European Protected Species (EPS) Risk Assessment
Craignure Ferry Terminal Infrastructure Upgrades

Prepared on behalf of

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Action	Name	Function	Date	Signature
Review	<Redacted>	Head of Projects	13/12/2023	<Redacte
Review	<Redacted	Project Manager	12/12/2023	<Redacte

Client:
Ramboll
Twenty3
Brunswick Place
Southampton
SO15 2AQ

FAO:
<Redacted>
Senior Consultant
<Redacted>
<Redacted>

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For further information, contact:
<Redacted>
<Redacted>

Ocean Science Consulting Limited (OSC)
Spott Road
Dunbar
East Lothian
EH42 1RR
UK

T: +44 (0)1368 865 722 (switchboard)
<Redacted>
<Redacted>

<Redac
<Reda
W: www.osc.co.uk

VAT number: 928 894 167
Company number: SC318365
Registered in Edinburgh, Scotland, UK.

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LIST OF ACRONYMS/ABBREVIATIONS

ADD	Acoustic Deterrent Device
ADDO	Acoustic Deterrent Device Operator
AFIG	Argyll Ferries Infrastructure Group
CalMac	Caledonian MacBrayne
ca	*Circa* or approximately
DAU	PAM acoustic Data Acquisition Unit
dB	DeciBel
DBBC	Double Big Bubble Curtain
EPS	European Protected Species
EU	European Union
GI	Ground Investigation
HF	High Frequency cetacean species
HWDT	Hebridean Whale and Dolphin Trust
LSI	Likely Significant Impact
M^3	Metres cubed
MMO	Marine Mammal Observer
PAMO	Passive Acoustic Operator
PTS	Permanent Threshold Shift
RMS	Root Mean Square
RNLI	Royal National Lifeboat Institution
SAC	Special Areas of Conservation
SPL	Sound Pressure Level
SEL	Sound Exposure Level
SELw	Weighted Sound Exposure Level
STAG	Scottish Transport Appraisal Guidance
TTS	Temporary Threshold Shift
UXO	UneXploded Ordinance
VHF	Very High Frequency cetacean species

SUMMARY

The Argyll and Bute Council is applying for a European Protected Species (EPS) license for the redevelopment of the ferry terminal at Craignure, Isle of Mull. A geotechnical survey of bore-hole drilling is to be carried out prior to installation of a new structure. EPS are present in the water around the isle of Mull, and a license is required for the risk of disturbance, injury, and/or death of cetaceans whilst the 18 rotary boreholes are created.

Due to their frequent occurrence in the area and protected status, three species were considered in this report: bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), and harbour porpoise (*Phocoena phocoena*). Noise levels for drilling operations that have been reported in the literature are *ca.* 155.9 dB re 1µPa Root Mean Square Sound Pressure Level @ 1 m with a frequency of 45 Hz. This is below primary hearing sensitivities and vocalisation frequencies for marine mammals of interest. The calculated maximum distance the listed cetaceans would be able to hear this frequency at is 170 m. A temporary or a permanent threshold shift may occur if a harbour porpoise (in the very-high frequency hearing group) approaches to within 40 or 6 m of the noise emission, respectively. Marine mammals may exhibit avoidance behaviour from the noise source, reducing their exposure duration to the sound. Operations are anticipated to take *ca.*28 days, further emphasising the short-duration nature of any potential impact.

Physical effects from turbidity created by the rotary action is considered to have a negligible impact on cetaceans due to them naturally residing and foraging in turbid environments. Due to a lack of studies directly analysing impacts of bore-hole drilling on cetaceans, studies analysing the impact of high sediment suspension on the prey were considered. These showed no mortality; additionally the recovery of the low levels of lesions in the gills of the prey have been previously shown.

To ensure no marine mammals are within the potential impact sone, two dedicated JNCC-certified Marine Mammal Observers (MMOs) / dual qualified Passive Acoustic Monitoring Operators will be onboard during the ground investigation works. This will enable monitoring marine mammals within the 500-m mitigation exclusion zone. A pre-operation search of 30 minutes will be performed to check for marine mammals within the mitigation zone prior to operations commencing. Any break in operation activity lasting >10 minutes will result in an additional marine mammal observation check. If a marine mammal is present within the mitigation exclusion zone, the operations shall not proceed until 20 minutes has passed since the last observation. Works will ideally be carried out from inshore to offshore to avoid embayment of marine mammals.

Considering the low risk of activities to marine mammals, as well as application of standard JNCC-approved mitigation protocols, it is anticipated that these operations will result in negligible impact to marine mammals in the area.

1. INTRODUCTION

The Argyll and Bute Council plans to redevelop the ferry terminal at Craignure, Isle of Mull (**Figure 1**). The terminal is owned by the Council and operated by Caledonian MacBrayne (CalMac), and it is the main terminal for the Isle of Mull. Regular ferries connect the isle to Oban and enable daily commuting for the island's residents, as well as access to mainland hospitals and freight deliveries. Ferries operate from this terminal 4–6 times per day during winter, and this doubles to 12 times per day in summer (Dunelm, 2023). The Royal National Lifeboat Institute (RNLI) also utilise the terminal for local rescue operations. The structure has elements which are in poor condition and some repair measures are urgently required to reinforce the ageing infrastructure (Dunelm, 2023). In addition, the current terminal does not enable overnight berthing throughout the year, which is a key limiting factor in ferry service timings and will be remedied with the new terminal. In addition, the altered layout of the new terminal and access will ease congestion and traffic queues in the village of Craignure.

The proposed new terminal will be situated west of the current pier and will be constructed as a suspended deck supported by steel tubular or bored piles. To design the new terminal, a Ground Investigation (GI) is necessary to gather geotechnical information about the seabed. The marine portion of the investigation will involve drilling 18 rotary boreholes, each approximately 200 mm in diameter, from a jack-up barge. These boreholes will reach a maximum depth of 20 m below the seabed, and each sample collected will have a volume of no more than 0.63 m^3.

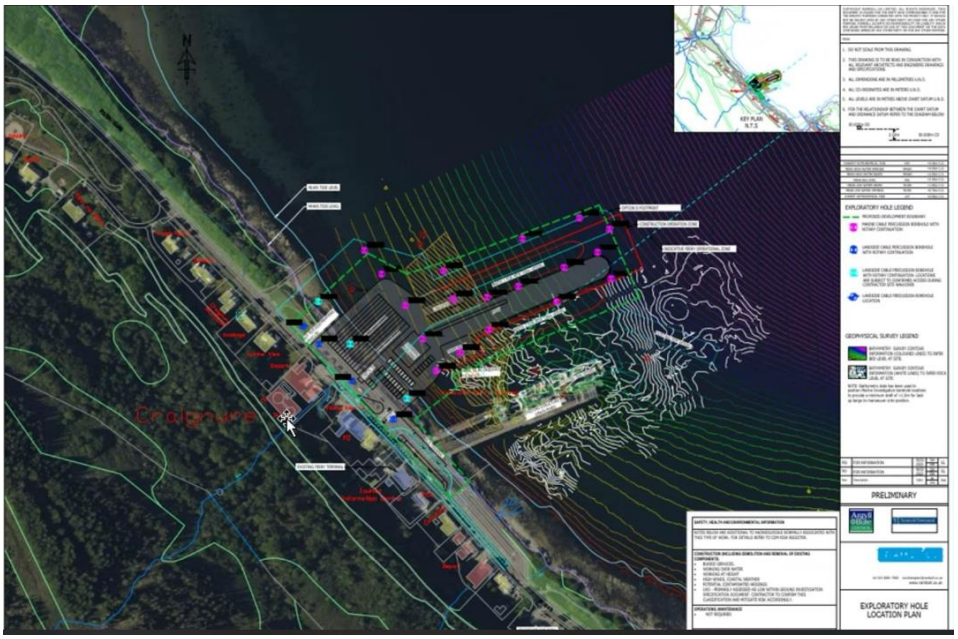

Figure 1: planned location of the new terminal at Craignure, Isle of Mull. *Source*: Ramboll (2022).

1.1. Objectives

Guidance from Marine Scotland (2020) highlights that site exploration (geotechnical surveys) have potential to result in disturbance, injury, and/or death of cetaceans and thus require a European Protected Species (EPS) licence.

This Risk assessment document accompanies the EPS licence application to Marine Scotland Licensing and Operation Team (MS-LOT) relating to the above bore-hole drilling for the new ferry terminal at Craignure. This document sets out the legislative context for the works, describes baseline information, and provides a risk assessment for the proposed works.

2. LEGISLATIVE BACKGROUND

2.1. Habitats Regulations

In Scotland, the Habitats regulations refer to the implementation of the European Union's Habitat Directive (Council Directive 92/43/EEC). The Habitats Directive aims to ensure the long-term conservation and sustainable management of natural habitats and species of European importance.

Regulations 39 (1) of The Conservation Regulations 1994 makes it an offence to:

- Deliberately or recklessly capture, injure, or kill a wild animal of an EPS;
- Deliberately or recklessly;
    - Harass a wild animal or group of wild animals that fall under the EPS;
    - Disturb such animal while it is occupying a structure for shelter or protection;
    - Obstruct access to breeding sites or places of rest; and,
    - Disrupt an animal in a manner which is likely to significantly affect the local distribution or abundance.

Regulation 39(2) provides that it is an offence to – Deliberately or recklessly disturb any dolphin, porpoise, or whale.

2.2. Marine Mammal Protection Act 1978

The Marine Mammal Protection Act prohibits intentional killing, injuring, or disturbance of marine mammals in Scottish waters, and recognises the importance of conserving and protecting marine mammal species ensuring their long-term survival.

2.3. Convention on the Conservation of European Wildlife and Natural Habitats

The Convention on the Conservation of European Wildlife and Natural Habitats is an international treaty aiming to protect and conserve Europe's wildlife and natural habitats. The convention requires member states to take appropriate measures to protect marine mammals and their habitats including establishing marine protected areas and regulating activities that may pose a threat to the health and well-being of marine mammals.

3. DETAILS OF PREVIOUS LICENCES

There are no previous licences for the new Craignure ferry terminal. An exemption for the EPS licence was sought for the current works; however, this was not granted. A seabed consent has been sought from the Crown Estate in association with these works.

4. BASELINE INFORMATION

4.1. Ground investigation works

The marine portion of the investigation will involve drilling 18 rotary boreholes, each approximately 200 mm in diameter, from a jack-up barge. These boreholes will reach a maximum depth of 20m below the seabed level, and each sample collected will have a volume of no more than 0.63 m^3.

4.2. Noise impacts

The contractor has recorded in-air noise levels of 95 dB (units unknown) at the source during rotary drilling. Li *et al.* (2023) report a source level for this type of drilling of 155.9 dB re 1µPa rms @ 1 m. Other studies have reported lower values for similar geotechnical drilling, specifically 142–145 dB re 1µPa @ 1 m (Erbe and McPherson, 2017) and 120 dB re 1µPa @ 41 m (Todd *et al.*, 2020). We use the results of Li *et al.* (2023) to provide conservative advice that mitigates against the upper bounds of possible noise levels.

Borehole drilling noise is produced by the drill bit grinding through layers of soil and rock, resulting in a non-impulsive sound with a fundamental frequency of 45 Hz (Li *et al.*, 2023). Noise generated during drilling originates mainly from within the seabed, and its intensity decreases significantly as it travels from soil and rock layers into water. Casings on the outside of the drill rod act as sound barriers and further hinder propagation of noise.

4.3. Ground investigation timings

Drilling investigation is expected to take *ca.* 28 days between March–June 2024. During this period, drilling operations are anticipated to occur 24 hours, with 4 hours downtime between each location while the jack-up repositions.

Activity	Earliest start	Latest finish	2024			
			March	April	May	June
Borehole drilling	01/03/2024	30/06/2024	X	X	X	X

Table 1: Timeline of borehole drilling. *Source*: Ramboll (2022).

4.4. EPS species in Hebrides

Sixteen different marine species have been recorded around the Hebrides by the Hebridean Whale and Dolphin Trust (HWDT); of these, the harbour porpoise (*Phocoena phocoena*) was the most encountered species, with 5,171 recorded sightings between 2003 and 2017 (HWDT, 2018). Short-beaked common dolphin (*Delphinus delphis*) sightings were noted to be increasing during this period. **Table 2** lists European protected species that may be encountered and their presence around the Hebrides. These species are protected under the amended Habitats Regulations 1994: Schedule 2 (UK Government, 2019).

Common Name	Latin Name	Presence
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Common
Bottlenose dolphin	*Tursiops truncatus*	Frequent
Common dolphin	*Delphinus delphis*	Common
Cuvier's beaked whale	*Ziphius cavirostris*	Frequent
Fin whale	*Balaenoptera physalus*	Rare
Harbour porpoise	*Phocoena phocoena*	Common
Humpback whale	*Megaptera novaeangliae*	Rare
Killer whale	*Orcinus orca*	Rare (resident pod of 8)
Long finned pilot whale	*Globicephala melas.*	Frequent
Minke whale	*Balaenoptera acutorostrata*	Frequent
Northern bottlenose whale	*Hyperoodon ampullatus*	Rare
<Re	<Redacte	Rare
Risso's dolphin	*Grampus griseus*	Common
Sei whale	*Balaenoptera borealis*	Rare
Sperm whale	*Physeter macrocephalus*	Rare
Striped dolphin	*Stenella coeruleoalba*	Rare
White-beaked dolphin	*Lagenorhynchus albirostris*	Common

Table 2: European Protected Species (EPS) observed in the Hebrides by the HWDT. *Sources*: HWDT (2017); HWDT (2018); HWDT (2023).

4.5. Distribution and behaviour of key species at Mull

Relevant species for the EPS licence at the Isle of Mull include bottlenose dolphin, short-beaked common dolphin, and harbour porpoise. Their functional hearing groups are listed in **Table 3**.

Functional hearing group	Common name	Latin name
Very-High Frequency (VHF)	Harbour porpoise	*Phocoena phocoena*
High Frequency (HF)	Short-beaked common dolphin	*Delphinus delphis*
	Bottlenose dolphin	*Tursiops truncatus*

Table 3: Functional hearing groups of marine mammals identified as regularly present in Mull. *Source*: hearing groups modified from Southall *et al.* (2019).

Each of these species is listed in Annex II and IV of the EC Habitats Directive. Member states of the European Union (EU) are required, by law, to consider establishing Special Areas of Conservation (SACs) for Annex II species.

Bottlenose dolphins are regularly sighted around the Isle of Mull (Shrimpton and Parsons, 2000). Sightings have been recorded in all months of the year, highlighting possible year-round residency (Mandleberg, 2006). Peak sightings, however, are thought to be between April and September (Evans, 2007). Bottlenose dolphins forage on a wide diversity of prey, with noted preference for herring (*Clupea harengus*), sandeels (Ammodytidae), Gadiformes, and Atlantic salmon (*Salmo salar*), as well as cephalopods (Santos *et al.*, 2001; HWDT, 2023).

Short-beaked commons dolphin have been increasing in HWDT sightings since 2014 and are now observed each month of the year (HWDT, 2017; HWDT, 2018). They were previously classified as summer visitors visiting between May–October. Plint *et al.* (2023) highlighted how there is a trend in these warm-water adapted dolphin species migrating northwards. This latitudinal migration has also been noted in the resident cold-water white-beaked dolphin drifting up the coastline into northern Scottish waters. Short-beaked common dolphins and white-beaked dolphins have a dietary overlap of 30% (Plint *et al.*, 2023), this interspecific competition may be marginalised with the latitudinal gradient exhibited. Short-beaked common dolphins have been shown to have a large total isotopic niche indicating the consumption of a large variety of prey. Plint *et al.* (2023) calculated their diet to include pelagic schooling fish, cephalopods, and Gadiformes. Short-beaked common dolphins can be characterised as opportunistic feeders and their presence may continue to increase in Scottish waters including around the Isle of Mull.

Harbour porpoise is one of the most frequently sighted species in the Hebrides and Scotland more generally (Dolman *et al.*, 2014; Hammond *et al.*, 2017; HWDT, 2018; Ryan *et al.*, 2018; Evans and Waggitt, 2020), inhabiting inshore waters between 50–150 m deep (Marubini *et al.*, 2009). Harbour porpoise is a year-round resident, with peak sightings occurring between July – October (Evans, 2007). The species can be identified easily, due to its small, triangular fin and 'rolling' surfacing motion, and can normally only be seen in calm and clear weather conditions in Beaufort sea state <2 (Hammond *et al.*, 2002). On the west coast of Scotland the porpoises are most frequently recorded in family groups of two to five individuals (Evans, 2007) and are found primarily in waters inshore of 14.6 km and deeper than 60 m (MacLeod *et al.*, 2007). Primary prey sources in the Hebrides include herring, sprat (*Sprattus sprattus*), whiting (*Merlangius merlangus*), and sandeels (Santos *et al.*, 2004; HWDT, 2023). Other prey may also include various shrimp, octopus, squid, and shellfish species.

The three species described have recorded confirmed sightings within waters surrounding the Isle of Mull as listed in **Table 4**.

Common name	Scientific name	Sightings around Isle of Mull 2018	2019	2022
Bottlenose dolphin	*Tursiops truncatus*	7	-	-
Short-beaked common dolphin	*Delphinus delphis*	-	-	4
Harbour porpoise	*Phocoena phocoena*	1	14	7

Table 4: Sightings around the Isle of Mull for bottlenose dolphins, short-beaked common dolphins and harbour porpoises in 2018, 2019, and 2022. *Source*: HWDT (2017).

5. RISK ASSESSMENT

5.1. Nature of potential impacts

5.1.1. Acoustic disturbance

Sound represents a major sensory channel for marine mammals, rendering them susceptible to anthropogenic noise generated by activities such as underwater

blasting, seismic exploration, drilling, and vessel traffic. Harmful effects of high-level underwater noise can be summarised as lethality, physical injury, hearing impairment, and behavioural alteration (Nowacek *et al.*, 2007; Southall *et al.*, 2007; Wright *et al.*, 2007).

The type and level of impact is primarily evaluated in terms of the sound pressure and frequency characteristics of the source. In most cases, hearing range of cetaceans is not well understood, but it is assumed generally that animals hear over similar frequency ranges to the sounds that they produce. Within this hearing range, biological damage is related to total quantity of energy received by a receptor; therefore, a continuous source operating at a given level is more damaging than an intermittent source reaching the same level. For continuous sources, the sound exposure level metric is reflective of this, as it accounts for the duration of the source.

Given that the source level for drilling noise 155.9 dB re 1µPa RMS is low and the fundamental frequency 45 Hz is below the hearing sensitivities for the marine mammals of interest, lethality or physical injury are not expected to occur (Li *et al.*, 2023). At most, there is potential for hearing damage or behavioural alteration at close distances to the source; however, criteria for behavioural impacts have not been established under the marine noise exposure criteria to date (Southall *et al.*, 2021) so only the potential for animals to undergo hearing damage is assessed.

Animals exposed to high-intensity noise, equal or superior to their most sensitive hearing frequencies, are likely to experience an increase in their hearing threshold (decrease in hearing sensitivity). This can be either temporary or permanent, resulting in Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS), respectively. The marine noise exposure criteria developed by Southall *et al.* (2019) include thresholds for TTS and PTS for both impulsive and non-impulsive noises (see **Table 5** for non-impulsive sources, of relevance for drilling). These are expressed in Sound Exposure Levels (SEL), weighted for the frequencies at which the marine mammals are sensitive.

Hearing group	SEL_w TTS (dB re 1µPa²s)	SEL_w PTS (dB re 1µPa²s)
High Frequency	178	198
Very High Frequency	153	173

Table 5: Weighted Sound Exposure Level (SELw) values for Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) for High Frequency (HF) and Very High Frequency (VHF) cetacean species. *Source*: modified from Southall *et al.* (2019).

5.1.2. Physical disturbance

Borehole drilling has potential to cause localised turbidity plumes near the construction area. Information on plumes caused by borehole drilling is limited, but studies on deep sea drilling and dredging confirm that plumes are generated by these activities and increase turbidity of the adjacent water column (Jones, 2021); (Haalboom, 2023). Dispersal effects of drilling or dredging are often modelled using plume dispersion models, while turbidity sensors can be used to monitor plumes. Haalboom (2023) state that with increased distance from the source, turbidity decreased.

Numerous marine mammals inhabit turbid environments, consequently many have increased reliance on auditory perception over vision to sense the environment around them (Au *et al.*, 2000). Sediment plumes are generally localised, so significant impacts from turbidity are unlikely. In addition, there is no evidence to suggest that turbidity from dredging (an activity which would cause greater sediment plumes than drilling) affects cetaceans (Todd *et al.*, 2015).

Turbidity may affect cetaceans indirectly through changing their prey abundance and distribution. No studies to date have been carried out on the effect of inshore rotary bore drilling on marine invertebrates and fish. Homborstad *et al.* (2006) exposed cod (*Gadus morhua*) to the most extreme levels of sediment suspension levels of 550 mg l^{-1} they may experience from bottom trawling. There was no resulting mortality, and their gills were found to exhibit hypertrophy and hyperplasia of the gill epithelium wherein 70% of the secondary lamellae in the gills showed lesions after 5 days of this intense exposure. The resulting survival and minimal impact of exposure to the extreme mud sediment suspension for the maximum duration at 10 days highlighted the cod's wide tolerance levels as expected of species inhabiting turbid environments. As stated by Homborstad *et al.* (2006) these results matched studies on other species which had also shown reversibility wherein their gills recovered with the levels of lesions reducing. Sediment suspension is not expected to remain at extreme levels and is predicted to settle quickly resulting in a short suspension duration. In lieu of studies on the effect of inshore rotary bore drilling turbidity, we can assume from extreme bottom-trawling sediment suspension, that the risk of changes to prey availability is low. Therefore, the low potential of slight changes in prey abundance and density within the project zone will have a low indirect resultant effect on the cetaceans.

Avoidance behaviour and stress from the operational noise may result in cetaceans fleeing and becoming trapped within the harbour. The GI works are advised to carry out directionality of inshore to offshore progression to avoid embayment of marine mammals. This intentional directional progression will reduce the likelihood of any present marine mammals in the vicinity to not be cornered into the harbour which would increase their risk of physical harm and in extreme circumstances mortality.

5.2. Magnitude of potential impact

5.2.1. Acoustic impact

Primary hearing sensitivities of relevant hearing groups are shown in **Table 6**.

Hearing group	Example species	Hearing sensitivity range (kHz)
High-Frequency (HF) cetaceans	Dolphins, toothed, beaked and bottlenose whales (*Hyperoodon* sp.)	8.8–110
Very High-Frequency (VHF) cetaceans	True porpoises, dwarf sperm whale (*Kogia* sp.), river dolphins, *Cephalorhynchus* dolphins	12–140

Table 6: Marine mammal functional hearing groups that may be in construction area. *Source:* modified from Southall *et al.* (2019).

Huang *et al.* (2023) estimate that drilling noise could be heard by marine mammals at a maximum of 170m, with a maximum distance for TTS at 40 m and PTS at 6 m

for VHF cetaceans (**Table 7**). The SELw does not exceed the hearing damage thresholds for HF cetaceans. Todd *et al.* (2020) similarly reported a maximum distance of audibility at 70 m for harbour porpoises. Magnitude of impact is thus determined to be low. Animals are expected generally to move away from noise and disturbing sound sources thereby reducing their exposure. Considering that the operation only occurs on *ca*. 28 days, this is unlikely to impact Favourable Conservation Status of the species.

Hearing group	Maximum distance of audibility from source (m)	Maximum distance from source for TTS (m)	Maximum distance from source for PTS (m)
High-Frequency (HF) cetaceans	170	-	-
Very High-Frequency (VHF) cetaceans	170	40	6

Table 7: Estimated distances of hearing impact including audibility, Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) in m, for High Frequency (HF) and Very High Frequency (VHF) cetaceans. *Source:* modified from Huang *et al.* (2023).

5.2.2. Location and spatial extent of impact

The works are located within the offshore area adjacent to the current Craignure Ferry Terminal (**Figure 2**) and are centred on National Grid reference NM 71777 37156. The address of the Dunelm site compound is: Craignure Ferry Terminal, Craignure, Ise of Mull PA65 6AY.

Figure 2: Site location and general boundary. *Source*: Ramboll (2022).

The Inner Hebrides and Minches SAC is located more than 300 m from the site, and consultation with NatureScot has been undertaken. NatureScot has concluded no Likely Significant Impact (LSI) will occur. Correspondence enclosed.

5.2.3. Timing and duration of impact

The fieldwork aspect of the investigation will commence with a mobilisation date of 01/03/2024 and is planned to be completed by the 30/06/2024. The works are anticipated to be completed over a *ca*. 28-day window during this period.

5.3. Alternatives

The Craignure Ferry Terminal on the Isle of Mull is in need of replacement in order to continue providing passenger services. The current terminal is deteriorating and does not meet all the necessary requirements. Additionally, the marshalling facilities for vehicles are inadequate, causing congestion in the village. Conducting a geotechnical investigation is a common method to gather data for the design and location of infrastructure during construction. There are limited alternatives to this method that would not disturb the water column.

Investment is necessary to replace the existing ferry terminal, and alternative options are being considered before making a decision. A Scottish Transport Appraisal Guidance (STAG) report has been prepared to evaluate potential alternatives for the new terminal design. These alternatives must meet four long-term transport planning objectives, including supporting a year-round service and accommodating next-generation vessels. The chosen option will be based on the results of the geotechnical investigation and will consider the STAG criteria of Environment, Safety, Economy, Integration, Accessibility, and Social Inclusion.

6. MITIGATION

Two dedicated JNCC-certified Marine Mammal Observer (MMO) / dual qualified Passive Acoustic Monitoring Operators (PAMOs) will be onboard during the GI works to monitor for 'animals of interest', advise on implementation of the licence, conduct pre-operation searches for marine mammals before commencing operations, and maintain continuous watch throughout operations. This will allow for 24-hour operations. JNCC monitoring forms, will be completed throughout the operations.

6.1. Exclusion zone

An exclusion zone of 500 m is required in line with industry best practice and the JNCC geophysical survey guidelines (JNCC, 2017) which provides a precautionary approach for the current drilling operations. If any marine mammals are detected visually within 500 m of the drilling location throughout the duration of a pre-watch or a break in drilling exceeding 10 minutes or longer, MMO will advise a delay in piling activities.

6.2. Pre-search

The exclusion zone will be monitored closely by an MMO for at least 30 minutes before drilling operations are due to commence.

6.3. Delay

A delay in the commencement of drilling will be recommended if a marine mammal is detected within the exclusion zone during the pre-search. Drilling will not begin until an MMO confirms visually that any marine mammals have moved outside the exclusion zone, or until 20 minutes has passed since the last visual observation.

6.4. Break in activity

If there is a break in drilling activity for 10 minutes or longer, a 30-minute pre-watch will be implemented. If the MMO has been on watch both before and during the break in drilling operations, and for at least 30 minutes, drilling may restart immediately.

6.5. Passive acoustic monitoring

PAM is required during periods of poor visibility/weather conditions, and night-time operations. Methodologies and processes are the same as visual watches, including mitigation zones, pre-watch time, and soft start.

The PAM Acoustic Data Acquisition Unit (DAU) will be located inside a dry, secure workspace where the Passive Acoustic Operator (PAMO) will be monitoring. The PAM system is comprised of a top-end (dry-end) acoustic processing electronics, an intermediate deck cable for conveying acoustic signals, and a bottom-end (wet-end) hydrophone array terminating with a depth sensor.

Mid-low frequency monitoring (sampling rate of 48,000 Hz, allowing frequency detection to 24,000 Hz) are used to detect cetacean vocalisations such as dolphin whistles (*ca.* frequency range of 8,000–16,000 Hz). High-frequency monitoring (sampling rate 500,000 Hz allowing frequency detection to 250,000 Hz) will be configured to detect, for example, harbour porpoise high-frequency clicks, using a click-detector function in PAMGuard and a National Instruments (NI) sound card.

7. SUMMARY OF POTENTIAL IMPACTS

The direct impact of anthropogenic noise on cetaceans includes changes in behaviour and foraging, stress, auditory masking, or physical harm. The sound exposure is for a short duration and the operation will only be licensed to begin with no marine mammals within the mitigation zone of 500m from the bore drilling. In addition, the frequency of the equipment is below the vocalisation of the cetaceans reducing the risk of shifts in their communication and foraging frequencies. HF and VHF cetaceans are calculated to have a maximum distance of 170m of audibility from the source. Potential avoidance behaviour from anthropogenic sounds and turbidity combined with the 500m mitigation zone decreases the risk of permanent harm being inflicted upon the cetacean such as a permanent threshold shift in their hearing. Directional operations of inshore to offshore progression will reduce the risk of embayment for the marine mammals.

The indirect effect of GI on the cetaceans within the waters surrounding the isle of Mull are thought to be negligible due to a combination of the short operation duration and natural residence of their prey within turbid waters. In situ of studies directly analysing the impact of bore drilling on the cetacean prey, studies analysing the impact of high sediment suspension on prey were considered. These showed no mortality and the low levels of lesions in their gills are thought to be recoverable.

8. EPS LICENCE ASSESSMENT

8.1. Test 1 "purpose" (regulation 44(2))

The ferry terminal at Craignure provides essential passenger services for residents of the Isle of Mull, and the replacement terminal is required to provide long-term continuation of this service. The replacement also aims to improve reliability of these ferry services and to reduce congestion currently felt on the road network in Craignure during ferry arrivals and departures.

There are various public interest served by this project. Provision of a vital passenger/ferry service to and from mainland Scotland for residents of the Isle of Mull. This covers commuting for work (where timetabling allows), alongside travel for hospital appointments and freight delivery to the island. The terminal also acts as an RNLI deployment structure for local rescue operations. The current pier does not provide a reliable year-round overnight berth which places significant restrictions on 'time on mainland' when the service is operated by a single crewed Oban-based vessel.

This project is imperative to go ahead due to serviceable life. The implication of not repairing the existing infrastructure is that load restrictions will need to be placed on the pier structures and linkspan. This will significantly reduce capacity and utility of the existing pier. The GI is the first step to determine and agree the potential location for a replacement terminal that is known to be needed in the short-to-medium term future; it is recognised that interim repair measures will be required to reinforce existing infrastructure while construction of the replacement takes place (to achieve the goal of minimising service disruption during construction).

Argyll & Bute Council are the Statutory Harbour Authority who own the pier. The replacement scheme is supporting by national strategic transport planning objectives in Scotland (Transport Scotland). This has been developed in conjunction with Argyll Ferries Infrastructure Group (AFIG) - Transport Scotland, CMAL, CFL.

8.2. Test 2 "satisfactory alternative" (Regulation 44 (3) a

Craignure Ferry terminal is the main terminal for the Isle of Mull with ferries operating to Oban 4–6 times per day during winter and up to 12 times per day during summer. A replacement ferry terminal is required to provide continued passenger services to the residents of the Isle of Mull; the existing terminal is reaching the end of its serviceable life, with some elements in poor condition and the arrangement does not meet the full requirements (such as the ability for vessels to berth overnight throughout the year). In addition, the terrestrial marshalling facilities are not considered to have capacity for vehicles using the ferries and so congestion and traffic queues are caused within the village of Craignure. When

undertaking construction works of this nature, a GI is a typical means to obtain sufficient geotechnical data to inform the proposed design and/or decide on the proposed location of particular infrastructure and inform construction methodologies. There are no alternatives to a GI that would obtain the required information while not causing any disturbance within the water column.

Investment to replace the existing ferry terminal is required, and alternative options have been, and are being, considered prior to committing to this investment. A Scottish Transport Appraisal Guidance (STAG) report has been prepared which demonstrates potential alternatives to the design of the replacement ferry terminal. These alternatives must meet the four long-term transport planning objectives which are:

1. To support a year-round 'full-day' service, able to berth at Craignure overnight;
2. All infrastructure (berthing, marshalling, passenger access and facilities) to support next-generation vessels;
3. Maintain/improve operator performance; and,
4. Minimise the short-term negative social and economic impacts during construction.

Based on the outcomes of the GI, the option selected will consider the STAG criteria: Environment, Safety, Economy, Integration, Accessibility and Social Inclusion

8.3. Test 3 "favourable conservation status" (Regulation 44 (3) (b))

This EPS risk assessment concludes that there would be a negligible risk of injury and a low-level risk of disturbance to cetaceans. Any disturbance that might occur would be temporary and localised. The JNCC geophysical survey guidelines (JNCC, 2017) will be followed along with mitigation proposed *in* ***Section 6*** where possible, to minimise impacts from the works.

9. CONCLUSION

There is a low risk of harm to relevant cetaceans from the proposed drilling for this GI operation. Potential direct impact of operational noise may cause short-term changes to behaviour and foraging, stress, auditory masking, or in unlikely circumstances, physical harm. The low operational noise of 155.9 dB re 1µPa RMS with the fundamental frequency 45 Hz is below primary hearing sensitivities and vocalisation frequencies for marine mammals of interest. Sound exposure is for a short duration of *ca.*28 days, and operations will only begin when it is confirmed that no marine mammals are within the mitigation zone of 500 m from the sound source. Should marine mammals enter this range while operations are in progress, it is unlikely that they would approach to a proximity that they find uncomfortable, let alone damaging. Increased turbidity in the water created by the bore drilling is predicted to have negligible effect on the cetaceans including upon abundance and presence of their prey.

Pre-search monitoring aims to reduce the risk of marine mammals within the mitigation zone. The GI works are also advised to carry out from inshore to outshore to avoid embayment of marine mammals and reduce physical harm or

stress. Two Dedicated JNCC-certified MMO and PAMOs will monitor during operations, therefore; risk of lethal harm, injury, or disturbance for bottlenose dolphin, short-beaked common dolphin, and harbour porpoise is low.

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