is considered that twenty minutes is a sufficient period of time to allow individuals to be at a distance where risk of injury or death is minor.

- A soft-start procedures is required for all impact piling, with initial power levels to be approximately 10% of the final level[5], thereby ensuring a significantly lower sound source when piling activity starts giving animals the opportunity to move away before accumulated sound energy would be likely to result in hearing damage;
- Sound monitoring, including the collection of noise data from piling soft-starts, will be undertaken to monitor the effectiveness of the mitigation measures; and
- Any noise data collected during the construction of the Proposed Development will be considered for addition to the JNCC Marine Noise Registry.

14.9 Residual Effects

14.9.1 The adoption of the standard JNCC Mitigation Protocols along with additional PAM observation (when required) and appropriate soft-start procedures, is expected to further reduce the likelihood of PTS or TTS in harbour porpoise as a result of impact piling.

14.9.2 None-the-less some behavioural disturbance may still occur at the entrance to the Bay and into Loch Snizort, in areas outwith the 500m mitigation zone, but this will be temporary and short-term although as a result of a frequently recurring noise source, during construction. . It is anticipated that harbour porpoise may avoid the area around Uig Bay and Loch Snizort during the construction period but available evidence indicates animals will return to baseline once operations have stopped. No effects on the harbour porpoise population, other than temporary displacement from a non-key habitat, are anticipated.

14.9.3 Injury to harbour porpoise and other cetaceans is unlikely and responses will be limited to temporary avoidance of a relatively small number of animals. Thus, the magnitude of the impact is a minor shift away from baseline conditions during construction (low) No significant change to the operational noise climate is expected. Thus, the magnitude is assessed as Low in the medium-term and negligible in the long-term. For a receptor of high sensitivity this results in a residual impact of minor/moderate adverse impact significance.

Predicted Effects II - Disturbance or toxicity from Increases in Suspended Sediment and Changes to Water Quality.

14.9.4 The Proposed Development requires dredging, both capital and maintenance, and the disposal of this sediment at a newly licenced Proposed Sea Disposal Site just outside Uig Bay (**Figure 3.-3**). These activities have the potential to increase suspended and dispersed sediments, sediment deposition, and the release of any associated sediment contaminants into the water column and to the seabed.

14.9.5 There are two dredge pockets in the Proposed Development Site (**Figure 3-3**) with an estimated total volume of 27,992 m^3 of dredged sediment for disposal.

14.9.6 The main dredge pocket, Dredge Pocket 1 (DP1), is at the ferry berthing area, where the current pocket needs to be deepened to accommodate the new larger CFL ferry. The capital dredge at DP1 consists of approximately 29,642 m^3 of sediment.

14.9.7 A smaller dredge pocket (DP2) is at a section in front of the fisherman's compound, which will be dredged to a depth of 1.3 mCD (including 300 mm over dredge). The estimated volume from DP2 is approximately 1,150 m^3

[5] For example, in an offshore test piling project the soft-start increased the impact hammer power level from 80kJ to 800kJ over the standard 20 minute soft-start period (Robinson et al., 2007). The soft-start in this case resulted in a reduction of the Sound Pressure Level by 12dB.

14.9.8 For the purpose of undertaking this EIA, it is has been assumed that a CSD will be deployed to undertake the dredging required for the Proposed Development. Alternatively a backhoe dredger could be used but given the hard ground conditions on site the CSD method is considered the most likely option. The CSD method is also considered to be the worst-case option of the two and has therefore been used to undertake the assessment.

14.9.9 During CSD operations the dredged material is drawn up through the cutterhead and suction pipe and discharged in a hopper barge (self-propelled vessel) for transport to the Proposed Sea Disposal Site. Overflowing will not be allowed from the hopper barges during dredging operations.

14.9.10 It is anticipated that maintenance dredging will be required every 3-5 years to ensure safe operation of the ferry service. Maintenance dredging will likely use backhoe, grab and/or plough methods which have previously been used at Uig Harbour.

14.9.11 Results of the sediment characterisation and dispersion studies (see **Chapter 7: Marine Physical Environment**) indicate that surficial sediments from both dredge pockets are predominantly comprised of sand and silt material. However, sediments obtained from below the surface (i.e. borehole and trial pit samples) indicate an increased proportion of coarser material (sand and gravel) with fewer fines, particularly at Dredge Pocket 1 (DP1). In terms of anticipated dredge material, the composition from DP1 has been determined to be predominantly sand (57%), and predominantly fines (silt and clay) for DP2.

14.9.12 Sediment contamination was found to be widespread around Uig Bay, including within the two Dredge Pockets and the Proposed Sea Disposal Site with elevated levels of chromium and nickel above Action Levels (AL) at all stations sampled (Marine Scotland, 2017) (**Chapters 7 and 8**).

Magnitude of Effect

14.9.13 The magnitude of potential effects on environmental baseline conditions takes into account the scale or degree of change from the existing situation as a result of the effect; the duration and reversibility as well as consideration of relevant legislative or policy standards or guidelines.

14.9.14 Table 6-3 provides general definitions of the magnitude criteria used in the EIA. In each of the specialist chapters of the EIA Report, magnitude criteria are defined with reference to that particular discipline. The magnitude criteria in relation to water quality effects in marine mammals are shown in Table 14-10 below.

Table 4-10 Approach to EIA - Criteria used to Define the Magnitude of Effects

Magnitude Criteria	Description
High	Total loss or major alteration to key elements/features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed. Long-term and widespread changes in water quality above the range of natural variability.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed. Medium term and widespread changes in water quality.

Magnitude Criteria	Description
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of the baseline condition will be similar to the pre-development situation. Short-term and localised change in water quality above natural variability.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation. Water quality changes are short-term and within the range of natural variability such as storm driven changes.

Changes in suspended sediment concentration

14.9.15 Increased SSC are unlikely to affect marine mammals. Many species are observed in areas with high sediment load such as estuaries, demonstrating this tolerance. Higher turbidity than usual may reduce visual foraging in seals but cetaceans are able to locate prey using sound so increased SSC is unlikely to have an impact. Also, all marine mammals can easily move away from more turbid areas if required.

14.9.16 Changes in SSC as a result of dredging and dredge spoil disposal have been modelled and the impact assessed in **Chapter 7: Marine Physical Environment**. Increases in SSCs were found to be short-term only and at levels likely to be observed to occur naturally. The impact of increased SSCs was assessed to be of negligible significance.

14.9.17 In relation to marine mammals the magnitude of the effect is also negligible, leading to an assessed impact significance of minor for cetaceans and negligible for seals.

Changes in Water Quality

14.9.18 The release of sediments into the water column also has the potential to affect water quality indicators such as DO, biological and chemical oxygen demand and the concentration of in-water pollutant concentrations. An increase in chemical and biological oxygen demand, associated with elevated SSCs can reduce DO concentrations. However, the dredged material is coarse in nature and so the potential magnitude of the change in DO in the water column has been assessed as negligible (**Chapter 8**).

14.9.19 The sediments in Uig Bay are however, known to be contaminated, particularly with the heavy metals chromium and nickel and copper to some extent. The maximum dissolved fraction of these metals in the water column has been calculated, based on recognised sediment-water partition coefficients. This analysis, described in full in **Chapter 8**, indicates that dredging and disposal will result in increases in the concentration of these metals in the water but they will be very localised, largely restricted to the areas in which the activities occur, and they will be short-lived because of the rapid settlement of sediments, the partition to which they are mostly bound. The calculations also indicate that the EQS values are not exceeded. Thus, the magnitude of the effect of the Proposed Development on water quality has been assessed as low.

14.9.20 If low level contaminants are released into the water column during dredging or disposal, they may accumulate in marine animals and plants and transfer up the food chain to marine mammals. When present in sufficient quantities, contaminants can cause morphological or reproductive disorders in mammals and other fauna (ABP Research R512 1995). However, the concentrations predicted for the Proposed Development are lower than EQS values, indicating a low ecotoxicological risk, and considering the very short-term nature of the increases

the magnitude of the effect in marine mammals has been assessed as being negligible. For cetaceans, a receptor of high sensitivity this results in an impact of low significance and for seals, with moderate sensitivity, the impact significance is negligible.

14.10 Mitigation & Monitoring

Construction

14.10.1 Details of proposed acoustic mitigation commitments are set out within paragraphs 14.8.83 .

14.10.2 No mitigation measures or monitoring are required during the construction phase of the pier in relation to changes in water quality.

Operation

14.10.3 No mitigation measures are required during the operation phase of the pier which includes the continuation of vessel movements at the same pre-construction frequency and the same 3-5 yearly maintenance dredging programme to maintain the dredge pocket. Sediments will be disposed of at the Proposed Sea Disposal Site just outside Uig Bay for which a Marine Licence application may be required. It will be necessary to supply any information and allow whatever examinations and tests the licensing authority feels necessary, to help them decide if a licence should be issued.

14.11 Unplanned Events

14.11.1 Incorporated mitigation measures will be in place to minimise the potential for the accidental occurrence of spillage of hazardous wastes into the marine environment, and as such, will include chemical handling procedures for oils and fuels. HSE monitoring procedures with strict weather & personnel limits will be implemented during construction. It is considered that this will help minimise the risk of any accidental spillage.

14.11.2 Preparedness and response is vital in spill management and as such, plans will be in place should an accidental event occur.

14.12 Cumulative Effects

14.12.1 Grieg Seafood Ltd has a licence for the reinstatement of the Uig Bay (Rubha Riadhain) finfish farm operation with the intention of production recommencing in 2019. A total of eight cages of 120 m circumference with a feed barge at the north-eastern end of the cage group will be installed. The cages will be towed by sea to the Uig Bay site and anchored to the seabed.

14.12.2 The likely activities that could interact with the Proposed Development are:

- Increase in underwater sound due to installation and operation of the fish farm.
- Increase in the density of seals in Uig Bay as a result of the opening of the Uig Bay fish farm.

Cumulative Increase in Underwater Sound

14.12.3 Any noise from fish farm construction is expected to be minimal and will be masked by piling noise. There will be no fish added until the construction is complete and any seals in the Bay will be covered by the soft-start procedures. There is therefore, no anticipated cumulative effect of underwater sound from the two projects.

Increase in Seal Density

14.12.4 If seal density increases at the inner fish farm in Uig Bay the location of the farm is significantly outside the distance (up to 200 m) at which any permanent impact on seal hearing is predicted to occur. Some behavioural disturbance is possible but there will be soft-start mechanisms allowing easy movement away from the sound source.

14.13 European Protected Species (EPS) Licence Application Information

14.13.1 The construction works at Uig Pier have been demonstrated to have the potential to cause a minor to moderate behavioural disturbance effect to EPS, in particular the harbour porpoise. It is therefore considered necessary that the Proposed Development will require an EPS Disturbance Licence.

14.13.2 The following section gives consideration to the three fundamental tests in relation to an EPS assessment, namely:

- There is an over-riding public interest;
- There is no satisfactory alternative; and
- The action is not detrimental to the population of harbour porpoise at favourable status

Over-riding Public Interest

14.13.3 As discussed in **Chapter 1** Uig Harbour forms part of the 'Skye Triangle' of ports which provide lifeline ferry services for communities in the Western Isles; a role highlighted by national and local policy (see below).

14.13.4 The new vessel which will operate from Uig will be one of a new generation dual-fuel vessels currently under construction for CMAL, which is specifically required in order to deliver The Scottish Government commitment to deliver emission reductions as part of their Climate Change commitments. In order to accommodate this new vessel and make provision for LNG fuelling facilities the harbour upgrades proposed within the Proposed Development are essential.

There is no Satisfactory Alternative

14.13.5 Alternatives to the Proposed Development have been considered as set out within **Chapter 2**: **Alternatives and Design Evolution**.

The Action is not Detrimental to the Population of Harbour Porpoise at Favourable Conservation Status

14.13.6 With the proposed mitigation measures that will be adopted by the Proposed Development, the construction programme at Uig will not be detrimental to the harbour porpoise population protected by the Inner Hebrides and Minches SAC. The 'Favourable Conservation Status' and long-term survival of harbour porpoise are not anticipated to be affected by the Proposed Development works as detailed below.

14.13.7 The conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within its natural range.

14.13.8 The conservation status will be taken as 'favourable' when the following (i) to iii) conditions are met. The impact of the Proposed Development on each of these conditions is discussed below:

- Population dynamics data on the species concerned indicates that it is maintaining itself on a long-term basis as a viable component of its natural habitats: There are no

recent data available to determine the maintenance of population dynamics as the SAC was only proposed in 2016. The SCANS data, used in the current assessment and for the designation of the IHM SAC are the most recent data on population numbers. The impact assessment above indicates that after project control measures and additional mitigation the impact on harbour porpoise will be some minor behavioural disturbance. It is considered this will not have any effect on the maintenance of harbour porpoise populations in the Inner Hebrides and Minches SAC or Scotland more widely.

- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future. The Proposed Development will not reduce the natural habitat of harbour porpoise. The key activity on the project is impact piling that will result in some behavioural avoidance disturbance to a small number of harbour porpoise over the period of construction which may exclude animals for short periods of time when piling activities are being undertaken. When the building works at the pier are complete the underwater sound environment will return to the pre-works baseline and any avoidance behaviour by harbour porpoise will stop. The area affected by the Proposed Development is also very small in relation to the total range of the harbour porpoise and is a very small proportion of the porpoise Inner Hebrides and Minches cSAC.
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. The area around the Proposed Development in Uig Bay, whilst in close proximity to the SAC boundary (approximately 1 km away), is an area of the protected site that has a much lower density of harbour porpoise than other areas. This indicates that Uig and Loch Snizort are probably not the most important habitat and foraging area for the species.

  In the northern area of Skye, that includes Loch Snizort, part of the SAC the density of harbour porpoise is 0.394 individuals/km^2 compared to 1.071 animals per km^2, in the Inner Hebrides which includes the southern region of the Isle of Skye. The area of Loch Snizort is approximately 115 km^2 which accounts for less than 1% of the total SAC harbour porpoise habitat.

  Therefore, whilst there will be some disturbance to harbour porpoise during piling works they are (i) temporary; (ii) short in duration, estimated to be less than an hour per day on average though piling activity will be frequent and (iii) comprises a very small area, which does not represent the most preferred habitat within the SAC.

  Thus, the Proposed Development is highly unlikely to reduce the habitat required for harbour porpoise to maintain the long-term population.

14.14 Summary & Conclusion

14.14.1 No significant impacts to marine mammals, as a result of the construction or operation of Uig Ferry Terminal, after control and mitigation measures, are predicted (Table 14-11).

Table 14-11 Summary of Impact Assessment for Marine Mammals

Effect/ Activity	Receptor	Receptor Sensitivity	Magnitude of Event Prior to Mitigation	Impact Significance Prior to Mitigation	Mitigation Measures Adopted	Post Mitigation Impact Significance
Injury or disturbance from vibratory piling	All cetaceans	High	Negligible	Low	None	Adverse Minor
	Seals	Medium	Negligible	Negligible	None	Adverse Negligible
Injury or disturbance from impact piling	Harbour porpoise	High	Medium	Moderate/ Major	Increased observation zone, PAM operator, bubble curtain	Adverse Minor/ Moderate
	All other cetaceans	High	Negligible	Minor	As above	Adverse Minor
	Seals	Medium	Low	Minor	As above	Adverse Minor
Change in suspended sediments from dredge and disposal	All cetaceans	High	Negligible	Minor	None	Adverse Minor
	Seals	Medium	Negligible	Negligible	None	Adverse Negligible
Change in water quality	All cetaceans	High	Negligible	Minor	None	Adverse Minor
	Seals	Medium	Negligible	Negligible	None	Adverse Negligible

15. Ornithology

15.1 Introduction

15.1.1 This chapter of the Environmental Impact Assessment (EIA) Report provides an assessment of the potential effects of the Uig Harbour Redevelopment (hereafter referred to as the 'Proposed Development') on ornithology interest. Where appropriate, it provides proportionate measures to avoid, mitigate or compensate for adverse impacts.

15.1.2 **Chapter 3: Project Description** of this EIA Report provides a detailed description of the works required to implement the Proposed Development.

15.1.3 The Proposed Development lies within Uig Bay, a sheltered inlet of Loch Snizort on the west coast of the Trotternish Peninsula in the north of Skye. At its widest (excluding the secondary bay of Camas Beag), Uig Bay is approximately 1.5 km across. Much of the shoreline comprises loose cobbles over muddy sand, with cliffs rising around Rubha Riadhain on the south side of the bay. At its head, where the River Rha and River Conon flow into Uig Bay, a more extensive area of muddy sand is exposed at low tide. There are also patchy areas of saltmarsh at the head of Uig Bay, extending in a thin patchy strip round the north side of Uig Bay to the existing marshalling area car park. Further details on the intertidal and benthic habitats which support bird populations within Uig Bay are provided in **Chapter 12: Benthic Ecology** of this EIA Report.

15.2 Legislative and Policy Context

15.2.1 This assessment has been undertaken within the context of the following relevant legislation, planning policies and guidance documents:

- Directive 2009/147/EC on the conservation of wild birds ('Birds Directive');
- Convention on Wetlands of International Importance ('Ramsar Convention');
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) ('Habitat Regulations');
- Wildlife and Countryside Act (1981) (as amended in Scotland) ('WCA');
- Wildlife and Natural Environment (Scotland) Act 2011 (as amended) ('WANE Act');
- Scottish Planning Policy 2014;
- Highland-wide Local Development Plan 2012; and
- Birds of Conservation Concern (BoCC) 4 (Eaton, et al., 2015).

15.2.2 .Further information on the above legislation and policy is given in **Appendix 4.1**.

15.3 Assessment Methodology & Data Sources

Desk Study

15.3.1 A search was made to identify any international nature conservation designations with bird species as qualifying features (i.e. SPAs and Ramsar sites) within 10 km of the Proposed Development, national statutory nature conservation designations (i.e. Sites of Special Scientific Interest (SSSIs)) with birds as notified features within 2 km, and any other local designations with ornithological interest within 2 km. The

search utilised the SNH SiteLink website (SNH, 2018)and the Highland-wide Local Development Plan.

15.3.2 Ornithological information specifically concerning corncrake and white-tailed eagle was obtained through personal communication with SNH and the Highland Raptor Study Group.

15.3.3 Information was obtained from the report on a single breeding bird survey carried out around Uig Harbour in May 2017 provided in **Appendix 15.1**.

15.3.4 Data from the Wetland Bird Survey (WeBS) was not used[6]. Uig Bay is a vacant WeBS count area, no surveys having been carried out since 2005/06 when a single survey recorded ten species, all in low numbers (WeBS, 2018). Given the age of these WeBS data and that all of the recorded species were present during the surveys carried out for this EIA, they were not considered useful.

Survey Scope

15.3.5 The required survey scope was developed based on a review of desk study information and previously completed third party survey results, as discussed below.

Breeding Birds

15.3.6 The habitats within and immediately around Uig Bay are generally of low value to breeding bird species, other than those which are common and widespread. This is particularly the case around Uig Harbour and the settlement of Uig itself.

15.3.7 A Phase 1 habitat survey was carried out in 2017 in the Proposed Development Site (Tyler, 2017b), which determined that semi-improved acid grassland and introduced shrub habitats were present in the Proposed Development vicinity. Additional observations during the bird surveys (see below for further detail) identified small amounts of rough neutral grassland and ruderal vegetation along the shore and adjacent to existing buildings. A thin strip of rough neutral grassland and ruderal vegetation, occasionally damp, continues around the edge of Uig Bay. There is also a very thin and intermittent strip of saltmarsh vegetation around the upper edge of the intertidal zone between the existing pier and head of Uig Bay. The nature and small extent of these habitats is consistent with the likely presence of small numbers of common and widespread bird species, with the exception of corncrake *Crex crex* which is discussed below. Although breeding bird surveys were consequently excluded from the survey scope (see below), this conclusion is supported by a single breeding bird survey carried out around the Proposed Development in May 2017 (Tyler, 2017c) which found only a small number of common and widespread breeding species.

15.3.8 The cliffs of Rubha Riadhain, on the southern outer edge of Uig Bay, could support nesting seabirds. However, at approximately 1.2 km from the closest point of the pier at Uig Harbour there is no risk of disturbance to seabirds breeding on these formations, which were consequently excluded from the survey scope. Possible disturbance of these birds by dredging barges whilst foraging is discussed in the impact assessment below.

15.3.9 There are however two notable breeding species of possible concern in the Uig Bay area: corncrake *Crex crex* and white-tailed eagle *Haliaeetus albicilla*. Corncrake was reported to be irregularly present (i.e. not every year) in the Uig area by the RSPB Corncrake Officer for Skye. A white-tailed eagle breeding site was reported in the relevant 10 km square by the Highland Raptor Study Group (*pers. comm.* 1st December 2017) and had also been referred to by SNH (Alex Turner, SNH, *pers.*

[6] WeBS is a national scheme coordinated by the British Trust for Ornithology (BTO) to monitor non-breeding waterbirds, involving synchronised monthly bird counts at wetlands and coastal areas.

comm. 17th July 2017). The white-tailed eagles were reported to have used the breeding site for at least the last three years, and it is assumed that they will continue to do so. As specially-protected bird species of high conservation concern listed on Schedule 1 of the Wildlife and Countryside Act 1981 WCA, measures must be taken to minimise risk of their disturbance and associated legal offences.

15.3.10 For both corncrake and white-tailed eagle, sufficient desk study and third party information is already available to inform this assessment includes mitigation commitments and specific precautionary methods of working in order to avoid their disturbance.

15.3.11 Given the lack of likely impact on breeding seabirds, the general low value of the area for breeding birds, and the likely negligible impact of works associated with the Proposed Development which can be mitigated by standard mitigation (such as timed clearance of vegetation or ecologist supervision of such clearance), breeding birds were removed from the survey scope. SNH agreed with this course of action (Alex Turner, SNH, *pers. comm.* 17th July 2017).

Wintering/Passage Birds

15.3.12 However, coastal areas, and especially sheltered bays and estuaries which provide refuge from harsh winter conditions, can be important areas for birds outside of the breeding season. Given suitable foraging and roosting habitat, which occur within Uig Bay, wintering/passage waterbirds may aggregate in large flocks through the winter or during migration in spring and autumn. Such aggregations of birds may utilise specific areas and can be vulnerable to disturbance, especially in cold weather when their energy requirements are highest. Consequently, the potential for wintering/passage waterbirds to make use of the bay during the non-breeding season was investigated, and the scope accordingly included a non-breeding bird survey.

Field Survey

15.3.13 A program of winter bird surveys was carried out to collect information on the assemblage of non-breeding waterbirds in Uig Bay between September and December 2017, inclusive.

15.3.14 The surveys followed an adapted version of the methods described in (Bibby, Burgess, Hill, & Mustoe, 2000) for counting flocking and migrating birds. Suitably qualified and experienced AECOM Ecologists walked around Uig Bay on each survey, walking in different directions on each visit. The surveys were timed to coincide with high tide or low tide to collect information on bird usage of the area for foraging (which for certain species such as waders would occur more widely at low tide) and roosting (which for the same species would be more prevalent at high tide when foraging areas were under water). High tide and low tide surveys were carried out within two hours either side of the time of high or low tide, respectively.

15.3.15 The target species during the surveys were all species of waterbird, as defined by the British Trust for Ornithology (BTO) for the WeBS (WeBS, 2018). These were all species of divers, grebes, cormorants, herons, swans, geese, ducks, rails, waders, gulls, terns and kingfisher *Alcedo atthis*. However, other notable species such as raptors listed on Schedule 1 of the WCA were also recorded.

15.3.16 Whilst walking around the bay, the surveyors made regular stops to scan the survey area using binoculars and tripod-mounted telescope, and recorded all target species encountered. To facilitate recording, the bay was split into five ‘count sectors’, the birds present in each sector being counted separately. The count sectors, which together comprise the ‘Site’, are shown in **Figure 15.1**. In addition, birds on the existing pier structure were counted separately. Effort was made to try and avoid double counting (e.g. when birds were observed moving from one count

sector to another, these were not re-recorded). Only birds which were clearly using the bay were recorded (i.e. those simply flying over and not foraging, roosting or loafing were not counted).

15.3.17 A record of the survey dates and weather conditions on each occasion are provided in Table 15-1, below. The time of high or low tide is as given for Uig Bay (Loch Snizort).

Table 5-1 Uig Bay - Wintering Waterbird Survey Schedule

Survey Date	Surveyor*	High or Low Tide Survey?	Time of High/ Low Tide	Start Time	End Time	Summary of Weather Conditions
22 September 2017	TM	High	07:27	06:45	08:45	Moderate breeze at survey start but easing throughout, water calm in Uig Bay and excellent visibility at all times.
19 October 2017	ND	Low	13:33	12:00	15:00	Light breeze from the west or south-west with no rain and excellent visibility throughout survey.
17 November 2017	ND	Low	12:10	10:20	12:15	Wind speeds varying from light to moderate, coming from the west, with light showers during survey but visibility still beyond 2 km.
12 December 2017	TM	High	14:20	12:20	14:10	Light to moderate winds throughout creating minor swell which is not believed to have significantly hampered observation of loafing birds on water, persistent rain during second half of survey with visibility through optics reduced.

** TM = Tony Marshall (AECOM Principal Ecologist); ND = Nick Dadds (AECOM Senior Ecologist).*

15.3.18 The data collected during each survey were aggregated into tables, which are set out in the baseline conditions (Section 15.4) below.

Assessment Method

15.3.19 This assessment of potential impacts on ornithological features broadly follows guidelines for Ecological Impact Assessment (EcIA) published by the CIEEM (2018) and represents an expanded methodology which remains in line with the core impact assessment methodology set out within **Chapter 6: Approach to EIA** of this report. These guidelines have been endorsed by, amongst others, the Institute of Environmental Management and Assessment (IEMA), the Wildlife Trusts, the Association of Local Government Ecologists (ALGE) and SNH. The principal steps are summarised below:

- Data are obtained on ornithological features potentially affected through targeted desk study and field survey to determine baseline conditions (both at the expected time of

construction commencement and, for comparison, at a future point in the absence of the Proposed Development);

- The importance of identified ornithological features is evaluated in a geographic context, and features requiring more detailed impact assessment are determined;
- The potential impacts of the Proposed Development that could affect ornithological features are described, accounting for embedded mitigation;
- The likely effects on ornithological features are assessed and if possible quantified;
- Measures are developed to mitigate (by avoidance or reduction), or if necessary compensate, for any likely significant adverse effects;
- The significance of any residual effects (beneficial or adverse) is reported; and
- Scope for enhancement in relation to ornithological features is considered.

15.3.20 The geographic scale for evaluating ornithological features in this assessment is shown in the list below, in decreasing order of importance. The Regional level uses the relevant Natural Heritage Zone (NHZ) as defined by SNH (2002) rather than a statutory area:

- International;
- National (Scotland or UK);
- Regional (Western Seaboard NHZ);
- Local (approx. 10 km radius from the Proposed Development); and
- Site (Uig Bay).

15.3.21 The assessment considers the sensitivity of bird species to possible disturbance or harm as a result of different aspects of the Proposed Development, using published evidence (where available) or professional judgement.

15.3.22 Consideration is given to cumulative effects, since impacts acting in combination may have a cumulative impact exceeding that of the separate individual impacts. Cumulative effects on a feature may arise from a combination of effects from the Proposed Development itself (e.g. effects at the construction and operational stages), or the combined effects arising from the Proposed Development and other developments.

15.3.23 In determining the significance of effects, the professional opinion of experienced ecologists is applied as necessary.

15.3.24 Notwithstanding the significance of any impacts, this chapter also comments on compliance with nature conservation legislation and states any requirements to achieve compliance.

Limitations

15.3.25 A total of four monthly counts of waterbirds using Uig Bay were made between September and December 2017. Although the survey programme did not cover the full winter period[7] it is not considered that this presents a significant limitation to the assessment of potential effects on non-breeding birds from the Proposed Development, as the results of the surveys revealed that Uig Bay supports a relatively limited assemblage of wintering waterbirds comprising a limited diversity of species when compared to more important estuaries and coastal areas. It is not expected that the numbers of birds or the diversity of species would be significantly

[7] The full winter period is typically taken to extend from September to February, inclusive.

different in January or February and it is therefore considered to be reasonable to conduct the EIA on the results of the survey programme completed in 2017.

Summary of Consultation

15.3.26 Consultations specific to this chapter were made with the organisations in Table 15-2 below.

Table 5-2 Summary of Consultations Relevant to Ornithology

Consultee	Summary Response	Comment/Action Taken
SNH Area Officer for Skye and Lochalsh	Commented on proposed survey scope, which was agreed with. Stated that it would likely be acceptable to exclude all breeding bird surveys (including corncrake) from the survey scope, with implementation of standard mitigation including nesting bird checks ahead of construction. Commented that possible effects on white-tailed eagle should be addressed.	None required regarding survey scope. White-tailed eagle included in assessment and Highland Raptor Study Group contacted.
RSPB Corncrake Officer for Skye	Reported that corncrake breeds in some years in the fields around the peripheries of Uig, and that the small area of habitat to be lost to the Proposed Development is of moderate rather than high quality for corncrakes.	This information has been incorporated into the impact assessment.
Highland Raptor Study Group	Reported that white-tailed eagle breeds within the 10 km square containing the Proposed Development.	This information has been incorporated into the impact assessment.

15.4 Baseline Conditions

Designated Sites

15.4.1 There are no SPAs or Ramsar sites within 10 km of Uig Harbour. Neither are there any SSSIs with notified ornithological interest or other local designations with ornithological interest within 2 km. The bird species present in Uig Bay do not warrant larger search distances for designated sites (as may be the case for foraging geese, for example).

Ornithological Desk Study Data

15.4.2 It is understood that in some years corncrake breeds in the fields around the peripheries of the town of Uig[8]. Additionally, white-tailed eagle is reported to breed within the 10 km square which includes Uig Bay[9]. Note that in accordance with SNH guidance on sensitive species, more precise locations of the breeding sites for these species cannot be disclosed in a publicly-available document such as this EIA Report. A confidential figure (**Figure 15.2**) to this report is available for viewing by relevant parties.

15.4.3 The breeding bird survey carried out around Uig Harbour in May 2017 recorded a total of eight species, of which four were considered to be breeding. These were house sparrow *Passer domesticus*, starling *Sturnus vulgaris*, sedge warbler

[8] As identified during consultation with the RSPB Corncrake Officer for Skye.
[9] As identified during consultation with the Highland Raptor Study Group.

Acrocephalus schoenobaenus and wren *Troglodytes troglodytes*. Further details of this survey are provided in **Appendix 15.1** (Tyler, 2017c).

15.4.4 Although the Uig Bay WeBS count area is currently vacant, it is notable that it is identified by the BTO as being of the lowest priority for survey, indicating that it is considered to be of limited importance to passage and over-wintering waterbirds. The other WeBS count areas in Loch Snizort are also vacant but are similarly identified as being of low priority for survey, further suggesting that the wider area is not of high importance to non-breeding waterbirds. By contrast, Loch Slapin, on the south side of Skye, is vacant but identified as being of high priority for survey, suggesting a potential relatively high importance of this site to non-breeding birds.

Field Survey

15.4.5 The following bird species were recorded during the wintering waterbird surveys, listed in each group in descending order of maximum observed abundance:

- Waders: curlew Numenius arquata, redshank Tringa totanus, oystercatcher Haematopus ostralegus, turnstone Arenaria interpres;
- Ducks: eider Somateria mollissima, mallard Anas platyrhynchos, red-breasted merganser Mergus merganser, wigeon Anas penelope;
- Seabirds: herring gull *Larus argentatus*, great black-backed gull *Larus marinus*, shag *Phalacrocorax aristotelis*, common gull *Larus canus*, gannet *Morus bassanus*, cormorant *Phalacrocorax carbo*, black guillemot *Cepphus grylle*, great northern diver *Gavia immer*, red-throated diver *Gavia stellata*, black-throated diver *Gavia arctica*, razorbill *Alca torda*; and
- Other waterbirds: grey heron *Ardea cinerea*, dipper *Cinclus cinclus*.

15.4.6 The survey area was split into five sectors, as shown in **Figure 15-1**, and as described below:

- Sector 1: The northern section of the outer part of Uig Bay, extending westwards from the existing pier;
- Sector 2: The area immediately east of the existing pier, encompassing the proposed extension of the marshalling yard into the intertidal zone, a small existing slipway, and the area in which small vessels are currently moored.
- Sector 3: The head of Uig Bay, encompassing the most extensive mudflat area.
- Sector 4: The zone extending south-east of the existing pier.
- Sector 5: The southern section of the outer part of Uig Bay, directly south of Sector 1.

15.4.7 The results of the wintering waterbird surveys for September, October, November and December are set out in Tables 15-3 to Table 15-6 below by count sector as shown in **Figure 15-1.**

Table 5-3 September 2017 Waterbird Survey Results

Species	Count Sector						
	1	2	3	4	5	Pier	Total
Wigeon			4				**4**
Mallard			30				**30**

Eider				12			**12**
Red-breasted merganser			13				**13**
Gannet	6	2	3	3	16		**30**
Cormorant	1						**1**
Shag				3	1		**4**
Grey heron		1	4				**5**
Oystercatcher	2		1	1			**4**
Curlew			16				**16**
Redshank	9		8				**17**
Black guillemot				3			**3**
Razorbill		1					**1**
Great black-backed gull			3			1	**4**
Common gull			30				**30**
Herring gull	30	3	4	2		28	**67**
Total	**48**	**7**	**116**	**24**	**17**	**29**	**(241)**

Table 5-4 October 2017 Waterbird Survey Results

Species	Count Sector						
	1	2	3	4	5	Pier	Total
Mallard			8	16			**24**
Eider	43	6		22			**71**
Goldeneye				1			**1**
Red-breasted merganser		5	7		1		**13**
Red-throated diver					1		**1**
Great northern diver					2		**2**
Shag	3	6	1	2	30		**42**
Grey heron		2	1	1			**4**
Oystercatcher	1		3		1		**5**
Curlew		1	7		1		**9**
Redshank	3	3	1				**7**
Black guillemot			1	3	1		**5**
Black-headed gull					1		**1**

Species	Count Sector						
	1	2	3	4	5	Pier	Total
Great black-backed gull	12		42	1	9		**64**
Common gull			26		3		**29**
Herring gull	33	18	31	1	27		**110**
Dipper			1				**1**
Total	**95**	**41**	**129**	**47**	**77**	**0**	**(389)**

Table 5-5 November 2017 Waterbird Survey Results

Species	Count Sector						
	1	2	3	4	5	Pier	Total
Wigeon			5				**5**
Mallard			10				**10**
Eider	12	3		3		25	**43**
Red-breasted merganser		2					**2**
Black-throated diver					1		**1**
Shag	3	3			5		**11**
Grey heron	1	2					**3**
Oystercatcher		1	2				**3**
Curlew	1	3	2				**6**
Redshank			3				**3**
Turnstone	4						**4**
Black-headed gull			1				**1**
Great black-backed gull	1	4	17				**22**
Herring gull	3	9	8				**20**
Dipper		1					**1**
Total	**25**	**28**	**48**	**3**	**6**	**25**	**(135)**

15.4.8 As shown in the above tables, the largest numbers of birds were consistently observed in Sector 3. This is to be expected given that the largest expanse of intertidal substrate is found in this sector, attracting various foraging and roosting/loafing birds. The majority of the recorded birds in this sector comprised common species of gulls and ducks (primarily great black-backed gull, herring gull, common gull, mallard and wigeon). Counts of wading birds were low, reaching peaks of 16 curlew and 8 redshank in this sector in September 2017, with a maximum of 3 oystercatcher in October.

15.4.9 Total counts of curlew and redshank across all sectors reached a maximum of only 16 and 17 birds, respectively, in September. Oystercatcher numbers were very low (maximum 5 birds). Turnstone peaked at 9 birds in December (in Sectors 1 and 2, the only sectors in which they were recorded). **Note**: turnstone were observed both roosting and foraging in Sector 1.

15.4.10 Total counts of gulls, mallard, wigeon and waders were generally lower elsewhere than in Sector 3. Exceptions to this were redshank and herring gull. Redshank peaked at 9 birds in Sector 1. Herring gull was at times present in larger numbers in Sector 1 (up to 33 birds), Sector 2 (up to 18 birds) and sector 5 (up to 27). On one occasion, 27 herring gulls were present roosting on the existing main pier.

15.4.11 Of the other sea-going birds, shags were the most common. Shags occurred throughout the recording area and were exceptionally abundant in October, with 30 birds recorded in Sector 5. Note that on the day after the October survey, 26 shags were also incidentally observed on the small slipway in Sector 2, east of the main pier. Gannets were recorded once in high numbers (30 in September), the majority being in the outer parts of the bay. Other sea-going birds comprised small numbers of divers in the outer parts of the bay, and small numbers of black guillemot in most sectors. Additionally, up to 13 red-breasted merganser were observed (mostly in the inner parts of the bay including Sector 2).

15.4.12 Other than the sighting of 27 herring gulls on the main pier in September, the only birds noted in close proximity to the main pier were a flock of 25 eider, which were observed sheltering in the immediate lee of the pier, in November. Eider were observed in all sectors of Uig Bay but were most frequent in the outer parts (Sectors 1, 4 and 5) and peaked at a total of 43 birds in November.

15.4.13 Although no observed aggregations of birds were especially large, the locations of roosts or other larger groups are shown on **Figure 15-1** along with the count sectors. These mainly involved roosting gulls, but also highlighted is a small roost of turnstone (4 birds), a group of 20 mallard and a high-tide roost of 16 curlew. Also illustrated in this figure are the locations of two larger flocks of eider, one by the pier (25 birds) and one in the open water in the middle of the bay (43 birds), and two locations of shag (26 roosting on the small pier in Sector 2, and 24 foraging on the south side of the Uig Bay).

15.4.14 The gull roosts at or by the pier were dominated by herring gull, and this species also occurred in various other locations, including in larger numbers in the roosts at the head of Uig Bay at low tide, and once on the south edge of Uig Bay. Within the gull roosts at the head of the bay in autumn (September/October) were up to 30 common gulls, both at high and low tide, but this species was not regularly seen elsewhere in the bay. Great black-backed gulls also predominately occurred at the roosts at the head of the bay, with up to 42 birds in October.

15.4.15 The following notable incidental observations were made of non-waterbird species:

- During the September survey, a peregrine *Falco peregrinus* was observed flying westwards along the north side of Uig Bay;
- During the October survey, a golden eagle *Aquila chrysaetos* overflew Sectors 2, 1 and 5 at height;
- During the November survey, a raven *Corvus corax* was present in Sector 3; and
- During the December survey, 5 red-throated divers were present on the sea beyond sectors 1 and 5.

Future Baseline

15.4.16 There is one relevant development known to be in progress in the Uig Bay area, involving a new salmon fish farm on the south side of Uig Bay. This is discussed under cumulative effects in Section 15.10.

15.4.17 The current activity of vessels in the bay (the existing ferry, and a small number of fishing, commercial and recreational vessels) is not expected to alter significantly prior to the Proposed Development. The effects of the new fish farm on the south side of Uig Bay are not expected to be significant cumulatively (see Section 15.10). There are therefore no notable influences on the bird assemblage that may cause a significant alteration prior to the Proposed Development commencing. It is therefore anticipated that the baseline will not be significantly different to that described above at that time.

15.4.18 These factors are also expected to remain similar in the long-term in the absence of the Proposed Development. Factors which may affect the long-term future baseline would include changes in national or international trends in bird distributions, and 'coastal squeeze' as a result of climate change.

15.5 Evaluation and Sensitivity

Breeding Birds

15.5.1 As discussed in Section 15.3 above, with the exception of corncrake and white-tailed eagle, significant effects on breeding birds are not anticipated as a result of the general low value of potentially affected habitat to support breeding birds.

Corncrake

15.5.2 Corncrake is listed on Schedule 1 of the WCA that is now largely confined as a breeding bird to the Inner and Outer Hebrides and Orkney. Within the Western Seaboard NHZ[10], breeding corncrakes are confined to parts of north and west Skye, and small islands to the south of Skye and near Mull (Forrester and Andrews, 2007). For this reason, and although the population around Uig vicinity is not always present, the local corncrake population is considered to be of Regional importance.

15.5.3 Corncrake is relatively tolerant to disturbance, since it is known to nest in close proximity to people and agricultural activities, including at Uig where the reported nesting locations include fields immediately adjacent to the town. Consequently, nesting corncrakes are considered to be of Low sensitivity.

White Tailed Eagle

15.5.4 White-tailed eagle is a relatively rare breeding species and is listed on Schedule 1 (and also on additional Schedules 1A and A1 which protect it from harassment at any time and protect habitually used nests from damage/interference at any time). A single breeding site for this species is considered to be of Regional rather than National importance, given that the national population estimate in 2007 was reasonable at 250-300 birds (Forrester & Andrews, 2007) and this figure is now likely to be higher given reported national breeding success and further introductions since then (SNH, 2016).

15.5.5 Sensitivity of white-tailed eagle to disturbance whilst nesting is likely to vary from pair to pair and be greater for those birds not habituated to existing disturbance sources. Breeding behaviour may be adversely affected if disturbance occurs within 500-750 m and possibly (in the extreme) up to 1 km (Ruddock & Whitfield, 2007). Consequently, nesting white-tailed eagle is considered to be of High sensitivity.

[10] A biogeographic area defined by SNH that is based on natural diversity rather than administrative boundaries.

Wintering and Passage Birds

15.5.6 Table 15-6 below sets out the nature conservation value of the observed wintering/passage bird populations. For comparison, total wintering or passage population estimates for Scotland or regions have been taken from (Forrester & Andrews, 2007) Note (as set out in para 15.3.19) that for the geographic scale of value in this assessment, 'Local' refers to an approximate 10 km radius from the Proposed Development, and 'Site' means Uig Bay.

Table 5-6 Assessment Value of Wintering/Passaging Birds

Species	Value	Rationale
Wigeon	Local	Relatively common and widespread wintering species at coastal and freshwater locations throughout most of Scotland, present in moderate numbers in Uig Bay during field survey (maximum of 11, compared to Scottish winter estimate of 76,000-96,000).
Mallard	Local	Common and widespread species throughout Scotland all year, present in moderate numbers in Uig Bay during field survey (maximum of 30, compared to Scottish winter estimate of 65,000-90,000).
Eider	Local	Common and widespread species in most coastal waters all year around Scotland, present in moderate numbers in Uig Bay during field survey (maximum of 71, compared to estimates of, for example, 3,000 birds in Argyll and Outer Hebrides, and 4,500 in Sutherland/Caithness).
Goldeneye	Site	Common wintering species, only 1 bird seen during field survey in Uig Bay.
Red-breasted merganser	Local	Relatively common and widespread around Scotland, maximum of 13 seen in September/October 2017 though only 2 or 3 in November/December (compared to Scottish winter estimate of 8,500).
Gannet	Local	Very wide-ranging species seen commonly around Scottish coasts, present in moderate numbers in Uig Bay during field survey (maximum of 30) but mainly in outer parts of bay.
Red-throated diver	Local	Occurs widely around Scottish coasts in winter, 1 bird only seen in outer part of Uig Bay (compared to Scottish winter estimate of up to 4,850).
Black-throated diver	Local	Occurs locally around Scottish coasts in winter, though only 1 bird only seen, in outer part of Uig Bay (compared to Scottish winter estimate of 300-400).
Great northern diver	Local	Fairly common in winter particularly in northern Scottish waters, 2 birds seen simultaneously in outer part of Uig Bay (in comparison to estimate of 2,000-3,000 wintering birds around Scotland).
Cormorant	Site	Common and widespread coastal and freshwater species, maximum of 6 birds seen in Uig Bay during field survey in December (compared to Scottish winter estimate of 9,000-11,500).
Shag	Local	Common and widespread on the Scottish west coast, moderate numbers of up to 26 birds seen in September/October in Uig Bay, though present in as low numbers as 4 in December (compared to Scottish winter estimate of 60,000-80,000).

Species	Value	Rationale
Grey heron	Site	Common and widespread coastal and freshwater species, moderate numbers of up to 5 seen in Uig Bay during field survey (compared to Scottish winter estimate of 10,000-15,000).
Oystercatcher	Site	Common and widespread around Scottish coasts, small numbers of up to 5 seen in Uig Bay during field survey (compared to Scottish winter estimate of 80,000-120,000).
Curlew	Local	Common and widespread around Scottish coasts, fairly low numbers of up to 16 seen in Uig Bay during field survey (compared to Scottish winter estimate of a minimum of 85,700).
Redshank	Local	Common and widespread around Scottish coasts, fairly low numbers of up to 17 seen in Uig Bay during field survey (compared to Scottish winter estimate of 40,000-50,000).
Turnstone	Local	Common and widespread around Scottish coasts, fairly low numbers of up to 9 seen in Uig Bay during field survey (compared to Scottish winter estimate of 35,260).
Black guillemot	Local	Fairly common and widespread on Scottish west and north coasts, up to 5 seen in Uig Bay during field survey (compared to Scottish winter estimate of 40,000-60,000).
Razorbill	Site	Fairly common and widespread around Scottish coasts, only 1 seen in Uig Bay during field survey (compared to Scottish winter estimate of 50,000-250,000).
Black-headed gull	Site	Not common on the Scottish west coast in winter, but no more than 1 seen in Uig Bay during field survey (compared to Scottish winter/passage estimate of 20,000-155,000).
Great black-backed gull	Local	Fairly common and widespread around most Scottish coasts, up to 64 seen in Uig Bay during field survey (compared to Scottish winter/passage estimate of 7,500-10,000).
Common gull	Local	Not common on the Scottish west coast in winter, up to 30 seen in Uig Bay during field survey but this is considered likely to be unusual, particularly given reports of exceptional numbers elsewhere on Skye at Portree in November 2017 (Skye Birds, 2017) (compared to Scottish winter/passage estimate of 79,700-200,000), therefore not regionally important.
Herring gull	Local	Common and widespread around Scottish coasts, fairly large numbers of up to 110 seen in Uig Bay during field survey (compared to Scottish winter estimate of a minimum of 91,000, with an additional 5,000 - 20,000 Scandinavian birds).
Dipper	Site	Common and widespread across Scotland along watercourses, up to 1 seen on the River Rha, at the head of Uig Bay, during field survey.

15.5.7 Bird species in Table 15-6 with ‘Site’ level valuation have been assessed as such due to their common and widespread nature and the very low observed numbers within the field survey area. Any effects on the very low wintering numbers of these common species would not be of consequence even at a Local scale, and they are therefore not considered further. These species are: goldeneye, cormorant, oystercatcher, razorbill, black-headed gull and dipper.

15.5.8 The Proposed Development is not of a type which is likely to cause direct physical harm to the birds in question. However, the sensitivity to disturbance of those birds not screened out of further assessment in the previous paragraph is shown in the

following Table 15-7. Sensitivity of waders and mallard is taken from the three-point scale used by (Cutts, Hemingway, & Spencer, 2013). In the absence of disturbance data specifically for seabirds and shipping, sensitivity for shag, gulls, eider, divers, black guillemot and gannet is adapted from the five-point scale used by (Furness & Wade, 2012), which although concerned with disturbance by marine turbines and associated shipping or helicopters provides a guide to disturbance tolerance (levels 1 and 2 are translated as 'Low' sensitivity, level 3 as 'Moderate' and levels 4 and 5 as 'High'). Sensitivity of red-breasted merganser is assumed, in the absence of specific data and in view of field experience, to be Moderate, in line with most of the ducks.

Table 5-7 Sensitivity of Wintering/Passage Birds

Sensitivity	Waders	Ducks	Seabirds	Other
Birds that Occur Commonly or Only on the Shore at the Site				
High	Redshank	-	-	-
Moderate	Curlew	Wigeon Mallard	Shag	Grey heron
Low	Turnstone	-	Great black-backed gull Common gull Herring gull	-
Birds that Occur Mainly or Only on the Open Sea at the Site				
High	-	-	-	
Moderate	-	Eider Red-breasted merganser	Red-throated diver Black-throated diver Great northern diver Black guillemot	-
Low	-	-	Gannet	-

15.6 Avoidance Measures/Mitigation 'by design'

15.6.1 Necessary measures to ensure compliance of the construction works with environmental legislation will be embedded within a CEMP.

15.6.2 Potential impacts on seawater quality and pollution of intertidal habitat will be minimised through inclusion within the CEMP of standard industry good practice measures to control pollution during construction. Consequently, pollution-related impacts on birds or habitats utilised by them are considered highly unlikely to occur.

15.6.3 The disposal of dredged material has the potential to cause disturbance of breeding white-tailed eagle through noise or visual impacts if undertaken within 1 km of the breeding site during the breeding season. However, this has been largely addressed by embedded mitigation: the Proposed Sea Disposal Site, as shown in **Figure 3-1**, is greater than 1 km from the breeding site, therefore white-tailed eagle is unlikely to be affected by use of the Proposed Sea Disposal Site itself (possible disturbance from the barge whilst commuting to the Proposed Sea Disposal Site is addressed below).

15.7 Predicted Effects

Construction

Clearance of Vegetation Potentially Containing Corncrake or Other Bird Nests

15.7.1 Construction will require a small amount of vegetation to be cleared for a construction compound. The construction compound will be approximately 100 m by 200 m in size, partly on existing vegetation and partly on existing infrastructure (including fuel tanks) which will be removed. Hard-standing created for the construction compound will be permanently retained for subsequent use as car-parking space.

15.7.2 Existing vegetation in this area includes taller patches of grass and rank herbaceous vegetation (including patches of weedy vegetation such as common nettle *Urtica dioica*) that are potentially suitable for corncrake to nest within. Such vegetation, along with any shrubs or scrub that requires clearance are also potentially viable nesting habitats for common bird species. Nest sites of corncrake, as a Schedule 1 species, are strictly protected under the WCA, including from damage, obstruction and disturbance whilst active. Active nests of common birds are protected from damage or obstruction under the same legislation.

15.7.3 However, the area of vegetation potentially affected by the Proposed Development that is suitable for corncrakes is small, of moderate rather than high quality for corncrakes[11] and of minor importance given the occurrence of other suitable vegetation in fields around Uig. Therefore the removal of vegetation to facilitate the Proposed Development is expected to have no significant effect on the intermittent Uig breeding population, and the concern is a low likelihood of harm to active corncrake nests.

15.7.4 Should active corncrake nests be damaged or destroyed, or the active nest site be obstructed or disturbed such that breeding success is adversely affected, this would be Regionally significant given the scarcity and decline of corncrakes, as well as representing a failure to comply with legislation.

15.7.5 Damage or destruction of a small number of active nests of common birds would be less than locally significant, but would also constitute non-compliance with legislation.

15.7.6 However, impacts on active bird nests can be easily avoided by ensuring that vegetation within the construction working area is made unsuitable for nesting ahead of the start of the breeding season, as described in the mitigation in Section 15.8 below.

Loss of Intertidal Habitat Used by Birds to Land Reclamation to Accommodate the Expanded Marshalling Area

15.7.7 The land reclamation to accommodate the extended marshalling area will occur on intertidal habitat and birds using this relatively small area will be permanently displaced elsewhere, most likely further east where suitable foraging and roosting habitat exists, perhaps as far as the mudflats at the head of Uig Bay, or possibly to the west side of the pier. The area that will be lost does not have special ornithological interest. The largest (but still relatively low) numbers of birds in this area included roosting gulls (up to 18 herring gulls and 4 great black-backed gulls), which are resourceful species that could reasonably be expected to relocate to other parts of Uig Bay, particularly given the observed occurrence of gulls in other parts of the bay. Resting shag also occurred once in relatively high numbers (26) in Sector 2, but there is no reason to expect they could not continue to use the small

[11] As identified during consultation with the RSPB Corncrake Officer for Skye

slipway or other rocky and secluded parts of Uig Bay. The small numbers of waders (including up to 5 turnstone), heron, eider and red-breasted merganser would also be expected to move elsewhere around the bay (where they have also been observed), or in the case of eider further out in to the bay where they already occur. In all parts of Uig Bay, bird density was low such that small numbers of displaced birds are expected to be easily accommodated in terms of both physical roosting space and foraging capacity. Consequently, there is expected to be no significant effect from the limited loss of intertidal habitat on foraging and roosting birds caused by land reclamation.

15.7.8 Note: Direct effects of land reclamation to accommodate the marshalling area expansion on the intertidal habitat are considered in **Chapter 12: Benthic Ecology**.

Disturbance during the Widening of the Pier

15.7.9 No significant numbers of birds were noted on the pier or near it during the wintering bird surveys. The largest numbers of birds comprised eider (up to 25 were observed immediately adjacent to the pier) and herring gull (up to 27 were observed on the pier). These have been assessed to be of no more than Local value. Neither eider nor herring gull are highly sensitive to disturbance, nor are they rare or dependent on the pier, and are therefore able to relocate to other parts of the wider Uig Bay, where these birds were also observed and where bird densities are low and can be expected to accommodate additional birds. The same reasoning applies to the small numbers of other birds observed in those parts of Sectors 1, 2, 4 and 5 nearer to the pier. Consequently, there is expected to be no significant effect on birds (resting or foraging) from works to widen the pier.

Disturbance during Dredging

15.7.10 Dredging has the potential to cause disturbance of birds in the nearby intertidal zone and on the nearby sea. The dredging area is in the vicinity of the pier, where birds are accustomed to ferry activity and to existing periodic maintenance dredging and will consequently be partly habituated to the type of disturbance that dredging for the new ferry will cause. Moreover, the observed numbers and species of wintering/passage birds are of Local value at most, and do not include rare species or species dependent on the vicinity of the works that cannot relocate elsewhere in Uig Bay (where bird densities are low and can be expected to accommodate additional birds). These factors apply similarly to birds at sea during the breeding season. Consequently, there is expected to be no significant effect on birds from dredging.

Disturbance during Disposal of Dredged Material

15.7.11 The disposal of dredged material has the potential to cause disturbance of breeding white-tailed eagle through noise or visual impacts if undertaken within 1 km of the breeding site during the breeding season. However, this has been addressed through Proposed Development design, as the Proposed Sea Disposal Site, as shown in **Figure 3-1** is greater than 1 km from the breeding site.

15.7.12 Disturbance could also occur if the dredging barge passed within 1 km of the breeding site en route to the Proposed Sea Disposal Site. Should disturbance occur, and this resulted in lowered breeding success or breeding failure, this would be a Regionally significant effect and would also constitute non-compliance with legislation (WCA).

15.7.13 Other birds at sea in the vicinity of the Proposed Sea Disposal Site or hopper barge commuting route during dredging operations will be habituated to a degree of disturbance by the existing ferry and other smaller vessels. The observed numbers and species of wintering/passage birds are of Local value at most, and do not

include rare species or species solely dependent on the Proposed Sea Disposal Site that cannot relocate elsewhere. Furthermore, observed birds on the open sea are of moderate sensitivity to disturbance and are unlikely to be disturbed beyond a few hundred metres, in a bay that is up to 1.5 km wide (where bird densities on the water are low and can be expected to accommodate additional birds), and adjacent to the much larger Loch Snizort. These arguments will apply similarly to birds at sea during the breeding season. Consequently, there is expected to be no significant effect on birds from the disposal of dredged material.

Operation

15.7.14 The new ferry will be a little larger than the current vessel (approximately 5 m longer), and will operate on a similar schedule to that of the existing ferry, using the same (moderately expanded) pier and a similar approach route. Operational effects of the new ferry will therefore be similar to those of the existing ferry within current baseline conditions.

15.7.15 Notwithstanding this, the following possible operational changes which may affect identified birds have been given further consideration.

Disturbance by Ship Wash

15.7.16 Ship wash from the existing ferry radiates outwards and was noted to cause a temporary small rise in sea level at the head of Uig Bay, particularly on arrival of the ferry. The wash visibly moved over substrate of shallow gradient at the intertidal mudflats (when exposed at low tide). However, the distance that the wash extended over the mudflats was small, it receded relatively quickly, and it did not appear to have a noticeable adverse effect on foraging waterbirds on the mudflats, which at most moved a short distance landwards. Given that the new ferry is not expected to displace significantly more water, the wash from it is expected to be only marginally greater, and it is improbable that this will have an effect on birds which is significantly different from that of the existing ferry. Consequently, there is expected to be no significant effect on birds from ship wash.

Disturbance as a Result of Increased Passenger Numbers

15.7.17 The increased passenger numbers expected as a result of the Proposed Development will be accommodated in the expanded marshalling area and pier. The expanded marshalling area, which will extend on to intertidal habitat dominated by loose small rocks and seaweed in Sector 2, can be expected to contain the highest levels of human activity in sight of the shore and adjacent water. Birds on the shore and nearby water in Sector 2 are already habituated to the movement of people and vehicles at the edge of the existing marshalling area, on the existing pier, and both on and travelling to/from the smaller vessels harboured in Sector 2.

15.7.18 Given that there will no longer be significant intertidal habitat seawards of the marshalling area (because the expansion will be built on the intertidal area), there could be a higher density of birds to the east on retained intertidal habitat. This strip of intertidal habitat is, however, relatively narrow compared to the area which will be lost to the marshalling area expansion, and more prone to disturbance from existing use of the small slipway. As such, and as discussed for loss of intertidal habitat under construction effects above, it is expected that many of the birds currently using the area will relocate to more substantial areas of intertidal such as the head of Uig Bay or the west side of the pier. It is not therefore anticipated that there will be a particularly high density of birds on retained intertidal habitat immediately east of the expanded marshalling area.

15.7.19 Furthermore, there is no intention to increase ease of access to the shore adjacent to the marshalling area, which will itself be fenced. In view of the small numbers of

birds involved, which are of no more than Local value, it is expected that there will be no significant effect on birds from increased passenger numbers.

Disturbance by Maintenance Activities

15.7.20 Maintenance of the expanded pier and ferry berth will involve activities, such as periodic maintenance dredging (expected to take approximately 2 weeks every 3-5 years), not dissimilar to those already carried out for the current pier and ferry berth. Given that the new ferry and expanded pier are not significantly larger, maintenance activities are expected to be similar in scale and frequency to the current baseline. As such, it is expected that there will be no significant effect on birds from maintenance activities.

15.8 Mitigation and Monitoring

Construction

15.8.1 The CEMP will incorporate the following measures to avoid impacts on breeding birds and specifically on corncrake and white-tailed eagle:

- If vegetation clearance is required during the breeding bird season, an ecological clerk of works (ECoW) will complete pre-clearance survey to ensure no breeding birds are present or would likely be disturbed
- **Corncrake**. Should works be required during the bird breeding season, then impacts on active nests of corncrake are possible. If present within the working area, corncrakes would be expected to occur in taller grassy or herbaceous vegetation. The breeding season for corncrake is April to August, inclusive (Forester & Wade, 2012) in addition common breeding birds might begin breeding in such vegetation (or other vegetation not suitable for corncrakes, such as shrubs) in March.
  - Cutting/strimming down of vegetation will therefore commence at the end of February, and a short sward will be maintained at all areas of vegetation throughout the working area until construction has been completed. This will prevent corncrakes (or other wild birds) from nesting in the working area, and will thereby avoid impacts on them and associated offences under the WCA.
- **White-tailed eagle**. Dredged material from the pier vicinity will be deposited in the outer part of Uig Bay at the location indicated in **Figure 3-1**, and the hopper barge disposing the dredged material will follow as direct a route as possible to this location. This will ensure that the likelihood of disturbance of any known white-tailed eagle breeding site is very low, thereby avoiding ornithological impact and complying with legislative protection under the WCA.

15.8.2 The CEMP will ensure legislative compliance regarding active nests of common birds through the same mitigation set out above for corncrake, by requiring all vegetation affected by construction (including shrubs and scrub) to be strimmed down to a short level prior to the breeding season (i.e. commencing from end of February) and to be maintained as such until construction has been completed.

15.8.3 The CEMP will also necessarily include standard industry good practice measures to control pollution during construction, for which reason pollution-related impacts on birds and habitats used by them are considered highly unlikely to occur.

15.8.4 Given the lack of expected significant effects during construction, as set out in Section 15.7, no further mitigation is considered necessary.

Operation

15.8.5 Given the lack of expected significant effects during operation, as set out in Section 15.7, no mitigation is considered necessary.

15.9 Residual Effects

Construction

15.9.1 There are no significant residual effects occurring during construction on ornithological features. The residual effects, along with unmitigated effects and mitigation, are listed in the summary table in Section 15.11 below.

Permanent

15.9.2 There are no significant residual effects occurring permanently on ornithological features. The residual effects, along with unmitigated effects and mitigation, are listed in the summary table in Section 15.11 below.

15.10 Cumulative Effects

15.10.1 With regard to other developments or plans that could affect the ornithological interests of Uig Bay or its vicinity, there is only one known relevant project. This is a consented salmon fish farm, whose lease area is located offshore of Rubha Riadhain in the southern part of Uig Bay. The applicant for the fish farm operates an existing fish farm in Loch Snizort just outside of Uig Bay, and others elsewhere around Skye. Operation of the existing fish farm in Loch Snizort includes daily visits by boat from Uig Pier, and it is assumed (in the worst case scenario) that the new fish farm will also follow this procedure. Construction of the new fish farm and its subsequent operation will cause a degree of disturbance to waterbirds. However, given the observed species and small numbers of birds in Uig Bay, of at most Local concern; that birds are accustomed to existing ferry and fish farm operations; and that there is capacity elsewhere within Uig Bay for temporarily disturbed birds to move to, there is not expected to be a significant disturbance effect on birds from the new fish farm. Consequently, and in view of the *de minimis* effects of the Proposed Development and absence of other relevant projects in the area, there are not expected to be significant cumulative effects with other projects concerning birds.

15.10.2 There are no effects of the Proposed Development itself that would in combination cause an effect to become significant. This is because all assessed effects as described in Section 15.7 are *de minimis* effects to a degree that even simultaneous combination of all effects (which would not occur) is considered to remain insignificant. Consequently, the possible separation of the Development delivery into three phases, or delivery as a single phase, is not considered to have an effect on this assessment.

15.10.3 Consequently, there are no significant cumulative effects concerning birds.

15.11 Summary & Conclusion

15.11.1 The Proposed Development is not expected to have any significant effects on ornithological features. This assessment is dependent on the above mitigation being embedded within a CEMP, in order to ensure that there are no significant effects and to ensure legislative compliance regarding breeding corncrake, white-tailed eagle and common birds.

15.11.2 Table 15-8 below summarises the predicted effects, their significance prior to mitigation, required mitigation and residual significance.

Table 5-8 Summary of Effects on Ornithological Features

Predicted Effect	Effect Significance	Mitigation	Residual Effect Significance
Construction Effects			
Permanent loss of intertidal habitat to marshalling area expansion. Small area of Uig Bay lost which is of no special importance to birds. Small numbers of common species of Local value at most permanently displaced, but able to relocate elsewhere in Uig Bay.	No significant effect	None	No significant effect
Potential disturbance or damage to active corncrake nests, constituting offences under WCA. Unlikely to occur but would be Regionally significant given scarcity of corncrakes and decline in breeding population/range. Loss of small amount of moderate quality corncrake habitat not significant given occurrence of other suitable vegetation around Uig.	Regionally significant effect (and legislative compliance required)	CEMP will state that where works to be carried out in the breeding season, taller grass/herb areas to be strimmed down beforehand and kept short to prevent nesting	No significant effect
Potential damage to small number of active nests of common birds, constituting offences under WCA.	No significant effect (legislative compliance still required)	As above, but applying also to shrubs/scrub	No significant effect
Temporary disturbance of birds by dredging. Small numbers of common species affected of Local value at most, that will be able to relocate elsewhere in Uig Bay.	No significant effect	None	No significant effect
Temporary disturbance of birds during disposal of dredged material. Possible disturbance of white-tailed eagle if disposal commuting route passes within 1 km of breeding locations. Other birds affected involve small numbers of common species of Local value at most, that will be able to relocate elsewhere in Uig Bay.	Regionally significant effect (and breach of legislation) if white-tailed eagle breeding success reduced	CEMP will specify the commuting route to Proposed Sea Disposal Site to be as direct as possible as shown in **Figure 3-6**).	No significant effect
Temporary disturbance of birds during pier expansion. Small numbers of common species affected of Local value at most, that will be able to relocate elsewhere in Uig Bay.	No significant effect	None	No significant effect
Operational Effects			
Marginally increased minor disturbance by ship wash for very short periods. Affects only small numbers of mobile common birds on exposed mudflats, with no permanent effect.	No significant effect	None	No significant effect

Predicted Effect	Effect Significance	Mitigation	Residual Effect Significance
Disturbance by increased passenger numbers. Likely to affect few birds since those in current vicinity of proposed marshalling area expansion will be permanently displaced by its construction (see above).	No significant effect	None	No significant effect
Disturbance by maintenance activities. Expected to be similar to existing procedures with no significant change from baseline conditions.	No significant effect	None	No significant effect