

Vattenfall Wind Power Ltd.

HT1 Hydrogen Demonstrator Project

UXO Investigations Supporting Environmental Information

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RSK GENERAL NOTES

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ACRONYMS & DEFINITIONS

Acronyms

Acronym	Definition
ACAS	Aberdeenshire Council Archaeology Service
AEOI	Adverse Effect on Integrity
AEZ	Archaeological Exclusion Zone
AOWF	Aberdeen Offshore Wind Farm
Birds Directive	European Union Council Directive 2009/147/EC
cUXO	Confirmed Unexploded Ordnance
DBA	Desk Based Assessment
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EM	Electromagnetic
EOWDC	European Offshore Windfarm Deployment Centre
ES	Environmental Statement
FLO	Fisheries Liaison Officer
HES	Historic Environment Scotland
HRA	Habitats Regulations Assessment
HT1	Hydrogen Turbine 1
JNCC	Joint Nature Conservation Committee
LNR	Local Nature Reserves
LSE	Likely Significant Effects
MBES	Multi-Beam Echosounder
MCA	Maritime and Coastguard Agency
MoD	Ministry of Defence
MTL	Master Target List
MPA	Marine Protected Areas
MS-LOT	Marine Scotland - Licensing Operations Team
NLB	Northern Lighthouse Board
OWF	Offshore Wind Farm
PAD	Protocol for Archaeological Discoveries
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PEL	Probable Effects Level
pUXO	Potential Unexploded Ordnance
ROV	Remotely Operated Vehicle

RSK	RSK Environment Ltd
SAC	Special Area of Conservation
SEPA	Scottish Environmental Protection Agency
SPA	Special Protection Area
SSS	SideScan Sonar
SSSI	Site of Scientific Special Interest
TBT	tributyltin
UXO	Unexploded Ordnance
Vattenfall	Vattenfall Wind Ltd.
WFD	Water Framework Directive
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
Units	
m	Metre
ft	Foot
km	Kilometre
nm	Nautical mile
T	Tonne

Definitions

Term	Meaning
Aberdeen Harbour	Includes the original Aberdeen Harbour at the mouth of the River Dee and the New South Harbour in Nigg Bay.
Aberdeen South Harbour	Refers to the New Aberdeen Harbour/Port in Nigg Bay. Originally called the 'Aberdeen Harbour Extension'.
Corridor	Refers to the pipeline corridor, which connects the WTG B06 to landfall
Marine Protected Areas	Areas of the ocean set aside for long-term conservation aims. MPAs involve the protective management of natural areas according to pre-defined management objectives. MPAs can be conserved for a number of reasons including economic resources, biodiversity conservation, and species protection.
MS-LOT – Marine Scotland – Licensing Operations Team	The regulator on behalf of Scottish Ministers for marine licence applications in the Scottish inshore region (between 0 and 12 nm) under the Marine (Scotland) Act 2010 and in the Scottish offshore region (between 12 and 200 nm) under the Marine and Coastal Access Act 2009.
Obstruction	An object that may constitute danger for surface navigation or an area (foul ground) over which it is safe to navigate but which should be avoided for anchoring.
Targets	Specified anomalies that have been classified as potential unexploded ordnance.

1 INTRODUCTION

1.1 Project background

Aberdeen Offshore Wind Farm (AOWF), also known as the European Offshore Wind Deployment Centre (EOWDC), is located between 2 and 5 km off the Aberdeenshire coast, in a 7 km² area, in water depths from 20-30 m. The offshore wind farm demonstration project is now solely owned by Vattenfall. The offshore wind farm (OWF) has an installed energy capacity of 96.8 MW consisting of 11 x 8.8 MW turbines supported by three-legged suction bucket jacket foundations, an industry first, with a 13 km long array cable connecting to an offshore transformer, which exports the energy from the turbines to the onshore substation at Blackdog. The AOWF lease area is at:

57° 14.723' N 002° 00.911' W 57° 15.240' N 001° 56.865' W

57° 12.360' N 001° 58.680' W 57° 11.842' N 002° 02.721' W

As part of the continuous innovative approach to the demonstration site, Vattenfall are now looking to demonstrate the feasibility of offshore hydrogen production by installing hydrogen generating equipment on an extended transition piece platform at one of the Aberdeen turbines. The hydrogen generating equipment would be connected to land via a buried pipeline, where the hydrogen would be stored for offtake.

Hydrogen production equipment will be installed on an extended transition piece platform on the existing Wind Turbine Generator (WTG) B06 turbine. The pipeline corridor will then connect WTG B06 to the selected landfall location, towards Girdle Ness, at Aberdeen South Harbour.

1.2 Document purpose

This document has been drafted in support of an application for a Marine Licence to be submitted to the Marine Scotland Licensing Operations Team (MS-LOT) to carry out an Unexploded Ordnance (UXO) investigation survey, to determine the potential presence of UXO and non-UXO objects along the proposed pipeline route corridor (as shown in Figure 1.1 attached). This will involve the use of an ROV (Remotely Operated Vehicle) deployed from a suitable dynamically positioned (DP) ROV support vessel to carry out electromagnetic (EM) and visual surveys to identify potential UXO targets and subsequent localised dredging works to further determine the nature of potential UXO targets, ensuring that these will not be a safety risk during subsequent pipeline installation works. Target objects that have been exposed by dredging and are confirmed as non-UXO will be removed, if possible, from the pipeline route corridor. Where UXO targets are confirmed, their position will be recorded for subsequent clearance and appropriate authorities will be notified. Clearance activities and subsequent post-clearance surveys (where required) will be the subject of a separate Marine Licence application and are not covered here. This assessment supports the Marine Licence application for the initial UXO investigation survey only. In order for the investigation work to take place, a Marine Licence is required from MS-LOT, under the Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009. This document will contain supporting environmental

information to help inform the Marine Licensing process, in order for the proposed investigation work to be carried out.

1.3 Consultation

Correspondence has been initiated with NatureScot regarding the proposed scope of works. This correspondence has been as an email to NatureScot on 26/04/22. At the time of the application being submitted no undue concerns from NatureScot have been raised on the scope of works proposed or on the content of this supporting assessment. The key findings from this assessment have been included in this correspondence. Correspondence has also been initiated with Historic Environment Scotland (HES) to discuss the scope of the Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) with regards to the UXO surveys. These documents would be drafted in the expectation of them being required as a condition of the marine licence.

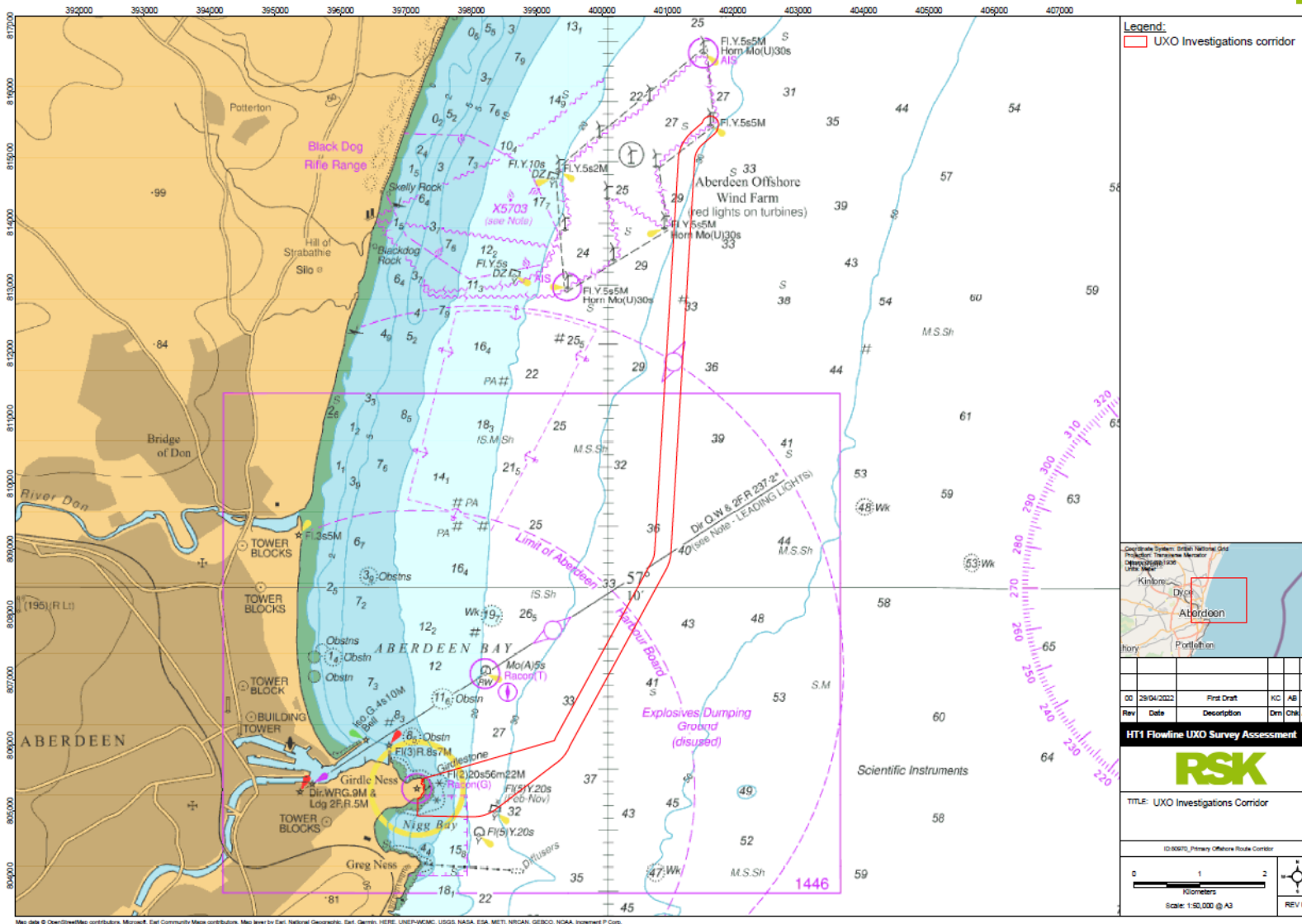


Figure 1.1: UXO Investigations Offshore Route Corridor

Vattenfall Wind Power Ltd.

Proposed Hydrogen Electrolyser at Aberdeen Development: Hydrogen Turbine 1 (HT1) – UXO Investigations Supporting Environmental Information

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2 DESCRIPTION OF WORKS

2.1 Introduction

The aim of the UXO investigation surveys is to investigate specified anomalies (targets) that have been classified as a potential unexploded ordnance along, on or in proximity to the proposed pipeline route corridor. EM and visual surveys using ROV will be used to determine the locations of non-UXO objects and potential UXO along the route, both offshore and nearshore. Localised dredging works may be required to expose targets for further investigation and removal, or location recording and notification of appropriate authorities for subsequent clearance.

The following provides an outline of the proposed scope of works of the UXO investigations such that a high level environmental assessment can be made.

Figure 1.1 shows the route corridor that will be surveyed as part of these UXO investigation works.

An initial UXO survey was conducted along the corridor in early 2022; this included a magnetometer survey supplemented by review of additional multi-beam echosounder (MBES) and sidescan sonar (SSS) surveys. Though these results have yet to be fully processed and evaluated, an estimated c. 300 potential UXO (pUXO) targets is assumed, based on the documented locations of minefields and previous UXO finds in the area.

2.2 Potential for UXO

The area is suspected to contain various types of UXO – an assumption based on the documented locations of minefields and previous UXO finds in the wider area. An explosive ordnance clearance campaign will be required before any installation activities can take place. The work proposed here is to identify and locate targets that may cause a safety risk during construction.

There is a Ministry of Defence (MoD) firing range present to the west of the AOWF at Blackdog. There is a safety exclusion zone seaward of this range and the area has the potential to contain a significant number of UXO targets.

There is also an explosives dumping ground in the south east of the survey route, with the potential for UXO to be present.

Various other potential UXO (pUXO) sources in Aberdeen Bay have been identified (RSK, 2021a). The sources include:

- military ranges (Royal Navy and British Army)
- munitions dumping grounds
- sea mines (British and German)
- anti-aircraft artillery projectiles
- coastal gun batteries
- unexploded bombs
- wrecks

- convoy routes

2.3 Potential for non-UXO objects

Boulder fields and exposed bedrock are expected to pose an obstacle to operations, particularly in the shallower regions along the proposed pipeline route corridor. The surveys will help to determine the locations of these non-UXO objects along the route. There is also the potential for other metallic obstructions, that will require a degree of investigation and if it can be done so easily, they will be removed from the immediate vicinity of the pipeline route.

2.4 Proposed vessel

The vessel will be suitably equipped to undertake the scope of work in the operational areas proposed. The Vessel master and officers will be specifically trained for or experienced with offshore ROV campaigns and similar survey works. While no specific survey vessel or vessel contractor has yet been appointed to undertake these works an example dynamically positioned ROV support vessel the *EDT Protea* is provided as an example of the type of vessel that would be used for much of the works. The *EDT Protea* is a 91.2 m DP Category 3 support vessel capable of deploying work class ROVs.

Please note that the proposed vessel is subject to change but would be replaced with a vessel of similar specification and as such the *EDT Protea* is considered to be a suitable surrogate vessel for the purposes of this assessment.

2.5 Schedule

The survey for potential UXO target investigations is proposed to commence during August 2022 for an approximate duration of 2 months. The indicative programme for these works will be required to take into consideration any unforeseen weather or consenting delays and as such the overall timeframe is more difficult to estimate with certainty at this time. In order to allow a contingency for weather or any other delays it has been assumed that the overall survey window be for the period from the potential commencement of survey in August 2022 to the end of July 2023 (c. 12 months). This is also the anticipated marine licence period. Irrespective of the licence period, the UXO investigations survey is expected to take c. 2 months to complete within that period. It is not considered that the time of year is a significant factor in the assessment of environmental impacts for the UXO investigations survey.

2.6 Investigation of potential UXO targets method

2.6.1 EM survey

To mitigate the risk posed by non-ferrous UXO¹, a c. 1.1 km long and 50 m wide section of the pipeline route corridor where a particular risk of non-ferrous UXO has been previously identified, will be surveyed with an EM sensor. Suitable equipment will be

¹ Such as Luftmine B (LMB) mines; parachute naval mines used by the Luftwaffe during the Second World War.

mobilised for detection of potential targets at a burial depth of 2 m below seafloor. The recorded data will be processed and gridded and a list of anomalies delivered. The target positioning will form the basis for the uncovering operations. The EM sensor would be deployed from the ROV and would also be supplemented by underwater imagery from the ROV's onboard video camera systems. The electromagnetic detection method will be either continuous wave or transient. Line spacing of the spread will be adapted to the method and altitude of the equipment.

The ROV survey will be limited by the depth of operation of the ROV, which is c. 10 m below chart datum.

2.6.2 Target identification

This work will involve the localisation, excavation and identification of pUXO based on a Master Target List (MTL). The procedures shall follow the below guidelines:

- The ROV spread will begin by covering a 10 m x 10 m, centred on the target position, using electromagnetic sensors, at an ROV flying height < 0.5 m above seabed.
- Once the target is located, localised dredging works will commence and continue until the target is visible. Dredging will be carried out with a suction pump until the target is free from sediment.
- If confirmed as non-UXO, the object will be relocated either to the ROV (e.g., basket), or outside the 10 m x 10 m box. This will ensure it is placed outside the clearance corridor (unless the object is confirmed as being of potential archaeological interest).
- The target location will then be inspected again with the EM sensor to make sure that no second target is hidden under the first target.
- If a target inspection results in a confirmed UXO identification (cUXO), Vattenfall and responsible authorities will be notified.
- cUXO are to be left in situ without further disturbance

The ROV track plot will be recorded and plotted as documentation, as will the electromagnetic data.

3 EMBEDDED MITIGATION MEASURES

There are a number of embedded mitigation measures that will be implemented for the proposed UXO investigation works to help reduce any potential impacts. Table 3.1 below details these mitigation measures.

Table 3.1: Embedded Mitigation Measures

Mitigation Measure	Description
Notification of investigation works to appropriate parties	Issue of Notice to Mariners to assets owners, HM coastguard, Royal Navy, Marine Scotland, the fishing industry and other marine users and the Kingfisher charts in advance of any investigation works. A Weekly Notice of Operations will also be issued routinely including all ongoing and planned operations.
Marine Archaeological Written Scheme of Investigation (WSI)	A WSI will be required. The primary aim of the WSI is to reduce the potential risks of impact from the proposed works on cultural heritage assets, and to set out clearly the procedures in a PAD that will be followed to avoid, minimise or mitigate these impacts.
Pollution Prevention	No vessels associated with the UXO investigation surveys will be re-fuelled in the Aberdeen and Nigg Bay area to avoid accidental spills. Where applicable vessels on the project will follow the protocols detailed in MARPOL 73/78.
Vessel Management Plan	Vessel management mitigation measures to be implemented during investigation works, which will be detailed in a Vessel Management Plan.

4 ENVIRONMENTAL ASSESSMENT

4.1 Introduction

This section provides an overview of the baseline environment and key receptors that may be impacted by the investigation surveys, to determine the locations of pUXO. It provides a concise summary of baseline environmental information, largely drawn upon from the EIA Screening Opinion Request Report and offshore routing feasibility study that were carried out for the HT1 Hydrogen Demonstration Project (RSK, 2021a and b).

Key environmental effects on the environmental receptors associated with the investigation works are:

- The increased presence of vessels operating in the Aberdeen and Nigg Bay areas potentially causing an increased collision risk or disturbance and potential for pollution risk
- physical disturbance to the seabed from dredging works and ROV thrusters, resulting in
 - temporary disturbance to the seabed
 - localised habitat loss in areas of dredging through direct footprint of the works as well as by smothering by suspended sediments
 - Localised suspended sediment impacts resulting in disturbance to seabed habitats and a reduction in seawater quality

Underwater noise is also considered due to the presence of the DP support vessel and ROV, as well as from suction pump dredging works. These impacts are not expected to be significant. As there is no UXO detonation clearance works or any geophysical survey operations taking place under the proposed scope of work, it is not anticipated that significant impacts as a consequence of the additional underwater noise from the survey will result and as such underwater noise is not considered further in this assessment.

The following key points have been considered, which have a bearing on the magnitude of effect and sensitivity of receptor:

- the footprint of the UXO investigations will be localised and the impact on the seabed will be relatively minor in terms of spatial extent, within a 25 m wide corridor
- the duration of the survey will be relatively short (approximately 2 months work assuming no delays for weather, or other operational / consenting reasons)
- removal and disposal of confirmed UXO and post operations geophysical survey is not within this scope of work

4.2 Screening of potential effects

Each of the receptors that have potential to be impacted by the proposed work has been subject to a screening exercise, shown in Table 4.1, namely disturbance to the seabed, impacts on seawater quality, and the presence of the vessel and equipment conducting operations during the surveys. As discussed in Section 4.1, underwater noise will be considered within impacts from the presence of vessel, as it is not expected to have a significant impact on receptors.

Table 4.1: Screening of potential environmental receptors

Receptor	Impacts on seabed and seawater quality	Presence of vessel	Justification for scoping out
Physical environment	✓	✗	Due to the localised and temporary nature of the UXO investigation works there are no potential impacts expected on the physical environment resulting from the presence of survey vessels.
Benthic ecology	✓	✗	Due to the localised and temporary nature of the UXO investigation works there are no potential impacts expected on the benthic ecology resulting from the presence of survey vessels.
Fish and shellfish ecology	✓	✗	Due to the localised and temporary nature of the UXO investigation works there are no potential impacts expected on the fish and shellfish ecology resulting from the presence of survey vessels.
Marine mammals	✗	✓	Due to the localised and temporary nature of the UXO investigation works there are no potential impacts on marine mammals resulting from seabed and seawater quality impacts. Indirect effects on marine mammal prey species are therefore not considered further.
Ornithology	✗	✓	Due to the localised and temporary nature of the UXO investigation works there are no potential impacts expected on ornithology resulting from seabed disturbance.
Protected sites	✓	✓	All potential impacts associated with the UXO investigation works may affect the designated features of protected sites in the area.
Commercial fisheries	✓	✓	All potential impacts associated with the UXO investigation works could affect commercial fisheries in the area.
Shipping and navigation	✗	✓	Due to the localised and temporary nature of the UXO investigation works there is no potential impact expected on shipping and navigation resulting from the disturbance to the seabed or seawater quality.
Marine archaeology	✓	✗	Due to the localised and temporary nature of the UXO investigation works there is no potential impact expected

Receptor	Impacts on seabed and seawater quality	Presence of vessel	Justification for scoping out
			on archaeological receptors resulting from the presence of survey vessels.
Aviation and Ministry of Defence (MOD)	✗	✗	There are no aviation and MOD receptors that could be impacted by the UXO investigation works and so these receptors are not assessed further in this application.
Infrastructure	✗	✗	There are no infrastructure receptors that could be impacted by the UXO investigation works and so these are not assessed further in this application.

Key: ✓ = Scoped in; ✗ = Scoped out

4.3 Physical environment

4.3.3 Summary of baseline

The bathymetry in the surrounding area ranges from 0-60 m, and the inclination towards the shore is gentle. Around the Nigg Bay headlands there is greater variability in depth and steeper seabed gradients. The seabed in the area around the AOWF slopes east-south-east with decreasing gradient between 1 in 110 and 1 in 140 to the 25 m contour, which continues to decrease further offshore at a gradient of 1 in 300.

The section of the surrounding area to the AOWF is mostly fine well sorted sands, with fine muddy sands near WTG B06, while the rest of the area is sandy sediment. No bedrock is exposed in the surrounding area with sediment thickness ranging from 30-50 m at WTG B06 to 5-20 m near the shore. Sediment near the Aberdeen South Harbour is rock at the headlands, with much of the central area mobile sand, with coarse shingle strips (Aberdeen Harbour, 2015). However, there are likely to have been alterations to the nature of the seabed sediments in the Nigg Bay area as a consequence of the new harbour construction works.

Offshore, there is a gradual net transport of sediment (sand). Longshore drift of material is dominated by waves in a northern direction, although southern drift is also possible.

The mean spring tidal range is 3.4 m at AOWF and 3.5 m at Aberdeen South Harbour.

Seawater within the overall study area along the survey route corridor is of fully marine conditions. The survey area is on a relatively exposed coast with some terrigenous inputs from the Don, Dee and Ythan estuaries, although these inputs are considered relatively minor and the waterbody is well-mixed. There are two relevant Water Framework Directive (WFD) water bodies: Cruden Bay to Don Estuary coastal water body and the Don Estuary to Souter Head (Aberdeen) coastal water body. The current status of these water bodies meets the requirements of the Water Framework Directive (WFD: 2000/60/EC): Cruden Bay to Don Estuary coastal water body has an overall water body status of high, while Don Estuary to Souter Head (Aberdeen) coastal water body has an overall status of good. As such, SEPA are obliged to ensure that there is no deterioration

from "Good" status, unless it is as a result of a new activity providing significant specified benefits to society or the wider environment.

The water quality along the pipeline corridor is expected to be good, before reaching areas around Aberdeen South Harbour, which has known potential water quality issues in the bay, particularly around low tide (RSK, 2021b).

Seabed sediment from Aberdeen Harbour has been previously tested for a range of contaminants: metals, tributyltin (TBT), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), showed all samples having contaminant concentrations below Action Level 1 for all contaminants tested. These are deemed as posing no risk to the environment if dredged sediment is disposed at sea, when compared against thresholds set in the Marine Scotland guidelines (Aberdeen Harbour, 2015).

4.3.4 Assessment of potential effects on the physical environment

During the UXO investigation work, there is potential for physical disturbance of the seabed at localised areas, where dredging and/or non-UXO object removal / relocations takes place. There is also the potential that operating ROVs and other sensors close to the seabed could cause minor disturbances to the seabed. However, it is considered that the depressions caused by the dredging works using suction pumps would have a negligible effect, given the small-scale nature of the works, and could potentially be reversed by natural processes in a relatively short period of time. Burial depths for potential UXO targets are not anticipated to be very deep (typically <2 m). The dredging will also result in a small amount of sediment entering the water column, before settling back to the seabed, with the potential for the dispersion of finer sediment. This temporary increase in suspended sediment concentrations into the water column will be localised and for a short duration and any settling out of finer sediments onto the seabed are also anticipated to be localised.

The Don Estuary to Souter Head (Aberdeen) coastal water body is designated as a heavily modified water body due to physical alternations that cannot be addressed without significant impact on navigation and from an increased risk of subsidence or flooding. No deterioration in status of either this coastal water body or the Cruden Bay to Don Estuary coastal water body is expected to occur as a result of the proposed investigations.

Typical levels of sediment contamination in the area correspond with the background contamination levels reported for the North East Atlantic Sea. The contaminants in the sediments within the original AOWF area were all found to be below the Probable Effects Level (PEL) or below detection limits, assuming contaminant levels are consistent throughout the area and all hydrocarbons, organotins and polychlorinated biphenyls (PCB) concentrations were below the limit of detection (AOWFL, 2011). Therefore, any impacts from sediment disturbance is unlikely to impact significantly on seawater quality. There will be an increase in turbidity during the dredging works as part of the uncovering of potential targets, however this is anticipated to be limited in both extent and duration. In addition, as the route corridor is in an area of relatively high hydrodynamic energy, a high level of dilution and rapid dispersion would be expected (AOWFL, 2011), if any contaminants were to enter the water column. Previous modelling conducted for the new harbour construction works has shown that the residence time of water within Nigg Bay is rapidly exchanged with offshore waters, with 90% of the water being flushed within 6

hours (Aberdeen Harbour, 2015). Therefore a high level of dilution and dispersal of pollutants would also be expected for the nearshore areas along the survey route corridor close to the landfall and approaches.

Based on the methods being used for the investigation works and associated dredging or non-UXO object removal / relocation, any impacts on the physical environment are expected to be localised to the area of works and for a short duration with rapid recovery likely, and so are considered not significant.

4.4 Benthic ecology

4.4.3 Summary of baseline

The offshore subtidal benthic habitat including the dominant community assemblage in the area of the proposed UXO survey route corridor is described in the AOWF ES (Environmental Statement) as *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (SS.SSA.CMuSa.AalbNuc) (AOWFL, 2011; JNCC, 2015). Here, the infauna community was shown to be dominated by polychaetes (e.g. *Notomastus latericeus*), bivalves (*Abra alba*, *Nucula nitidosa* and *Fabulina fabula*) and echinoderms (e.g. brittle stars *Ophiura* spp.). The epifaunal community is dominated by brittle stars, brown shrimp (*Crangon crangon*) and flying crab (*Liocarcinus holsatus*) (AOWFL, 2011).

The subtidal benthic habitat including the dominant community assemblage further inshore is described as *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (SS.SSA.IFiSa.NcirBat) (AOWFL, 2011; JNCC, 2015). Infralittoral fine sand habitats are characterised by amphipods (e.g. *Bathyporeia*) and polychaetes (e.g. *Nephtys cirrosa*).

There are additional subtidal habitats in the southern section of the area closer to the route corridors landfall and approaches, described in the Aberdeen South Harbour Project ES, around Nigg Bay (Aberdeen Harbour, 2015) These are *Laminaria digitata* on moderately exposed sublittoral fringe rock (IR.MIR.KR.Ldig) in the shallow subtidal areas at the peripheries of the bay, *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand (SS.SSa.IMuSa.FfabMag), and echinoderms and crustose communities (CR.MCR.EcCr).

The intertidal shoreline in the southern section of the area, where the Aberdeen South Harbour Project is located, contains some rockier habitats around the headlands of Nigg Bay (Aberdeen Harbour, 2015), although this area will have been subjected to a degree of alteration by the ongoing construction of the new harbour.

Some of the habitats around the northerly headland of Nigg Bay (Girdle Ness) include *Mytilus edulis* and barnacles on very exposed eulittoral rock, *Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock, *Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock, and yellow and grey lichens on supralittoral rock.

4.4.4 Assessment of potential effects on benthic ecology

The impacts on benthic ecology from the proposed UXO investigation works may occur due to direct physical disturbance to the seabed, habitat loss, or from increases in

suspended sediment concentrations and the subsequent deposition. This may have a direct impact on benthic species, particularly filter feeders or those susceptible to increased levels of sediments in suspension, minor deposition or smothering.

With regards to the subtidal environment, the AOWF site is considered to have benthic ecology with the potential for high recoverability (AOWFL, 2011), with the benthic habitat largely consistent across the area. None of the subtidal benthic habitats observed, or the species associated with them, are Scottish Priority Marine Features, and there are no protected areas designated for subtidal benthic habitats. The impact of sediment suspension as a result of the minor dredging proposed, and/or non-UXO object removal / relocation, would not be expected to have a significant impact, given the short term duration of the work, within a localised area. The biotopes present in the AOWF area are not sensitive to increased sediment loads, have a low sensitivity to sediment disturbance and would be expected to recover from any localised smothering (AOWFL, 2011). Therefore, the habitats and species present are expected to recover quickly, given that any disturbance of sediments and seabed habitats is expected to be localised and temporary in nature.

In the intertidal environment, the habitats are subject to regular disturbance from environmental processes. These habitats are not sensitive to short term disturbance and would therefore, be able to recover given that species are acclimated to such conditions, where there is regular disturbance (Tillin, 2016). None of the intertidal biotopes identified at Aberdeen South Harbour are valued as either Annex I habitats or habitats of principal importance. Works under the proposed scope of works will not have a direct impact on intertidal benthic habitats, however there is the potential for limited and minor levels of sedimentation in the nearshore waters and the intertidal. Due to the in-direct nature of any such impacts on the intertidal environment, the recoverability and common nature of the intertidal biotopes present, and the fact that they are not protected features, as well as taking into context the current status of the new harbour (Aberdeen South Harbour) construction works, any effects on the intertidal environment are not expected to be significant.

Whilst there is potential for physical disturbance to the seabed during associated dredging or non-UXO object removal / relocation to occur, any impacts are not likely to be significant, due to the temporary, localised nature of the work and the expected ability of the species present, to recover. Negative impacts on benthic ecology are therefore considered not significant.

4.5 Fish and shellfish ecology

4.5.3 Summary of baseline

There is a large range of teleost (ray-finned) fish, elasmobranchs (e.g. sharks, rays, skates) and shellfish that can be found in the area, in and around Aberdeen and Nigg Bay. Species may use the area for spawning or nursery grounds or pass through the area along migration routes.

Demersal species include cod and sand eel. Species such as Atlantic salmon and the European eel are known to pass through the area along a migration route. Pelagic species include herring, which also use the area for spawning and a nursery. Herring and

elasmobranchs, including thornback skate and small-spotted catshark are thought to spawn in the area, with spawning grounds that are benthic or demersal.

Other key teleost and elasmobranch species which are in the area are sea trout, whiting, saithe, plaice, lemon sole and common skate, with haddock and mackerel accounting for some of the commercially important fish. Numerous shellfish species, such as freshwater pearl mussel and European lobster are present in the area, as are cephalopods, including long-finned squid and cuttlefish.

4.5.4 Assessment of potential effects on fish and shellfish ecology

As several fish species have spawning and/or nursery grounds within the AOWF area, there is potential for impacts associated with the UXO investigation work, to result in localised disturbance to spawning/nursery grounds, and/or disturb fish. There is potential to cause loss or disturbance of seabed habitat and spawning substrate. Shellfish could also be disturbed through direct disturbance as well as sediment resuspension. Any work is not expected to impact pelagic species, which can undertake avoidance behaviour if required.

Due to the localised and temporary nature of the work, any impacts due to physical disturbance to the seabed from dredging or non-UXO object removal / relocation, including habitat loss or removal of potential spawning substrate, are likely to be negligible. The high degree of potential recoverability of seabed habitat is also a consideration as is the fact that the survey area and any localised dredging or object removal represent a fraction of benthic or demersal spawning or nursery areas for fish species. These spawning and nursery areas are widespread and the area off the Aberdeen coast does not represent an area that is recognised as being of particular importance for fish species. The impact of the investigation survey on fish and shellfish species from direct disturbance and increased sediment suspension is therefore, considered not significant.

Due to the localised and temporary duration of the use of EM, its use of a relatively low level of intensity and the fact that it will be constantly moving along the survey route corridor, it is unlikely there will be negative impacts on species of sensitive fish or other sensitive animals or ecology from the use of EM sensors. Due to the fact that the survey will be in constant transit along the route corridor, the EM outputs do not present a permanent barrier to sensitive species migration or foraging in the way that a permanently installed power cable on the seabed can.

4.6 Marine mammals

4.6.3 Summary of baseline

During the boat surveys carried out for the AOWF development, harbour porpoise were the most regularly sighted species, with bottlenose dolphins also regularly sighted (AOWFL, 2011; Genesis, 2012a). These are two resident species in the area. Other cetacean species sighted during the surveys were white-beaked and Risso's dolphins, and minke whales (AOWFL, 2011; Genesis, 2012a). During recent geophysical surveys carried out between December 2021 and March 2022, one harbour porpoise and several groups of unidentified dolphins, likely bottlenose dolphins, were seen along the pipeline route (Fugro, 2022).

Minke whales, humpback whales and short-beaked common dolphins have all been observed within the area around Aberdeen Harbour (Hague *et al.*, 2020), although humpback whales and common dolphins are rare visitors to the area.

Grey and harbour seals also use the area year-round (Hague *et al.*, 2020), with the nearest main haul-out sites of both species at Donmouth and the mouth of the Ythan River. They also use the estuaries of the River Dee and Don as feeding grounds (AOWFL, 2011). Grey seals use Aberdeen Bay more consistently than harbour seals, with the seals seen during the recent geophysical surveys likely to be grey seals (Fugro, 2022), although harbour seals are seen regularly along the coast.

Although not strictly a marine mammal, the European otter uses the Dee estuary and Aberdeen Harbour as a foraging area.

4.6.4 Assessment of potential effects on marine mammals

There is a potential for the increased vessel presence to impact marine mammals, due to an increased collision risk or disturbance and avoidance behaviour. This risk is predicted to be negligible for the UXO investigations survey as vessel traffic will be insignificantly increased, with only a single large ROV support vessel used to carry out the survey. The vessel will be following a pre-defined route and will be operating at low and predictable speeds. Marine mammals are therefore likely to be able to avoid the vessel. Slow-moving vessels also present a much reduced risk to marine mammals than high-speed vessels (Bristow & Reeves, 2001; Gregory & Rowden, 2001; Leung Ng & Leung, 2003; Buckstaff, 2004).

Any disturbance impacts or avoidance of the area by marine mammals is expected to be temporary, should it occur. The vessel and ROV are also unlikely to cause a significant increase in noise against the background noise levels in Aberdeen Bay, so disturbance related to vessel and equipment noise is not considered to have a significant impact during the investigation survey. It is also important to take into context the existing high levels of vessel traffic in Aberdeen and Nigg Bay. The port of Aberdeen takes a significant volume of vessel traffic, largely associated with the North Sea operations, in addition vessels operate to and from the AOWF. Construction vessel traffic is also present in Nigg Bay associated with the new Aberdeen South Harbour. As such marine mammals are habituated to the existing high numbers of vessels physically present and the underwater noise that may result.

The presence of the vessel associated with the proposed survey will be temporary, and any effects will be extremely localised. Species that predominate in the area are relatively small and mobile, so negative impacts on marine mammals with regards to collision risk or disturbance are not considered significant.

4.7 Ornithology

4.7.3 Summary of baseline

Marine birds can be classified as offshore – those that breed along coast but spend the majority of time outside of the breeding season over the open sea – and coastal – those that breed along the coast but may collect food from the open sea (this includes coastal

waders, wildfowl and other shorebirds). The area within Aberdeen Bay is likely to be used as a foraging area for both offshore and coastal birds.

Common offshore birds in the area, include; black-legged kittiwake, great black-backed gull, Arctic skua, great skua, fulmar, Manx shearwater, Northern gannet, Atlantic puffin, razorbill and guillemot.

Common coastal birds in the area include; whooper swan, pink-footed goose, barnacle goose, Eurasian wigeon, Eurasian teal, eider, long-tailed duck, common scoter, red-throated diver, common gull, sandwich tern, common tern, arctic tern, black-headed gull, lesser black-backed gull, herring gull, cormorant, and European shag.

4.7.4 Assessment of potential effects on ornithology

There is potential for vessel presence to impact on ornithological receptors. However, birds are highly mobile so would be able to temporarily move out from the area where the survey is being carried out. Also, as the area is busy with shipping and recreational boating, birds are likely to be habituated to vessel traffic and the addition of a slow moving survey vessel for a period of approximately 2 months would have a minimal temporary disturbance on birds, particularly as this will be localised. Given the minimal increase in vessel traffic that will be caused and the short duration, impacts are not likely to be significant. The potential for birds to be displaced from their foraging habitats or to be forced to alter flight routes as a result of the UXO investigation works' vessel presence is unlikely.

4.8 Protected sites

4.8.3 Summary of baseline

There are a number of coastal or marine protected areas that are within 20 km of the UXO investigations survey route. These are described in Table 4.2.

Table 4.2: Designated sites within 20 km of the works area

Site name	Reason designated
Special Protection Area (SPA)	
Ythan Estuary, Sands of Forvie and Meikle Lock	Supports populations of European importance of the migratory pink-footed goose (<i>Anser brachyrhynchus</i>), populations of European importance of sandwich tern (<i>Thalasseus sandvicensis</i>), common tern (<i>Sterna hirundo</i>), little tern (<i>Sternula albifrons</i>), and a wintering waterbird assemblage, which includes nationally important populations of pink-footed goose, eider (<i>Somateria mollissima</i>), redshank (<i>Tringa tetanus</i>) and lapwing (<i>Vanellus vanellus</i>).
Buchan Ness to Collieston Coast	Supports a breeding seabird assemblage, which includes nationally important populations of fulmar (<i>Fulmarus glacialis</i>), guillemot (<i>Uria aalge</i>), herring gull (<i>Larus argentatus</i>), black-legged kittiwake (<i>Rissa tridactyla</i>) and European shag (<i>Phalacrocorax aristotelis</i>).

Site name	Reason designated
Special Area of Conservation (SAC)	
River Dee	Supports a functional population of freshwater pearl mussels (<i>Margaritifera margaritifera</i>), a significant proportion of the Scottish Atlantic salmon (<i>Salmo salar</i>) resource and a strong, high quality population of otters (<i>Lutra lutra</i>).
Garron Point	Supports the only remaining population of narrow-mouthed whorl snail (<i>Vertigo angustior</i>) in Scotland.
Sands of Forvie	Supports dune habitats: shifting dunes, shifting dunes with marram, lime-deficient dune heathland with crowberry and humid dune slacks.
Buchan Ness to Collieston	Supports vegetated sea cliffs of the Atlantic and Baltic coasts.
Nigg Bay	Designated for geological interest: quaternary of Scotland.
Cove Bay	Designated for geological and biological interest: maritime cliff and Dickie's bladder-fern (<i>Cystopteris dickieana</i>).
Findon Moor	Designated for biological interest: lowland heathland.
Garron Point	Designated for geological and biological interest: Dalradian geology, maritime cliff, narrow-mouthed whorl snail (<i>Vertigo angustior</i>) and the Northern brown argus butterfly (<i>Aricia artaxerxes</i>).
Forveran Links	Designated for geological and biological interest: coastal geomorphology of Scotland and sand dunes.
Sands of Forvie and Ythan Estuary	Designated for geological and biological interest: coastal geomorphology of Scotland, sand dune, estuary, saltmarsh, vascular plant assemblage and breeding bird assemblage.
Collieston to Whinnyfold Coast	Dalradian geology, maritime cliff, cliff-breeding seabird colony, and sea wormwood (<i>Seriphidium maritimum</i>).
Bullers of Buchan Coast	Designated for geological and biological interest: coastal geomorphology of Scotland, maritime cliff, and breeding seabird assemblage.
Donmouth	Designated for the beach, which is of local importance in terms of natural heritage.

Figure 4.1 and Figure 4.2 shows selected protected sites for nature conservation in relation to the proposed UXO investigation survey route corridor.

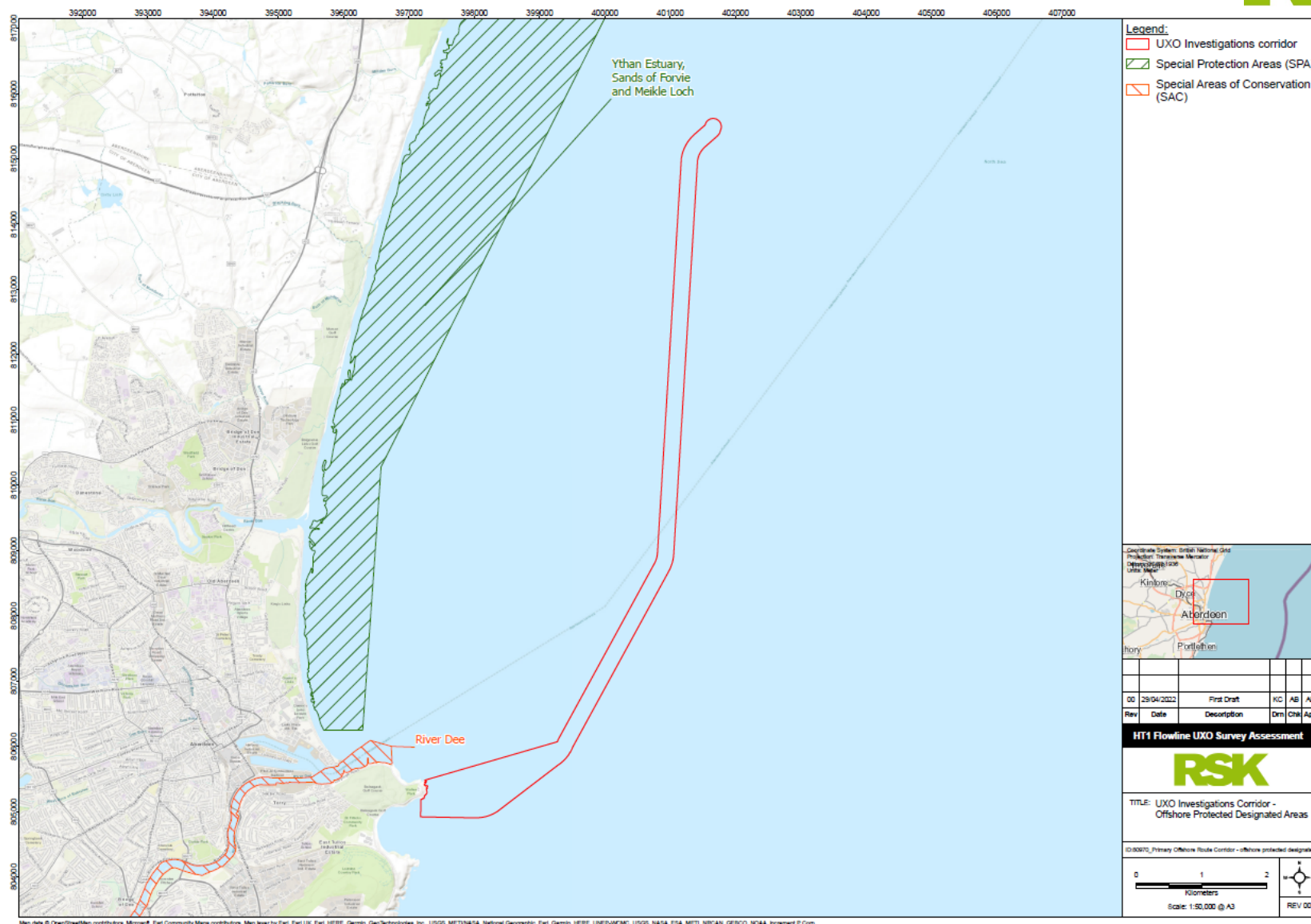


Figure 4.1: UXO Investigations Offshore Route Corridor - Protected Designated Areas 50 km

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Proposed Hydrogen Electrolyser at Aberdeen Development: Hydrogen Turbine 1 (HT1) – UXO Investigations Supporting Environmental Information

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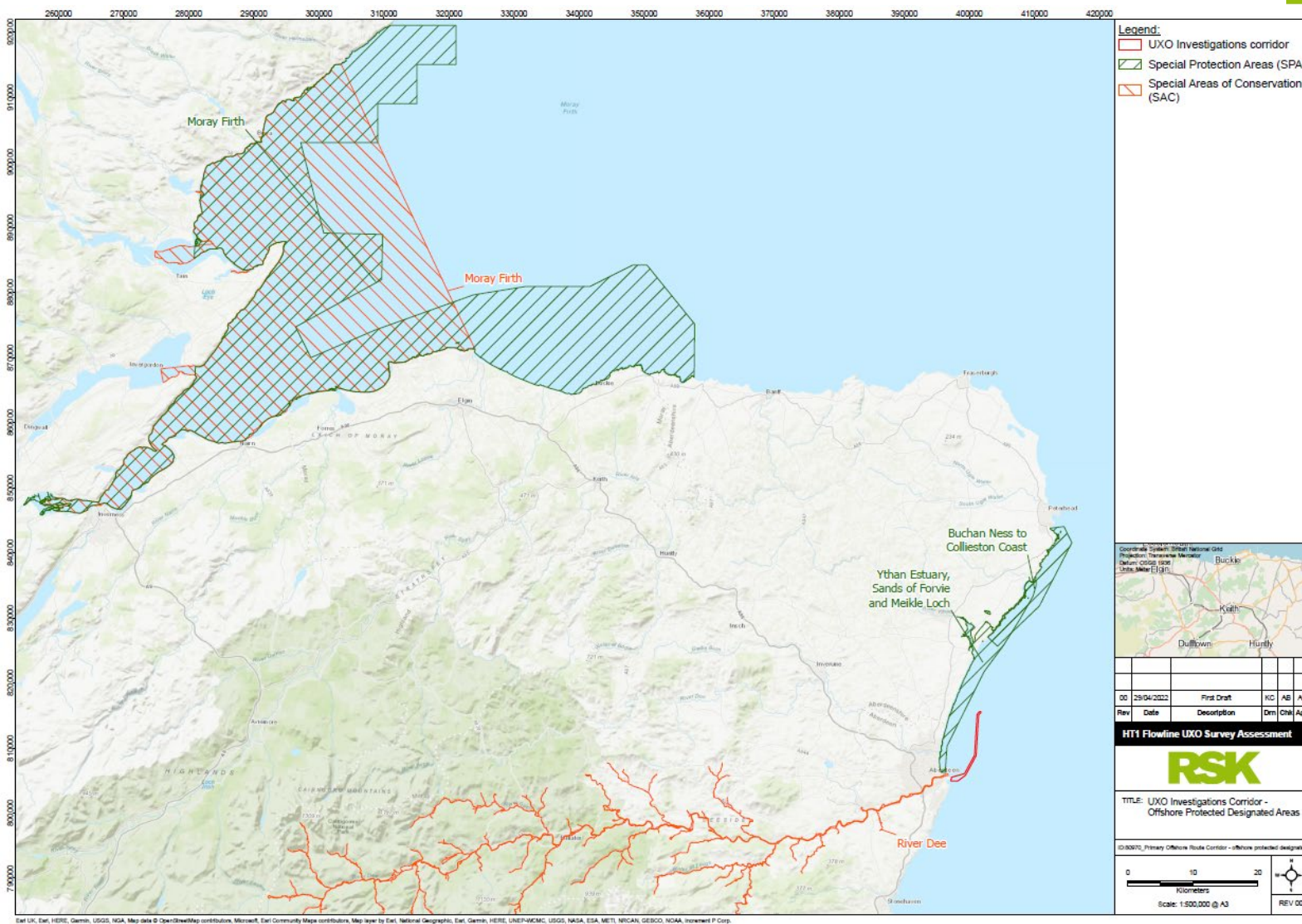


Figure 4.2: UXO Investigations Offshore Route Corridor - Protected Designated Areas 500 km

Vattenfall Wind Power Ltd.

Proposed Hydrogen Electrolyser at Aberdeen Development: Hydrogen Turbine 1 (HT1) – UXO Investigations Supporting Environmental Information

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4.8.4 Assessment of potential effects on protected sites

Not all of the sites in Table 4.2 will be impacted by the UXO investigations works, as many are designated for coastal terrestrial features. However, the proposed UXO investigation work has the potential to affect some of the protected features of designated sites that have been listed. The marine areas of the Ythan Estuary, Sands of Forvie and Meikle Lock SPA and the Buchan Ness to Collieston SPA may have connectivity with the survey route corridor, due to foraging ranges of qualifying species, while the River Dee SAC extends out to the tidal limit of the river in the estuary mouth and may also have connectivity with survey route due to migration routes of qualifying species. Therefore, the potential impacts to the integrity of these areas need to be considered and are discussed further in Section 6.2.

4.9 Commercial fisheries

4.9.3 Summary of baseline

Commercial fishing activities in the area surrounding the AOWF are considered to be at relatively low levels of intensity. Potting for crab and lobsters (inshore); trawling for whitefish (predominantly offshore); and dredging for scallops (predominantly offshore) accounts for the majority of the activity (AOWFL, 2011).

Data on inshore fishing activities gathered as part of the ScotMap project (Kafas *et al.*, 2014) suggest that fishing within the area is for the most part limited to creeling by small local vessels. These vessels have historically concentrated their activity around a localised nearshore area off Aberdeen. However, since the new Aberdeen Harbour extension project, it is likely that activity has moved south, outside the area. Creel fishing for crab or lobster are known to occur in the waters off Girdle Ness directly on the proposed survey route corridor.

Although at very low levels some demersal trawling activity by small vessels targeting flatfish has been historically reported from the surrounding area (Kafas *et al.*, 2014).

Total landings in Aberdeen in 2019 were 1,271 tonnage, made up of 2 tonnage of demersal species, 7 tonnage of pelagic species and 1,262 tonnage of shellfish (edible crab, lobster, *Nephrops*, scallops, velvet crab, plus other shellfish) (The Scottish Government, 2020a).

4.9.4 Assessment of potential effects on commercial fisheries

Impacts on commercial fisheries may occur due to the presence of the survey vessels and the associated requirement for an exclusion area to be established around them during survey operations. The localised disturbance to the seabed during the dredging works to uncover seabed objects may also have minor implications for demersal fishing activities. As the UXO investigation survey will only involve limited numbers of survey vessels over a short period of time and within a relatively localised area, no significant impacts are expected on commercial fisheries. It is recognised that the nearshore waters of the route are used for creel fishing and liaison with fishing organisations will be required to minimise any disturbance during the nearshore phases of the survey. Notices to Mariners will also inform any commercial fisheries of the investigation works, reducing

any potential conflict. No ecologically significant impacts are expected that would reduce the population of any target species.

Physical disturbance to the seabed during the UXO investigation works and dredging and/or non-UXO object removal / relocation where required, will be localised in extent and limited in the duration of impacts. The survey corridor will also only be relatively narrow, therefore any disturbance effects on the seabed are not expected to be significant, even if localised dredging occurs within the corridor. Due to the presence of potting activities there is a small potential for entanglement, but as the survey follows a pre-defined route any entanglement impacts should be minimal and it would be expected to be reduced as a consequence of adequate liaison prior to the mobilisation of the survey. Interactions with the fishing community or with fishing equipment would be managed by the survey's on-board Fisheries Liaison Officer (FLO). Therefore any negative impacts on commercial fisheries or target species during the UXO investigations work are not considered to be significant.

4.10 Shipping and navigation

4.10.3 Summary of baseline

A baseline navigation assessment has been undertaken (Anatec Limited, 2021), using data collected during one month in summer (June) and one month in winter (December) 2021. The port of Aberdeen is busy in terms of commercial vessel traffic, in particular serving the northern North Sea offshore oil and gas industry as well as a number of offshore windfarms. In addition a regular ferry service operates to the North Isles.

There is a high-density southwest / northeast route observed to/from Aberdeen Harbour through the area, passing to the east of the AOWF, and this was observed during both June and December. The majority of vessels recorded on this route were oil and gas support vessels, followed by passenger vessels .

There is also a high density of vessels in the Aberdeen South Harbour Development zone; mainly tugs, port tender vessels and dredgers. Other vessels in the area include cargo, fishing, search and rescue, recreational, and wind farm support vessels.

There is a designated (charted) anchorage area within the surrounding area, 2 nm north of the entrance to the Aberdeen Harbour, as well as a pilot boarding location. Aberdeen Harbour has compulsory pilotage for vessels with a length of 60+ m, and so the pilot boarding location may also be an area of high frequency anchorage.

Navigation buoys are also present in the area, directing vessels on the approach to Aberdeen Harbour. A fairway buoy (equipped with Radar and radio beacons - RACON) is the main navigational aid approximately 1.4 nm north-east from Aberdeen Harbour's South Breakwater.

There are no known maintenance dredged channels, dredging disposal or borrow (sand mining) areas in the surrounding area (Admiralty, 2021). It is understood that a dredged channel to a depth of 12 m below chart datum will be present into and out of the new Aberdeen South Harbour.

4.10.4 Assessment of potential effects on shipping and navigation

There is potential for the UXO investigation works to result in an obstruction to shipping and navigation. However, it is expected that investigation works at the AOWF end (around WTG B06) of the survey route corridor will not pose a conflict with many other users, due to the restrictions on navigation within the array area and the low traffic volumes in the wider area.

During the UXO investigation works there may be potential for interactions between the vessels into and out of the main port of Aberdeen as well as Aberdeen South Harbour, where the entrance to the harbour, the shipping channel and the survey route may intersect. If conflicts arise here, at the time of investigation works, there is potential for a minor impact on shipping. To ensure these are not significant the following mitigation measures are proposed:

- full liaison with MCA, NLB and Harbour Authorities will take place prior to the survey vessel starting work
- Notices to Mariners will be published as required
- Vessel Management Plan(s) and Navigation Safety Plan(s) will be developed as required

4.11 Marine archaeology

4.11.3 Summary of baseline

A total of 32 marine cultural heritage assets were identified within the proposed project area during preliminary archaeological assessments undertaken as part of the feasibility assessment (RSK, 2021a), including twelve wrecks and twenty obstructions. Of these, only two obstructions are listed as live; both are identified as anchors.

The ten wrecks identified within the survey area range in date from the 16th century to 1961. It is nevertheless important to recognise that all these records appear to relate to reports of wreck events; these either do not have reliable locational information or should not be seen as indicative of the presence or absence of physical remains. They are therefore included here to highlight the potential for encountering wrecks that have been reported in the past, but for which there is currently no material evidence to substantiate their existence.

It is also noteworthy that a further 303 wrecks and three aircraft were identified in the wider project area during the feasibility assessment (RSK, 2021b). Of these, 13 are considered to be live, one dead and four lifted. The remaining 288 records (including the three aircraft) must also be considered to be loss reports; given the ephemeral nature of aircraft crash sites and historical inaccuracies in the recording of wrecking incidents, the potential for encountering unrecorded cultural heritage assets during survey works must therefore be considered moderate. The cultural heritage assets that have been identified in this assessment will be evaluated further in an updated Desk Based Assessment (DBA) specific to the route corridor as well as in the project-specific Written Scheme of Investigation (WSI), which would be carried out prior to the mobilisation of the survey operations.

Known cultural heritage assets (including known wrecks and obstructions) in the vicinity of the UXO survey route corridor offshore and in the approaches to the Nigg Bay landfall are shown in Figure 4.3 and Figure 4.4.

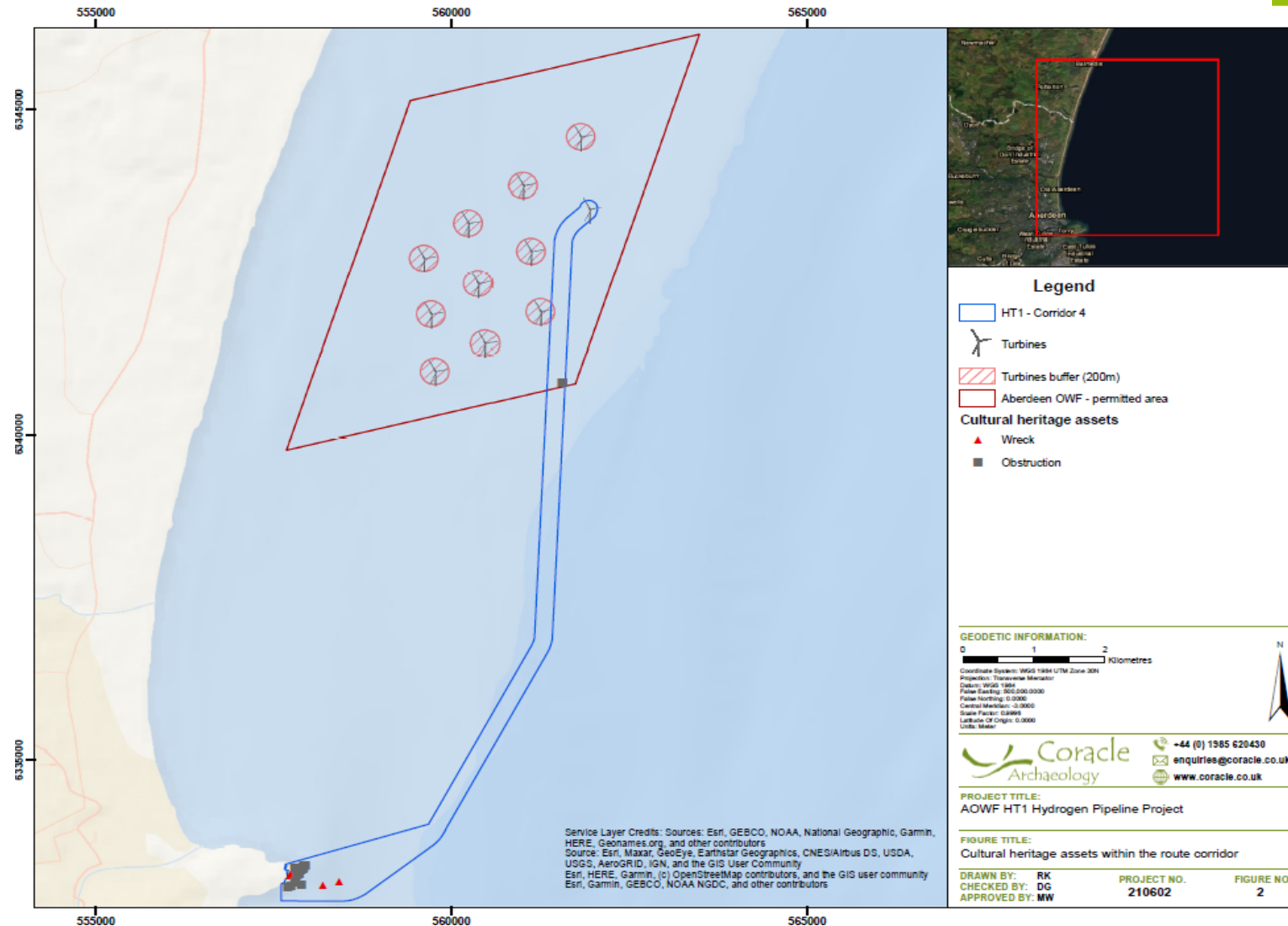


Figure 4.3: Cultural Heritage Assets within the UXO survey route corridor

Source: Coracle, 2022

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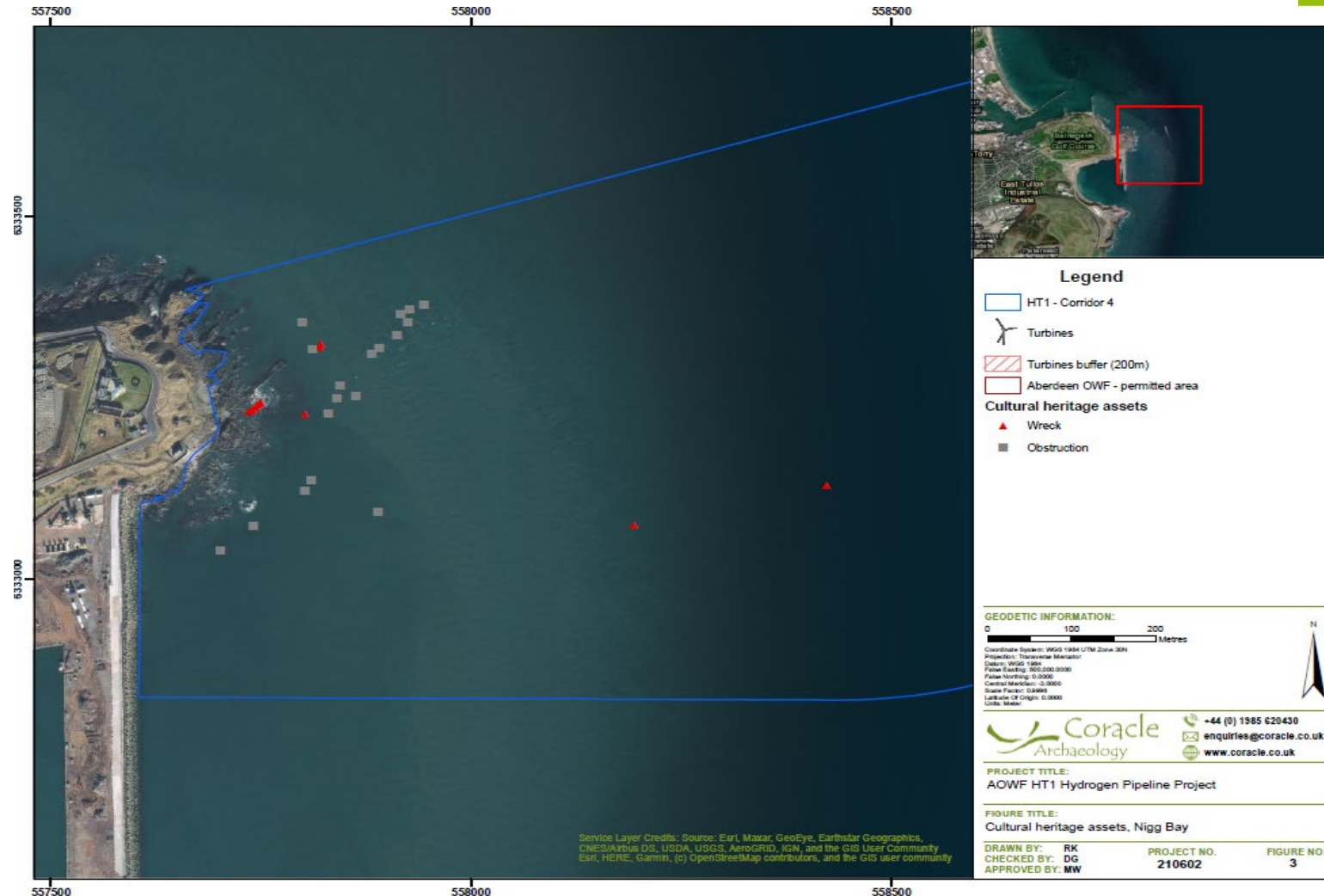


Figure 4.4: Cultural Heritage Assets within the UXO survey route corridor within the Nigg Bay landfall approaches

Source: Coracle, 2022

4.11.4 Assessment of potential effects on marine archaeology

As part of the survey works there are no field-based specific archaeological investigations planned, however, during the target inspections incidental archaeological finds may occur. This could result in the requirement for more work (i.e. dredging) following completion of the target inspection. The protocols that would be followed in the field in the event of a discovery are outlined further below. The details (video and location) will be passed from the survey operator to the client team such that relevant authorities can be notified. Objects of confirmed archaeological interest would not be moved from their location on the seabed as part of this survey but left in situ.

Prior to the commencement of the UXO investigation survey campaign, a WSI will be required. The WSI will be submitted to MS-LOT and HES along with the updated DBA in anticipation that this would be a condition of the marine licence. The primary aim of the WSI is to reduce the potential risks of impact from the proposed works on cultural heritage assets, and to set out clearly the procedures that will be followed to avoid, minimise or mitigate these impacts. The WSI will draw upon all current and relevant guidance, including both COWRIE (2007) and the Crown Estate (2021), and will be produced in an agreed format compatible with other WSIs for the project.

The WSI will draw upon the data previously collected above in the desk-based assessment. It will outline the cultural heritage and archaeological scope of works for the proposed project, identifying and providing locational information, where available, for all wreck sites and other archaeological features recorded in the UK Hydrographic Office and associated repositories and datasets. It will then establish mitigation procedures to protect cultural heritage assets; this may include the imposition of archaeological exclusion zones (AEZs), for example, or ongoing archaeological support during the UXO survey.

In addition to the WSI a Protocol for Archaeological Discoveries (PAD) will be developed prior to the commencement of the UXO inspection campaign. In accordance with relevant guidance and industry best practice (e.g. Crown Estate and Wessex Archaeology 2014), the PAD will set out clearly the protocols and reporting procedures that must be followed in the event of any unexpected archaeological discoveries (particularly during the removal of non-UXO items) and will provide contact details for all relevant stakeholders. It will outline the respective responsibilities of the developer, their contractors (the UXO survey team) and the archaeological consultant and establish formal lines of communication between the parties and with the archaeological curators, thus ensuring that in the event of any unexpected archaeological discovery appropriate archaeological input, review and recording is undertaken. A representative should also be nominated in the survey company (the nominated contact) to ensure that correct procedures are followed at all times. The PAD will also establish the reporting, conservation and archiving requirements of any archaeological works.

Prior to the commencement of the surveys, a toolbox talk will be presented to representatives of the works crews and survey team. This will be presented via Microsoft Teams and use a pre-prepared PowerPoint presentation to outline the roles and responsibilities of individuals as detailed in the PAD and ensure that all works are undertaken in adherence to the agreed terms and conditions.

As described above, heritage assets identified during the survey operations will need to be reviewed by the archaeological consultant; this will include review of survey footage and assessment of information provided by the survey teams. The archaeological consultant will then liaise with the national curators regarding appropriate mitigation prior to object removal; this may include, but is not limited to, additional surveys to confirm the nature and extent of the asset (e.g. ROV or geophysical), the imposition of AEZs and potential micro-routing of the proposed pipeline route corridor, or removal and conservation of the asset. Until these processes have been undergone, however the asset would remain in-situ.

5 POTENTIAL CUMULATIVE EFFECTS

Cumulative effects are those which are caused by the combined impact of anthropogenic actions and natural process at a certain location. These can occur when there is an environmental impact on a receptor caused by the combination of effects from multiple projects (either in existence or reasonably foreseen).

With regards to the UXO investigations survey route, active projects that have been identified within the survey area are construction works associated with the Aberdeen South Harbour, ongoing operational and maintenance works associated with AOWF and general vessel traffic from the main Aberdeen Harbour.

Any works associated with the AOWF, including surveys of transmission cables, are run by Vattenfall. Therefore, where possible, works programmes can be aligned to minimise any potential cumulative effects.

Ongoing construction works at Aberdeen South Harbour are unlikely to result in any cumulative effects as a result of the proposed survey work. Where dredging is required during the investigation works, this will be localised and at a relatively shallow depth, therefore, any additional disturbance to the benthic environment will be negligible.

Cumulative impacts with vessel traffic from Aberdeen Harbour are also unlikely to be significant. Given that one primary survey vessel will be used to carry out the survey, it is not expected that this will cause any considerable impact to receptors associated with an increase in vessel activity.

The addition of the vessel into the survey area is not expected to contribute significantly to any cumulative effects that would impact receptors. Due to the short term duration and localised and transient nature of the work, it is unlikely to cause any significant impacts, and appropriate liaison with appropriate navigation stakeholders as well as the issuance of a Notice to Mariners and the presence on board the survey vessel of a client / survey representative and FLO will further mitigate any potential conflict from interactions during the survey operations themselves.

6 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS ON INTEGRITY OF PROTECTED SPECIES

6.1 Introduction

This section provides an assessment of potential likely significant effects (LSE) on the integrity and conservation objectives of nearby designated (Natura 2000) sites, arising from the proposed UXO investigation survey operations. It considers whether a qualifying feature is likely to be directly or indirectly affected by operations, and if there will be a LSE on the favourable conservation status of the features for which the site was designated, in light of the conservation objectives for the site.

Under the 2010 Habitats Regulations, the competent authority would be required to undertake an Appropriate Assessment of the implications of a proposed activity in view of any affected designated site's conservation objectives, should it be determined that the proposed activity represents an LSE. The information presented in this section is intended to provide the competent authority with the relevant information to enable them to determine whether an Appropriate Assessment is required and where required, to support the completion of an Appropriate Assessment.

6.2 Designated sites

The designated sites identified as relevant to this assessment were selected due to their immediate proximity to the proposed UXO investigation works and/or existence of potential impact pathways relevant to the site features. The designated sites in proximity to the UXO investigations survey route corridor are shown in the Figure 4.1 and Figure 4.2.

As the purpose of this Section is to identify the potential for any LSE (and where LSE is identified to provide information to support an Appropriate Assessment) and given the small footprint and short duration of the UXO investigation operations, effect pathways to more distant designated sites were considered unlikely.

6.2.1 Consideration of LSE and the potential for AEOI

Potential sources of impacts from each aspect of the UXO investigation activities are considered below in Table 6.1 to Table 6.4, as applicable and/or relevant to each of the designated sites being considered:

- Ythan Estuary, Sands of Forvie and Meikle Lock SPA
- Buchan Ness to Collieston Coast SPA
- River Dee SAC
- Moray Firth SAC

The Moray Firth SAC is considered, as although it is not in immediate proximity to the proposed UXO investigation works, the bottlenose dolphins associated with this SAC are known to forage widely, with good evidence of a strong linkage between the individuals

occurring within the SAC and in the waters around Aberdeen Harbour, including the new Aberdeen South Harbour at Nigg Bay.

Table 6.1: Ythan Estuary, Sand of Forvie and Meikle Lock SPA

Description of site https://sitelink.nature.scot/site/8592	<p>The Ythan Estuary, Sand of Forvie and Meikle Lock SPA lies approximately 1 km (in a direct line from the closest point of the survey route corridor) west of the UXO survey investigations corridor. The site covers an area of approximately 71 km² and is a coastal site, which incorporated a 63 km² marine extension in 2020.</p> <p>The qualifying features relevant to this assessment are:</p> <ul style="list-style-type: none"> • breeding sandwich tern (<i>Sterna sandvicensis</i>) • breeding common tern (<i>Sterna hirundo</i>) • breeding little tern (<i>Sterna albifrons</i>) • wintering eider (<i>Somateria mollissima</i>), as part of the non-breeding waterbird assemblage <p>The marine extension, which is immediately offshore of the terrestrial area, is the foraging zone for both sandwich terns and little terns.</p>	
Conservation objectives of the site	<p>To ensure that the qualifying features are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status; and to ensure that the integrity of the site is restored in the context of environmental changes by meeting the following for each qualifying feature:</p> <ul style="list-style-type: none"> • populations of the qualifying features are viable components of the site • distributions of the qualifying features throughout the site are maintained by avoiding significant disturbance of the species • supporting habitats and processes relevant to the qualifying features and their prey/food resources are maintained, or where appropriate, restored 	
Potential for LSE	Presence of vessels	Seabirds may potentially be impacted through disturbance and displacement from foraging activities. However, studies show that they have the ability to habituate to regular noises, including those generated by vessels, and the impacts from the presence of the vessel undertaking UXO investigation works will be localised and temporary, particularly in the wider context of shipping and navigation in Aberdeen Bay. This results in very limited displacement or disturbance to foraging activities of qualifying species relative to the overall area available and so it is unlikely that the conservation objectives of the SPA would be compromised. Therefore, no potential LSEs are predicted.
	Physical disturbance to seabed	While investigative dredging or non-UXO object removal / relocation may create a minor sediment plume in demersal water depths as sediment is displaced from the area of investigation, it is unlikely that such a disturbance will negatively impact the foraging ability of seabirds. The displaced sediment will not differ from the naturally occurring settlement

		<p>once it settles, and any plume would be rapidly dispersed due to the hydrodynamics of the area.</p> <p>Any dredging or non-UXO object removal / relocation as part of the UXO investigation survey works will be localised and temporary, and so impacts from physical disturbance of the seabed on qualifying species are negligible and so it is unlikely that the conservation objectives of the SPA would be compromised. Therefore, no potential LSEs are predicted.</p>
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Table 6.2: Buchan Ness to Collieston Coast SPA

Description of site https://sitelink.nature.scot/site/8473	<p>The Buchan Ness to Collieston Coast SPA lies approximately 7 km (in a direct line from the closest point of the survey route corridor) northwest of the UXO investigations survey corridor. The site covers a coastal area of approximately 54 km², of which 97% is considered marine.</p> <p>The qualifying feature relevant to this assessment is the breeding seabird assemblage, including nationally important populations of</p> <ul style="list-style-type: none"> • fulmar (<i>Fulmarus glacialis</i>) • guillemot (<i>Uria aalge</i>) • herring gull (<i>Larus argentatus</i>) • black-legged kittiwake (<i>Rissa tridactyla</i>) • European shag (<i>Phalacrocorax aristotelis</i>) 	
Conservation objectives of the site	<p>To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term:</p> <ul style="list-style-type: none"> • 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 	
Potential for LSE	Presence of vessels	<p>Seabirds may potentially be impacted through disturbance and displacement from foraging activities. However, studies show that they have the ability to habituate to regular noises, including those generated by vessels, and the impacts from the presence of the vessel undertaking UXO investigation survey works will be localised and temporary, particularly in the wider context of shipping and navigation in Aberdeen Bay. This results in very limited displacement or disturbance to foraging activities of qualifying species relative to the overall</p>

		area available and so it is unlikely that the conservation objectives of the SPA would be compromised. Therefore, no potential LSEs are predicted.
	Physical disturbance to seabed	<p>While investigative dredging or non-UXO object removal / relocation may create a sediment plume as sediment is displaced from the area of investigation, it is unlikely that such a disturbance will negatively impact the foraging ability of seabirds. The displaced sediment will not differ from the naturally occurring settlement once it settles, and any plume would be rapidly dispersed due to the hydrodynamics of the area.</p> <p>Any dredging or non-UXO object removal / relocation as part of the UXO investigation works will be localised and temporary, and so impacts from physical disturbance of the seabed on qualifying species are negligible and so it is unlikely that the conservation objectives of the SPA would be compromised. Therefore, no potential LSEs are predicted.</p>

Table 6.3: River Dee SAC

Description of site https://sitelink.nature.scot/site/8357	<p>The River Dee SAC lies approximately 0.5 km (in a direct line from the closest point of the survey route corridor) west of the UXO investigations survey corridor landfall. The site covers an area of approximately 23 km² and is a riverine site, with coverage extending to the tidal limit of the river.</p> <p>The qualifying features relevant to this assessment are:</p> <ul style="list-style-type: none"> • European otter (<i>Lutra lutra</i>) • Scottish Atlantic salmon (<i>Salmo salar</i>) • freshwater pearl mussels (<i>Margaritifera margaritifera</i>) 	
Conservation objectives of the site	<p>To ensure that the qualifying species of the site are in favourable condition and make an appropriate contribution to achieving favourable conservation status; and to ensure that the integrity of the site is restored by meeting the following for each qualifying feature:</p> <ul style="list-style-type: none"> • populations of the qualifying species are restored or maintained as viable components of the site • distributions of the qualifying features throughout the site are restored or maintained throughout the site • supporting habitats and availability of food for the qualifying species are maintained, or where appropriate, restored • distribution and viability of freshwater pearl mussel host species and their supporting habitats are be maintained 	
Potential for LSE	Presence of vessels	Atlantic salmon or otter may be disturbed by the presence of vessel, however, due to the existing pressures (high vessel traffic) in the area being taken into context, the effect of only one temporary additional vessel is unlikely to be distinguishable from background. Although

		<p>otter do forage in Aberdeen harbour mouth, they are unlikely to be seen within the survey route corridor further offshore, limiting any potential for collision risk.</p> <p>Freshwater pearl mussel are freshwater, as are their host species (juvenile salmonid fish), and both are unlikely to be affected, either directly or indirectly, as there are no potential effects on adult Atlantic salmon from the presence of vessels.</p> <p>As the UXO investigation survey works are localised and temporary, it is unlikely that freshwater pearl mussels, Atlantic salmon or otter will be affected by the presence of the vessel associated with the UXO investigation survey works, and so the conservation objectives of the SAC would not be compromised. Therefore, no potential LSEs are predicted.</p>
	Physical disturbance to seabed	<p>While investigative dredging or non-UXO object removal / relocation may cause a temporary increase in suspended sediment load, it is unlikely that it would large enough to cause blockages of fish feeding filters or smothering. Any dredging associated with UXO investigation survey works be localised and intermittent and fish are expected to swim away from any work taking place. Adult salmon are also likely to be transient through the survey corridor on their migration to open sea. and so the effect on Atlantic salmon is predicted to be negligible.</p> <p>Although otter do forage in Aberdeen harbour mouth, they are unlikely to be seen within the survey route corridor further offshore, and so are unlikely to be affected, either directly or indirectly, by physical disturbance to the seabed.</p> <p>Freshwater pearl mussel are unlikely to be affected, either directly or indirectly, as there are no residual potential effects expected on adult Atlantic salmon from physical disturbance to the seabed.</p> <p>As the UXO investigation works are localised and temporary, it is unlikely that freshwater pearl mussels, Atlantic salmon or otter will be affected by any physical disturbance of the seabed associated with the UXO investigation works, and so the conservation objectives of the SAC would not be compromised. Therefore, no potential LSEs are predicted.</p>

Table 6.4: Moray Firth SAC

<p>Description of site</p> <p>https://sitelink.nature.scot/site/8327</p>	<p>The Moray Firth SAC lies in excess of 140 km (in a direct line from the closest point of the route corridor (based on a marine foraging distance, rather than as the crow flies) north and west of the UXO investigations survey corridor. The site covers an area of approximately 1,512 km² and is a marine site.</p> <p>The qualifying feature relevant to this assessment is:</p> <ul style="list-style-type: none"> • Bottlenose dolphin (<i>Tursiops truncatus</i>)
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Conservation objectives of the site	<p>To ensure that the qualifying species of the site are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status; and to ensure that the integrity of the site is maintained or restored in the context of environmental changes by meeting the following for the qualifying species:</p> <ul style="list-style-type: none"> • population of qualifying species is a viable component of the site • distribution of qualifying species throughout the site is maintained by avoiding significant disturbance • supporting habitats and processes relevant to qualifying species and the availability of prey for qualifying species are maintained 	
Potential for LSE	Presence of vessels	<p>The presence of vessels is unlikely to cause physical trauma to bottlenose dolphins but may make preferred habitats somewhat less attractive as a result of disturbance: through habitat displacement or area avoidance. However, as the dolphins are common in Aberdeen harbour mouth, this suggests that any habitat displacement or area avoidance due to the high vessel density and movements in the area is temporary. Marine mammals in the Aberdeen Bay are already experiencing vessel noise (due to existing activities) and their sensitivity to vessel noise was predicted to be low.</p> <p>The presence of vessels may increase the collision risk with the bottlenose dolphins but again, due to the high use of the area for shipping and navigation, most dolphins will have learnt to avoid or associate with vessels safely. The addition of a survey vessel is unlikely to significantly increase the risk of vessel collision with bottlenose dolphins and the vessel will be travelling extremely slowly and predictably while undertaking survey operations.</p> <p>The UXO investigation survey works will be localised and temporary and so any impacts from the presence of the vessel used to carry out the works are unlikely to affect the bottlenose dolphins in such a way that the SAC's conservation objectives are compromised. Therefore, no potential LSEs are predicted.</p>
	Physical disturbance to seabed	<p>As any dredging or non-UXO object removal / relocation associated with UXO investigation works be localised and intermittent, any physical disturbance to the seabed or their associated prey in the route corridor is unlikely to affect bottlenose dolphins. Bottlenose dolphins are highly mobile and wide ranging and coupled with evidence that dolphins return to areas disturbed by construction impacts (David, 2006; Buckstaff <i>et al.</i>, 2013, Weaver, 2021), this suggests there is unlikely to be an effect on bottlenose dolphins from physical disturbance of the seabed in such a way that the SAC's conservation objectives are compromised. Therefore, no potential LSE are predicted.</p>

7 CONCLUSION

This report has been prepared in advance of the proposed UXO investigations survey work for the Vattenfall HT1 Hydrogen Demonstration Project site pipeline route corridor, to support the required Marine License application for this activity. The investigation survey works is aiming to commence during August 2022 and be completed by the end of Q4 2022, however due to the potential for weather or technical delays to the proposed surveys the marine licence being applied for is to cover a period of 12 months.

Impacts that may affect associated marine receptors as a result of the proposed investigation survey works have been assessed at a high level. Given the short duration of the work and the localised extent for which the investigations will be carried out, alongside the proposed mitigation measures, which will be put in place where required, no significant impacts are predicted overall.

All UXO investigation survey activities will be carried out in accordance with industry best practice and standards. Where relevant, advance notification will be shared with stakeholders such as commercial fisheries, the MCA, NLB and Harbour authorities. The survey vessel work will be carried out in accordance with a Vessel Management Plan where appropriate and according to the procedures for vessel management under MARPOL 73/78.

The LSE Assessment was carried out to identify any potential impacts on the integrity of the European designated SAC and SPA conservation sites that are in the vicinity of the area and proposed survey route corridor or where a species associated with nearby designated sites may have an ecological connectivity to the area where survey works are proposed. It is concluded that no LSEs are expected for the designated sites due to the localised, temporary nature of the work and overall minor or negligible pathways for potential impacts that may be present, which will not cause significant disturbance.

It can therefore be concluded that there will be no foreseen significant impacts to the marine environmental and socio-economic receptors in the vicinity of the Vattenfall HT1 Hydrogen Demonstration pipeline route corridor, during the proposed UXO investigation survey works.

8 REFERENCES

- Aberdeen Harbour (2015), 'Aberdeen Harbour Expansion Project Environmental Statement.' Available at: <https://www.aberdeen-harbour.co.uk/south-harbour/environmental-mitigation/2016-documents/>.
- Admiralty (2021), 'Maps' <https://www.admiralty.co.uk/>.
- AOWFL (Aberdeen Offshore Wind Farm Limited) (2011), 'European Offshore Wind Deployment Centre Environmental Statement'. Available at: <http://marine.gov.scot/data/environmental-statement-construction-operation-generating-station-and-transmission-works>.
- Bristow, T. & Reeves, E.I.S. (2001), 'Site fidelity and behaviour of bottlenose dolphins (*Tursiops truncatus*) in Cardigan Bay, Wales'. *Aquatic Mammals* 27: 1-10.
- Buckstaff, K.C. (2004), 'Effects of watercraft noise on the acoustic behaviour of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida'. *Marine Mammal Science* 20: 709-725.
- Buckstaff, K.C., Wells, R.S., Gannon, J.G. & Nowacek, D.P. (2013), 'Responses of Bottlenose Dolphins (*Tursiops truncatus*) to Construction and Demolition of Coastal Marine Structures'. *Aquatic Mammals*, 39(2): 174-186.
- Coracle Archaeology (2022), 'Aberdeen Offshore Wind Farm HT1 Hydrogen Pipeline Project - UXO survey marine licence application: marine cultural heritage requirements'. Report prepared on behalf of RSK Environment Ltd. Coracle project no.: 210602 Coracle report no.: 210602.2 – April 2022.
- COWRIE (2007), 'Historic Environment Guidance for the Offshore Renewable Energy Sector'. Wessex Archaeology.
- The Crown Estate & Wessex Archaeology (2021), 'Model Clauses for Archaeological Written Schemes of Investigation'. London: The Crown Estate.
- The Crown Estate & Wessex Archaeology (2014), 'Protocol for Archaeological Discoveries: Offshore Renewables Project,. London: The Crown Estate.
- David, J.A. (2006), 'Likely sensitivity of bottlenose dolphins to pile-driving noise.' *Water and Environment Journal*, 20(1): 48-54.
- Fugro (2022), 'Marine Mammal Mitigation Report'. Report prepared for Vattenfall Wind Power Limited for Aberdeen Offshore Wind Farm HT1 Pipeline Route.
- Genesis (2012a), 'Aberdeen Offshore Wind Farm Marine Mammals Baseline Addendum'. Available at: http://marine.gov.scot/datafiles/lot/eowdc/ES_Addendum/.
- Gregory, P.R. & Rowden, A.A. (2001), 'Behaviour patterns of bottlenose dolphins (*Tursiops truncatus*) relative to tidal state, time of day and boat traffic in Cardigan Bay, West Wales'. *Aquatic Mammals* 27: 105-113.
- Hague, E.L, Sinclair, R.R. & Sparling, C.E. (2020), 'Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters.' *Scottish Marine and Freshwater Series* 11(12).
- JNCC (2015), 'The Marine Habitat Classification for Britain and Ireland Version 15.03'. Available at: <https://mhcn.jncc.gov.uk/>.

Kafas, A., McLay, A., Chimienti, M., & Gubbins, M. (2014), 'ScotMap Inshore Fisheries Mapping in Scotland: Recording Fishermen's use of the Sea'. *Scottish Marine and Freshwater Science* 5 (17).

Leung Ng, S. & Leung, S. (2003), 'Behavioural response of Indo-Pacific humpback dolphin (*Sousa chinensis*) to vessel traffic'. *Marine Environmental Research* 56: 555-567.

RSK (2021a), 'HT1 Hydrogen Demonstrator Project EIA Screening Opinion Request Report'. Report prepared for Vattenfall Wind Power Limited.

RSK (2021b) 'HT1 Hydrogen Demonstrator Project Pipeline Routing Assessment'. Report prepared for Vattenfall Wind Power Limited.

The Scottish Government (2020a), 'Scottish Sea Fisheries Statistics 2019'. Available at: <https://www.gov.scot/publications/scottish-sea-fisheries-statistics-2019/pages/1/>.

Tillin, H.M. (2016), '*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand'. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [online]. Plymouth: Marine Biological Association of the United Kingdom.

Weaver, A. (2021), 'An Ethology of Adaptation: Dolphins Stop Feeding but Continue Socializing in Construction-Degraded Habitat'. *Frontiers in Marine Science*, p.226.