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Helvellyn Decommissioning Environmental Appraisal Report

Document Ref: APR_HV_PMGT_008

Rev: 4

January 2024

Document Control

Report Title:	Helvellyn Decommissioning Environmental Appraisal

Date:	January 2024

WPRL Document Ref:	APR_HV_PMGT_008

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Revision Record:					
Date	**Rev No.**	**Description**	**Prepared**	**Checked**	**Approved**
11/08/2022	0	Preliminary Draft For WPRL Review	FD	CD/GS	NC
22/01/2023	1	OPRED comments incorporated and 2022 pre-decommissioning survey results added.	FD	CD/GS	NC
10/08/2023	2	Issued for public consultation	FD	CD/GS	MM
10/10/2023	3	Consultee Comments	FD	CD/GS	MM
04/01/2024	4	Final	FD	CD/GS	MM

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Abbreviations

AIS	Automatic Identification System
BAP	Biodiversity Action Plan
BEIS	Department for Business Energy and Industrial Strategy
BRIG	Biodiversity Reporting and Information Group
CA	Comparative Assessment
CoP	Cessation of Production
DP	Decommissioning Programme
DSV	Diving Support Vessel
EA	Environmental Appraisal
EBS	Environmental Baseline Survey
EPS	European Protected Species
ERL	Effect Range Low
ERM	Effect Range Median
ERRV	Emergency Response and Rescue Vessel
ES	Environmental Statement
ESAS	European Seabirds at Sea
EUNIS	European Nature Information Systems
FBE	Fusion Bonded Epoxy
FCS	Favourable Conservation Status
FOCI	Features of Conservation Importance
Hb	Brillouin's index
HOCI	Habitat of Conservation Importance
HPI	Habitat of Principal Importance
ICES	International Council for the Exploration of the Sea
IUCN	Global International Union for the Conservation of Nature
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effects
MBES	Multi-beam Echo Sounder
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MoD	Ministry of Defence
MPA	Marine Protected Area
MSV	Multi-Purpose Support Vessel
MUs	Management Units
NORM	Naturally Occurring Radioactive Material

NSTA	North Sea Transition Authority
OEUK	Offshore Energies UK
OGA	Oil and Gas Authority
OGUK	Oil & Gas UK
OMR	The Conservation of Offshore Marine Habitats and Species Regulations
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
P&A	Plug and Abandonment
PAH	Polycyclic aromatic hydrocarbons
PETS	Portal Environmental Tracking System
PEXA	Practice and Exercise Area
PTS	Permanent Threshold Shift
PUK	Perenco UK Limited
RSD	Relative standard deviation
RSR	Radioactive Substance Regulation
SAC	Special Area of Conservation
SCANS	Small Cetacean Abundance of the North Sea
SEA	Strategic Environmental Assessment
SEMS	Safety and Environmental Management System
SNCBs	Statutory Nature Conservation Bodies
SNS	Southern North Sea
SOPEPs	Shipboard Oil Pollution Emergency Plans
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area
SSS	Side Scan Sonar
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TTS	Temporary Threshold Shift
UCM	Unresolved complex mixture
UHB	Upheaval Bucking
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association (now OEUK)
USBL	Ultra Short Baseline
WPRL	Waldorf Petroleum Resources Limited
WHPS	Wellhead Protection Structure
WMP	Waste Management Plan

1 Non-Technical Summary

1.1 Project Background

This non-technical summary provides an overview of the findings of the Environmental Appraisal (EA) conducted by Waldorf Petroleum Resources Limited (WPRL) for the decommissioning of the Helvellyn subsea installation and pipelines located in United Kingdom Continental Shelf (UKCS) Blocks 47/9, 47/10a and 47/14 in the Southern North Sea (SNS) (see Figure 1.1).

The Helvellyn gas field was discovered in 1985 and was developed by a single subsea development well tied back to the Perenco UK Limited (PUK) operated Amethyst A2D platform where gas is exported to Dimlington. Production started in 2004. The well is completed with a subsea production tree protected by an over-trawlable well head protection structure (WHPS). Production has since declined, decommissioning of the A2D platform is underway and as such Helvellyn no longer has a connected export route for the production gas and consequently the Helvellyn well shut-in. Remaining reserves are not sufficient to support an alternative export route investment and therefore a Cessation of Production (CoP) notification will be submitted to the North Sea Transition Authority (NSTA).

The Helvellyn well is tied back to the Amethyst A2D platform via a 15.7 km, 8 inch gas export pipeline (PL1956). A 15.7 km, 3 inch umbilical (PLU1957) is piggy backed to the pipeline. The pipeline and umbilical are trenched for the majority of the route. The subsea well and platform approaches, including the tie-in spools, have mattresses installed over the pipeline and umbilical to provide protection. At the riser to spool goose necks, the pipeline and umbilical are supported with grout bags. In addition, the trench transitions and several locations along the route of the pipeline have been rock dumped in order to provide protection or down force on the pipeline to prevent any upheaval buckling.

A summary of the Helvellyn infrastructure being decommissioned and therefore within the scope of the Helvellyn Decommissioning EA is provided in Table 1.1.

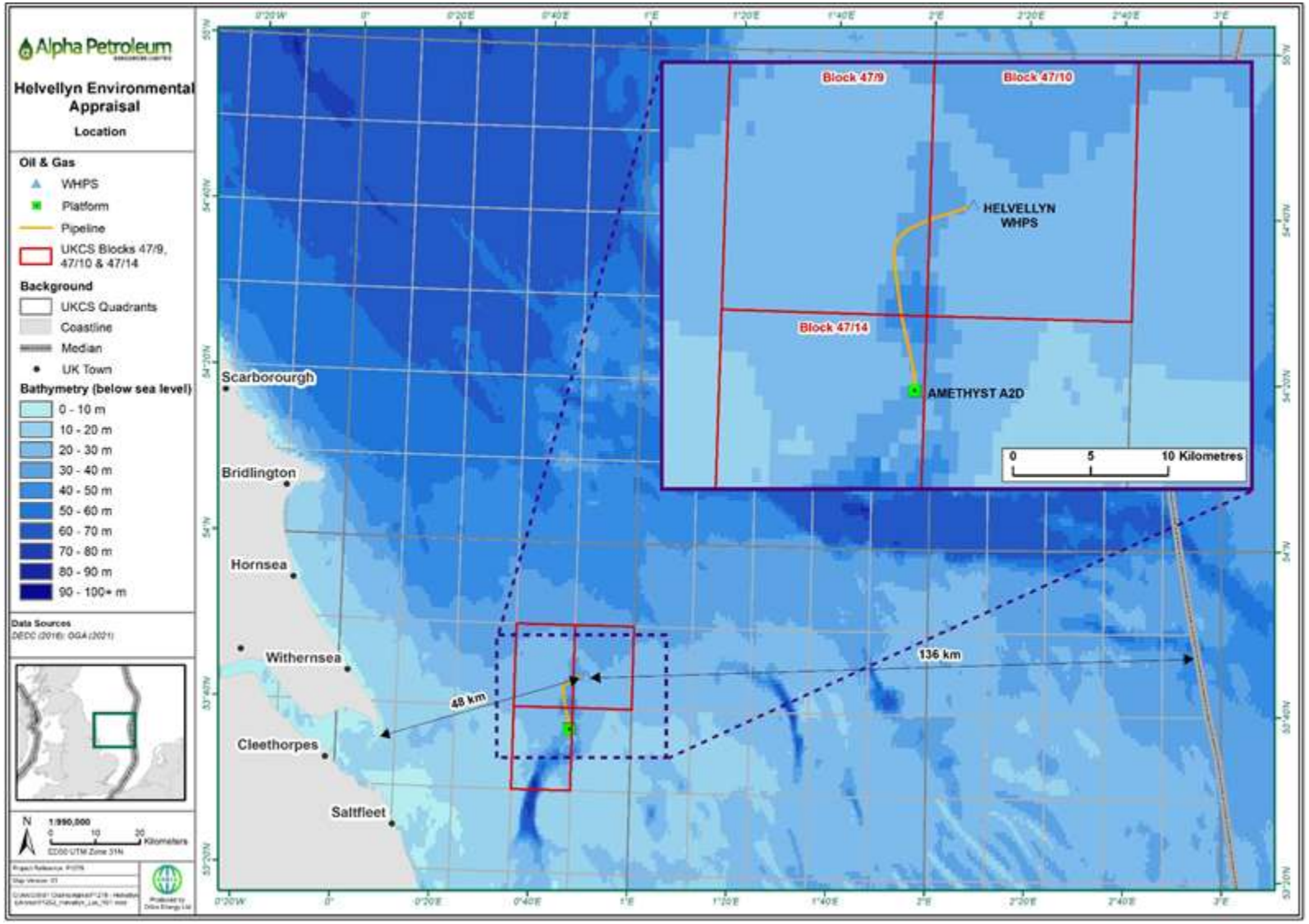
Table 1.1. Summary of Helvellyn Infrastructure Being Decommissioned

Installation	Weight	UKCS Block	Co-ordinates (ED50 31)
WHPS [1](Flow Base and Protection Cover), wellhead and xmas tree	100 tonnes (WHPS) 14 tonnes (wellhead and xmas tree)	47/10a	53° 43' 54.18" N; 00° 50' 31.67" E

Pipeline	Length	From – To End Points	Burial Status
Gas Export Pipeline (PL1956) [2]	15.7 km	Helvellyn subsea well (53° 43' 53.80" N; 00° 50' 31.80" E) to Amethyst A2D platform (53° 37' 24.00" N; 00° 47' 26. " E)	Trenched and buried up to platform and subsea well approaches
Chemical Injection Umbilical (PLU1957) [3]			

[1] The WHPS is attached to the wellhead and is not separately piled.
[2] From and including Helvellyn Wellhead Protection Structure to and not including Amethyst A2D Riser Flange
[3] From and not including Amethyst A2D J-Tube bellmouth to and including Helvellyn Subsea Wellhead Stab Plate
Note: The PUK owned A2D riser sections of the pipeline and umbilical will be decommissioned under a separate DP for the A2D jacket.

Figure 1.1. Helvellyn Infrastructure Location Map



1.2 Regulatory Background

The Petroleum Act 1998 (as amended by the Energy Act 2008 and 2016) is the principal legislation governing decommissioning in the UKCS. The Act requires the operator of an offshore installation or pipeline to submit a draft Decommissioning Programme (DP) for statutory and public consultation and to obtain approval for the DP from Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) before initiating decommissioning work.

The DP Document outlines in detail the infrastructure being decommissioned and the method by which the decommissioning will take place and is supported by the EA report. For Helvellyn, the EA report supports the following two DPs: the Helvellyn Installation DP and the Helvellyn Pipeline and Umbilical DP.

The purpose of the EA is to document the potential for, and significance of, environmental and societal impacts resulting from the DPs and summarise the proposed mitigations and control measures required to minimise any impacts to an acceptable level.

1.3 Proposed Decommissioning Activities

1.3.1 Helvellyn Subsea Installation

OSPAR decision 98/3 specifically prohibits the dumping or leaving in place of installations in the marine environment. As such, WPRL is proposing to completely remove the Helvellyn subsea installation and return it shore, as detailed in Table 1.2.

Table 1.2. Decommissioning Removal Options for Helvellyn Subsea Installation

Installation	Decommissioning Strategy	Removal Scenarios Assessed
WHPS, (Flow Base [1] and Protection Cover), wellhead and xmas tree	Complete removal (ca. 3m below seabed) followed by recover to shore for dismantlement, recycling and disposal.	A jack-up rig or other suitable vessel will be used to plug and abandon the well, with the conductor cut internally by either high pressure water jet or mechanical cutter at least 3m below the seabed. The WHPS, wellhead and xmas tree will then be recovered with the top 3m section of the well either by the rig/vessel, if the pipeline and umbilical has been cut prior to the P&A operations commencing or by a Multi-Purpose Support Vessel (MSV), if the P&A operations are completed ahead of the pipeline and umbilical being cut. No external excavation will be required. To allow access to the well during the P&A operations, the protection cover forming part of the WHPS will be removed. It will either be lifted to the rig/vessel or the protection cover will be temporarily wet stored, redeployed (depending on final decommissioning work timings) before final recovery with the full WHPS.

[1] The flow base includes manifold pipework

Of note is that a final decision on the subsea installation removal methodology will only be made following an engineering feasibility and commercial tendering process. The worse-case scenario in terms of the potential environmental impact has therefore been assessed in the EA report. Any deviations from the removal method currently described will aim to reduce the magnitude of the environmental impact of decommissioning operations.

1.3.2 Helvellyn Pipeline, Umbilical and Associated Stabilisation Material

OSPAR decision 98/3 does not include the decommissioning of pipelines, and there are no international guidelines on the decommissioning of disused pipelines. WPRL has therefore undertaken a Comparative Assessment (CA) in order to arrive at an optimal decommissioning solution for the Helvellyn pipeline and umbilical, and associated protective material (rock, mattresses and gravel bags). The selected decommissioning options derived from the CA, based on

consideration of safety, environmental, technical, societal and economic factors, are summarised in Table 1.3.

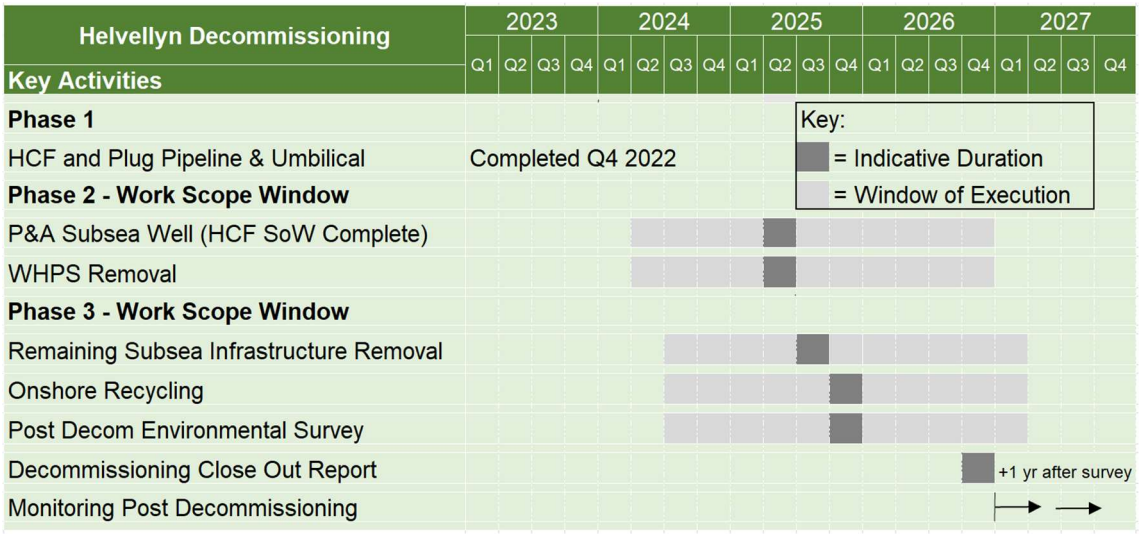
Table 1.3. Decommissioning Strategy for Helvellyn Pipeline, Umbilical and Associated Stabilisation Material

Infrastructure	Decommissioning Strategy	Main Reasons for Selection
Gas Export Pipeline (PL1956)	Pipeline left cleaned with main trenched and buried sections, including those sections protected by rock dump to be left in situ.	The pipeline is already trenched and buried to a depth well in excess of 0.6m, is in a stable state and no snagging events or damage has been reported during the operational life of the pipeline. In a flooded condition (as would be the decommissioned left in situ state) the pipeline is negatively buoyant and so no upward movement of the pipeline would be expected. No significant migration of the seabed has been experienced during the life of the field.
Chemical Injection Umbilical (PLU1957)	Umbilical left cleaned (with the exception of the power cores) with main trenched and buried sections, including those sections protected by rock dump to be left in situ.	The umbilical is already trenched and buried to a depth well in excess of 0.6m, is in a stable state and no snagging events or damage has been reported during the operational life of the field. As the umbilical will be left flooded condition it will be negatively buoyant and therefore no upward movement of the umbilical would be expected. No significant migration of the seabed has been experienced during the life of the field.
Spool sections, mattresses and gravel bags at Helvellyn and Amethyst A2D platform approaches	Riser to spool goose neck sections of pipeline, all concrete protection mattresses (fronded and non-fronded) and underlying pipeline sections and gravel bags at the Helvellyn and A2D approaches to be removed and returned to shore for recycling or disposal. The pipelines will be cut using either shear cutting or diamond wire cutting tools. It is anticipated the mattresses will be stacked subsea and bulk lifted to the deck of a Multi-Purpose Support Vessel (MSV) or DSV reducing the number of lifts required and the risk of break-up of individual mats during the recovery process.	Although the seabed will be temporarily disturbed by the recovery work, this option allows the seabed surface to be returned to its natural status, apart from in those areas where rock dump overlies the pipelines. The equipment and technologies required to recover and break up the materials are well known to the industry and are not technically challenging.
Anode sled	Anode sleds to be left in situ. If any individual anodes at the anode sled location 2 can be seen on the seabed surface at the time of decommissioning these will be cut and recovered.	Three anode sleds are fully buried within the 1.5-1.8 m deep trench by a rock and natural deposition. The fourth anode sled is marginally exposed. The rock dumped section are of graded rock with profiled side slopes, therefore there are no snagging concerns.

1.3.3 Project Schedule

The proposed Helvellyn decommissioning work is scheduled to be undertaken sometime between 2023 and 2025. An indicative schedule for the work is shown in Figure 1.2.

Figure 1.2. Indicative Helvellyn Decommissioning Schedule



1.4 The Baseline Environment

An overview of the key environmental and societal features in the vicinity of the Helvellyn infrastructure that may be affected by the proposed decommissioning works is provided in Table 1.4. This information has been compiled from a number of published sources as well as data collected during the Helvellyn pre-decommissioning environmental baseline and habitat assessment survey carried out by Fugro on behalf of WPRL in August 2022.

Table 1.4. Summary of Environmental and Societal Features in the vicinity of the Helvellyn Infrastructure

Feature	Description
Physical Features	
Location	The proposed Helvellyn decommissioning activities are located within UKCS Block 47/10a (Helvellyn WHPS), Block 47/14 (Amethyst A2D platform) and Block 47/9 (Helvellyn pipeline). The Helvellyn well is located approximately 48 km east of Spurn Point on the East Riding of Yorkshire coast and 136 km west of the UK / Netherlands median line. The Amethyst A2D platform is located approximately 42 km East Riding of Yorkshire coast and 144 km south west of the UK / Netherlands median line.
Bathymetry	Water depths vary from ~26m to ~44m along the pipeline route with the deepest section around 3.5km from Helvellyn and 27m and 26m respectively at the Helvellyn and Amethyst A2D ends.'
Seabed Sediments	The Helvellyn infrastructure is situated in an area of seabed mainly of coarse sand and gravels with sand ripples. Analysis of the sediment samples taken during the 2022 survey found that four stations conformed to Folk classifications of 'Sandy gravel', one station as 'Gravelly sand' and one station as 'Gravel'. The Total Organic Carbon (TOC) values across the survey stations were low and typical of this region of the SNS. Total Hydrocarbon Content (THC) values exceeded the SNS mean background concentration at all stations, however, all THC values were below the OSPAR 50 ppm ecological effects threshold. Total 2 to 6 ring polycyclic aromatic hydrocarbon (PAH) concentrations were also above the SNS mean background concentration at all stations. Analysis indicated a mixed input of petrogenic and pyrolytic sources of the aromatic material present. There was no evidence of drilling fluids in the gas chromatographic profiles. The majority of bioavailable metals were comparable to, or slightly higher than, their respective SNS mean background concentrations. There was no relationship between metals concentrations and distance from the subsea well. All metals concentrations were below their respective effects range low (ERL) values and therefore unlikely to cause adverse effects on the macrofaunal communities present.

Feature	Description
Oceanography	Tides in the SNS are predominately semi-diurnal and tidal waters offshore in this area of the SNS flood southwards and ebb northwards. Surface tidal streams in the vicinity of the Helvellyn infrastructure are a maximum of 1.4 and 0.8 m/s respectively for spring and neap tides. The annual mean significant wave high in the vicinity the proposed decommissioning work ranges from 1.21 m to 1.50 m.
Meteorology	Winds in the region are generally from between south and north-west. Wind strengths are generally between Beaufort scale 1- 6 (1 – 11 m/s) in the summer months, and 7 – 12 (14 – 32 m/s) in winter.
Biological Sensitivities	
Marine Protected Areas (MPAs)	The Helvellyn WHPS and approximately 12.5km of the pipeline route is located within the boundary of the Holderness Offshore Marine Conservation Zone (MCZ), which is designated for three broad-scale habitat types (A5.1: Subtidal coarse sediment, A5.2: Subtidal sand and A5.4: Subtidal mixed sediments), Ocean quahog (*Arctica islandica*) and North Sea glacial tunnel valleys.
Plankton	The phytoplankton community in this region of the SNS is dominated by the dinoflagellate genus *Tripos (T. fusus, T. furca, T. lineatus*), along with higher numbers of the diatom, *Chaetoceros* (subgenera *Hyalpchaete* and *Phaeoceros*) than are typically found in the northern North Sea. The zooplankton community is dominated by copepods including *Calanus helgolandicus* and *C. finmarchicus* as well as *Paracalanus* spp., *Pseudocalanus* spp., *Acartia* spp., *Temora* spp. and cladorcerans such as *Evadne* spp.
Seabed Communities	The 2022 survey at Helvellyn found that the sediment macrofauna was dominated by annelids and arthropods typical of coarse sediments. The most abundant taxa recorded were the annelids *Sabellaria spinulosa*, *Phyllodoce maculata*, *Syllis garciai* and *Ophelia borealis* and the arthropods *Urothoe marina* and *Ampelisca spinipes*. The mean diversity for the survey area was high with low interstation variability. When seabed photographic data, particle size distribution data and macrofaunal data were considered, the EUNIS classification 'Faunal communities of Atlantic circalittoral coarse sediment' (MC32) was identified. The biotope complex identified is contained within the broad-scale habitat 'Subtidal sands and gravels', a priority habitat within UK waters. Due to the cobbles and boulders observed in the survey area, the drop-down videos were assessed for the presence of stony reef. The majority of the survey area was classed as 'Not a reef' (percentage cover of cobbles and boulders < 10 %.), however, four of the drop-down video camera stations were classed as 'Low reef' (percentage cover of cobbles and boulders between 10 % and 40 %). The ross worm *Sabellaria spinulosa* was present at low density within the survey area, however the protected habitat 'reef' was not observed. No other sensitive habitats or species were observed.
Fish	Species likely to spawn within the vicinity of the Helvellyn infrastructure include cod (*Gadus morhua*), herring (*Clupea harengus*), lemon sole (*Microstomus kitt*), plaice (*Pleuronectes platessa*) (high intensity), sandeels, (*Ammodytidae* spp.) sole (*Solea solea*) and sprat (*Sprattus Sprattus*). The location is a likely nursery ground for cod, herring, horse mackerel (*Trachurus trachurus*), lemon sole, mackerel (*Scomber scombrus*), plaice, sandeels, sole (*Solea solea*), sprat and whiting (*Merlangius merlangus*). Additionally, age 0 group fish are defined as fish in the first year of their lives and can also be classified as juvenile. The Helvellyn infrastructure is located in an area of moderate probability of 0 group aggregations of sprat, plaice, horse mackerel and herring in the vicinity of the blocks of interest, and a low probability of 0 group aggregations of whiting, sole, Norway pout, mackerel, hake, haddock, cod, blue whiting and anglerfish.

Feature	Description
Seabirds	The offshore waters of the SNS are visited by seabirds, mainly for feeding purposes in and around the shallow sandbanks. The most abundant species of seabird predicted to be present in the vicinity of the Helvellyn infrastructure are kittiwake (*Rissa tridactyla*), in the breeding season, guillemot (*Uria aalge*), kittiwake, great black-backed gull (*Larus marinus*) and herring gull (*Larus argentatus*) over winter, and guillemot during the post breeding dispersal period. The Helvellyn infrastructure is located adjacent to a number of Special Protection Areas (SPAs), the closest of which is the Greater Wash SPA, located approximately 29 km south-west of the Helvellyn infrastructure. The site protects important foraging areas of red-throated diver (*Gavia stellata*), common scooter (*Melanitta nigra),* and little gull (*Hydrocoloeus minutus*) during the non-breeding season, and Sandwich tern (*Sterna sandvicensis*), common tern and little tern (*Sternula albifrons*) during the breeding season An assessment of the medium seabird sensitivity to oil pollution scores for the blocks of interest within which the Helvellyn infrastructure is located, indicates that sensitivity is generally low between April and July, medium to extremely high between August and December, and very high to medium between January and March.
Marine Mammals	Harbour porpoise (*Phocoena phocoena*) and white-beaked dolphin (*Lagenorhynchus albirostris*) are considered to be regularly occurring in the SNS and both species have been observed in the vicinity of the Helvellyn area. Minke whale (*Balaenoptera acutorostrata*) is also a frequent seasonal visitor. Additionally, common dolphin (*Delphinus delphis*), white-sided dolphin (*Lagenorhynchus acutus*) and bottlenose dolphin (*Tursiops truncatus*) have been observed in the vicinity of the Helvellyn infrastructure. The distribution of grey seal (*Halichoerus grypus*) in the vicinity of the Helvellyn infrastructure is moderate (< 50 individuals per 25 km^2) and the distribution of harbour seal (*Phoca vitulina*) is low (< 5 individual per 25 km^2).
Societal Aspects	
Fisheries	The Helvellyn infrastructure is located within ICES Rectangles 36F0. Fishing effort is relatively high in ICES Rectangle 36F0, which is an area targeted by both UK and international vessels. Annual fishing effort between 2017 and 2021 was 2,737 days in ICES Rectangle 36F0, with effort highest between May and November (peaking in July and August). The most frequently used gear type is trawls, traps and dredges. Shellfish species are predominantly targeted, including crabs, lobsters, scallop and whelks. The mean total fish landings (by weight) between 2017 and 2021 were 3,674 tonnes, with a mean value of £11,610,074.
Shipping	Shipping activity is high in the vicinity of the Helvellyn infrastructure.
Oil and Gas Activity	The Helvellyn infrastructure is located within a mature gas province with a comprehensive network of typically unmanned installations, larger processing hubs and associated interfield and export pipelines. A number of nearby installations are currently being decommissioned.
Offshore Renewables	The nearest offshore windfarm to the Helvellyn infrastructure is the Tritan Knoll wind farm (Under Construction), located in Block 47/14 10 km south of the Amethyst A2D platform. The nearest active wind farm is the Humber Gateway windfarm, which is located 30 km west of the Helvellyn infrastructure. The active Hornsea Project 1 and the Hornsea Project 2 wind export cables run through Block 47/14, located approximately 400 m and 700 m south of the Amethyst A2D platform respectively.
Military activities	The Helvellyn area overlaps with a Ministry of Defence Royal Airforce Practice and Exercise Area (PEXA).
Wrecks	No historically significant wrecks are located in the vicinity of the Helvellyn infrastructure and no wrecks were observed during the 2020 pre-decommissioning survey.
Cables	No telecommunication cables cross the Helvellyn infrastructure or the blocks of interest.

Feature	Description
Aggregate and Dredging Activity	Humber 4 aggregate production area (Area no.: 514/4) is located approximately 11 km from the Amethyst A2D platform and 19 km south west of the Helvellyn well. The Humber 1, Humber 2 and Humber 3 sites (514/1, 514/2 & 514/3) are also located to the south west, between 10 - 20 km from Block 47/14.

1.5 Impact Assessment

1.5.1 Environmental Impact Identification

In order to identify the potential environmental issues and impacts on the marine environment, which may arise from the proposed Helvellyn decommissioning activities (both from planned (routine) activities and unplanned (accidental) events), the WPRL decommissioning team undertook a preliminary scoping exercise.

The scoping exercise identified that the following sources of impact could potentially result in significant environmental effects and were therefore subject to comprehensive assessment, along with the potential for transboundary and cumulative impacts:

- Physical presence;
- Seabed disturbance;
- Underwater noise.

In addition, as the Helvellyn infrastructure is located within the Holderness Offshore MCZ and lies within 40 km of four other MPAs, an assessment has been undertaken to determine whether there are likely to be any significant effects on the conservation objectives of these MPAs as a result of the proposed Helvellyn decommissioning activities, either alone or in-combination with other plans or projects.

A summary of the results of the comprehensive assessment is provided in Section 1.5.2.

The following sources of impact were not considered to result in significant environmental effects and were therefore scoped out from detailed assessment:

- Energy use and atmospheric emissions;
- Waste management;
- Marine discharges;
- Accidental events.

The justification for this is provided in Table 1.5 below.

Table 1.5. Justification for Aspects Scoped out from Comprehensive Assessment

Aspect	Justification
Energy Use and Atmospheric Emissions	Atmospheric emissions will be produced during the proposed Helvellyn decommissioning activities as a result of the fuel consumed by offshore vessels, diesel-powered equipment and generators. It is predicted that these emissions will only result in localised and short term impacts on air quality, with prevailing metocean conditions expected to lead to the rapid dispersion and dilution of the emissions. The contribution to UKCS and global atmospheric emissions will be negligible.

Aspect	Justification
Marine Discharges	Routine marine discharges from the vessels proposed to be used to decommission the Helvellyn infrastructure will not result in significant environmental effects on the marine environment. Food waste will be macerated to increase the rate of dispersion and biodegradation at sea and waste water will be treated appropriately before being discharged to sea, in accordance with the requirements of the MARPOL convention. Ballast water discharges will be in accordance with the International Maritime Organisation Ballast Water Management Convention. The export pipeline and umbilical (with the exception of the hydraulic power cores) have been flushed and depressurised as part of the facilities making safe, any discharge of residual chemicals / condensate during pipeline cutting operations will be minimal and is anticipated to dissipate before it reaches the surface with no long-term persistence expected. The actuating fluid in the hydraulic cores, AQUALINK HT804F VER2, will rapidly disperse on discharge to the marine environment and will be readily broken down through natural biodegradation processes. It is acknowledged that as the lines will be decommissioned in situ they will degrade overtime and contaminants contained within the pipeline and umbilical material (e.g. coating) may be discharge into the marine environment. However, any discharges are expected to occur in very small quantities, over a long period of time. Additionally, since the pipeline and piggybacked umbilical are fully trenched and buried, the pathway for contaminant discharges will be limited.
Waste Management	The impacts of waste management are largely onshore and therefore outside the scope of the EA. Offshore, all vessels will be compliant with MARPOL and will have waste management plans in place that adhere to the waste hierarchy principle of reduce, reuse recycle. As such, there be no significant impact to the marine environment.
Accidental Events (accidental releases & dropped objects)	Prior to the proposed decommissioning activities commencing, the Helvellyn well and pipelines will be made hydrocarbon free. (Note; following the Comparative Assessment the pipelines have now been made hydrocarbon free). As such, the source of a worst case accidental release of hydrocarbons to sea will be from the loss of diesel inventory from a vessel used during the decommissioning activities in the unlikely event of a collision. However, diesel is a light oil, containing a large percentage of light and volatile compounds. Once spilt diesel is likely to remain on the sea surface and be subject to high rates of evaporation. It is therefore not expected to persist in the marine environment for a prolonged period of time. An approved OPEP will be in place prior to the proposed Helvellyn decommissioning activities commencing and any spills from vessels in transit or working outside of the 500 m zone are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). The proposed Helvellyn decommissioning activities require the use of subsea hydraulic cutting tools and ROVs that could fail and result in a release of a small number of litres of hydraulic fluid into the marine environment. However, in the event this did occur, it is anticipated that the hydraulic fluid would be rapidly dispersed in the marine environment given the highly dynamic nature of the area. To minimise the risk of a release, appropriate maintenance and pre-use checks on hydraulic equipment and ROVs will be undertaken. Where possible equipment with automatic hydraulic shut-off will be used to minimise the volume of fluid released in the event of a hydraulic line failure. Dropped object procedures are industry-standard and will be employed throughout the proposed operations. Post-decommissioning debris clearance surveys will aid in the identification of any dropped objects should they occur.

1.5.2 Summary of Assessment Results

1.5.2.1 Physical Presence

The majority of vessels utilised for the proposed decommissioning activities will be present on location within the existing 500 m safety exclusion zones surrounding the Helvellyn well and the Amethyst A2D platform. These zones are clearly marked on navigation charts and have been in place for a number of years. Activity outside the existing exclusion zones will represent a short-term increment in vessel presence over that which the area normally receives and it is not considered that this will result in a significant effect on other sea users. In addition, once the

Helvellyn WHPS has been removed, the 500 m safety exclusion zone surrounding the well will be withdrawn. This will result in a positive impact as an area of circa 0.79 km^2 will be made available to other sea users.

The potential for significant impacts to other sea users is therefore limited to the risk of fishing gear snagging on infrastructure that is being decommissioned in situ. To minimise the risk of snagging, WPRL is proposing to remove any exposed subsea infrastructure. The full length of pipeline and umbilical are currently buried to a depth well in excess of 0.6m, excluding the approaches at the subsea well and platform ends. The interim operational general inspection surveys conducted in 2013 and 2015 show a stable trench with natural backfill seen throughout the route when compared with the original 2002 as trenched surveys. The recent 2022 surveys have further confirmed the gradual trench infill and seabed stability. No significant migration of the seabed has been recorded during this period. The rock which has been deposited along the pipelines is very stable and there has been no migration due to seabed currents or fishing activity over the area. As the pipeline and piggybacked umbilical will be left in situ in a flooded condition no upward movement is expected. Additionally, of the four anode sleds present, three are fully buried, and rock dumped or buried under natural material, while the third is only marginally exposed. If any anode sleds are seen on the seabed surface during the offshore decommissioning campaign these will be cut and removed, if possible. As such, the residual risk to commercial fishing from the legacy of infrastructure decommissioned in situ is therefore predicted to be Low and not significant.

1.5.2.2 Seabed Disturbance

The following Helvellyn decommissioning activities have been identified as sources of potential seabed disturbance:

- Footprint of jack-up vessel used to P&A the well and potentially remove the WHPS, wellhead and xmas tree;
- Removal of WHPS, wellhead and xmas tree, including temporary wet storage of the protection cover;
- Cutting of pipeline ends, removal of exposed pipeline sections / tie-in spools, including mattresses and gravel bags at the approaches to the Helvellyn WHPS and Amethyst A2D platform and redeployment of mattresses to protect the cut ends of the pipelines, if exposed at the seabed.
- Potential exposed anode section removal from anode sled 2 if exposed at time of decommissioning work.

It is estimated that the total area of seabed likely to be temporary disturbed by the Helvellyn proposed decommissioning activities is ca. 2,714 m^2 (0.003 km^2).

Physical disturbance of the seabed can cause displacement or mortality of benthic species, such as sessile organisms, that are unable to move out of the impacted area. However, due to the transient nature of the operations, it is expected that recovery of the affected areas will be relatively rapid once the proposed activities have been completed. Removal of the Helvellyn infrastructure will also facilitate the restoration of the seabed back to its natural state.

During the proposed decommissioning activities there will be a temporary increase in turbidity through sediment resuspension resulting in smothering of some sensitive benthic species. However, the Helvellyn infrastructure is located within a highly dynamic area with strong near-seabed currents and highly mobile sediments and, as such, the fauna found here are robust infauna that are adapted to frequent disturbances and natural fluctuations in sediment loading and resuspension.

In addition, there will be a legacy impact in an area of seabed totalling ca. 18,876 m^2 (0.02 km^2) as result of rock dump previous placed along the pipelines which will be decommissioned in situ, as well as any mattresses redeployed to cover the cut pipeline ends, if exposed at the seabed. The hard substrate represents a permanent change to the natural habitat type and associated fauna

present; however, the scale of the impact is Negligible considering the very large extent of coarse sand and gravel sediment available in the SNS.

In all cases, the scale of changes to the seabed and its fauna are such that effects on higher trophic levels (e.g. fish and marine mammals), and any related effect on species of commercial interest are Negligible.

In summary, based on the nature of the seabed habitats and species present in the vicinity of the Helvellyn infrastructure, the comparatively small area of seabed that will be impacted by the proposed decommissioning activities and residual effects on seabed communities are predicted to be Minor to Negligible and not significant.

1.5.2.3 Underwater Noise Emissions

Vessel operations (in particular the use of dynamic positioning systems) have been identified as the primary sources of underwater noise that will arise from the Helvellyn decommissioning operations. The cutting tools used to sever the Helvellyn infrastructure are unlikely to result in sufficient levels of noise to cause significant disturbance to marine fauna.

There is potential for fish to be disturbed by the continuous underwater noise emissions generated from the decommissioning vessels, leading to temporary displacement from the area. Demersal spawning species that spawn on specific habitat substrates, such as herring and sandeels, are particularly vulnerable to disturbances. However, given the relatively high level of shipping traffic in this area of the southern North Sea, the additional underwater noise generated by the decommissioning vessels is likely to be insignificant.

The underwater noise emissions generated during the proposed Helvellyn decommissioning activities are not predicted to result in injury to marine mammals but do have the potential to cause a temporary disturbance out to a distance of ca. 3 km from the noise source. However, the percentage of the relevant Marine Mammal Management Unit reference population which would be disturbed is very small.

In summary, there is no evidence to suggest that the underwater noise emissions generated during the proposed Helvellyn decommissioning activities would result in injury or significant disturbance to marine fauna. Although there is potential for some behavioural disturbance, any impacts will be localised and temporary. Residual effects are therefore predicted to be Minor and not significant.

1.5.2.4 Transboundary Impacts

The Helvellyn subsea well and Amethyst A2D platform are located approximately 136 km and 144 km, respectively, west of the UK/Netherlands transboundary line. Any impacts arising from emissions, discharges and seabed disturbance generated as a result of the proposed Helvellyn decommissioning activities are predicted to be highly localised and are therefore not expected to result in any significant transboundary impacts. In the event any waste from the Helvellyn decommissioning activities is disposed of outside of the UK, WPRL will ensure regulations governing transfrontier shipment of waste are complied with

1.5.2.5 Cumulative Impacts

Cumulative impacts may arise from incremental changes caused by other past, present or reasonably foreseeable projects/proposals together with the proposed Helvellyn decommissioning activities. The nearest aggregate area to the Helvellyn infrastructure is Humber 4 (Area no.: 514/4), located approximately 11 km west of the Amethyst A2D platform and 19 km south west of the Helvellyn subsea well. There are a large number of existing oil and gas developments adjacent to the Helvellyn WHPS, the nearest of which is the PUK operated West Sole platform located approximately 16 km to the east. The nearest offshore windfarm to the Helvellyn infrastructure is the Tritan Knoll windfarm, located approximately 10 km south of the Amethyst A2D platform. The windfarm is operated by RWE Npower Renewables and is currently under construction, but is expected to be operational by 2022. However, given the distances between the projects and the

fact that any impacts arising from the proposed Helvellyn decommissioning activities will be localised, no significant cumulative effects on marine receptors are predicted.

1.5.2.6 Marine Protected Areas

The Helvellyn subsea well and approximately 12.5km of the pipeline route is located within the boundary of the Holderness Offshore Marine Conservation Zone (MCZ). This MPA has been designated for the protection of three broad-scale habitats (Subtidal coarse sediment; Subtidal sand; Subtidal mixed sediments), one species of conservation importance (Ocean quahog (*Arctica islandica*)) and one feature of geological interest (North Sea glacial tunnel valleys).

The proposed Helvellyn decommissioning activities are predicted to disturb an area of seabed totalling 0.003 km^2, which equates to 0.0003 % of the MCZ site area. The Helvellyn infrastructure lies within an extensive area of subtidal coarse sediment and the biotope complex identified during the pre-decommissioning survey is contained within the protected habitat 'Subtidal sands and gravels'. However, any disturbance to this habitat will be temporary and will not change the structure, function, quality, or the composition of biological communities present within the seabed sediments. In addition, any impacts arising from the emissions and discharges generated by the proposed Helvellyn decommissioning operations are predicted to be highly localised and are therefore not expected to result in significant impacts to the qualifying features of the MCZ. WPRL is not aware of any current, consented or planned project which could have a significant impact on the MCZ's qualifying features in-combination with the proposed Helvellyn decommissioning operations. As such, it is not considered that the proposed Helvellyn decommissioning activities will have an adverse effect on the integrity of the MCZ either alone or in-combination with other plans or projects.

The Greater Wash SPA, which lies along the adjacent coastline approximately 29 km to the south west of the Helvellyn WHPS, has also been scoped into the assessment as vessels could be transiting through this site on the way to the Helvellyn location. The SPA is designated for the protection of red-throated diver, common scoter and little gull during the non-breeding season, and for breeding Sandwich tern, common tern and little tern. Of the bird species present within the SPA, common scoter and red-throated diver are vulnerable to disturbance by boats and large aggregations of these species are present within the SPA between November and March. In contrast, little gull and tern species are generally tolerant of vessel activity.

Based on the distribution of red-throated diver and common scoter within the SPA, red-throated diver are most at risk of displacement, albeit temporarily, if vessels mobilise or demobilise from either Hull, Great Yarmouth or Lowestoft. To minimise disturbance, WPRL therefore proposes to implement the following mitigation measures:

- Restricting, to the extent possible, vessel movements within the Greater Wash SPA to existing navigation routes when transiting to / from the Helvellyn location;
- Maintaining direct transit routes;
- Avoiding over-revving of engines;
- Briefing vessel crew on the purpose and implications of vessel management practices within the Greater Wash SPA.

Given the above, the EA concluded that the proposed Helvellyn decommissioning activities will not have an adverse effect on the integrity of the Greater Wash SPA either alone or in-combination with other plans or projects.

Three other MPAs are located within 40 km of the Helvellyn infrastructure, namely the SNS SAC (7 km), Inner Dowsing, Race Bank and North Ridge SAC (23 km) and Holderness Inshore MCZ (36 km). However, given the distances involved and the fact that any impacts arising from the emissions and discharges generated by the proposed decommissioning operations are predicted to be highly localised, it is not predicted that any of these MPAs will be significantly impacted.

1.6 Conclusions

The EA has confirmed that the Helvellyn Subsea Installation DP and the Helvellyn Pipeline and Umbilical DP can be executed with no significant adverse effects on the marine environment.

An initial screening of the potential impacts to environmental and societal receptors from the proposed Helvellyn decommissioning activities concluded that the only aspects considered to be potentially significant and therefore requiring further assessment were physical presence, seabed disturbance and underwater noise. However, following further assessment and upon implementation of the identified mitigation measures, it is has been concluded that no significant residual effects are predicted to occur, with the majority of impacts being localised and temporary in nature.

Of note is that the Helvellyn infrastructure lies within the boundary of the Holderness Offshore MCZ and is located within 40km of four other MPAs. However, the EA has concluded that there will not be any significant effects on the conservation objectives of these MPAs as a result of the proposed Helvellyn decommissioning activities, either alone or in-combination with other plans or projects.

WPRL operates under an integrated Safety and Environmental Management System and has established contractor selection and management procedures. As a number of contractors will be involved in the detailed planning and execution of the proposed Helvellyn decommissioning activities, WPRL will produce a SEMS interface document for the project to help ensure the mitigation and control measures identified in the EA are successfully implemented.

2 Introduction

2.1 Background

Waldorf Petroleum Resources Limited (WPRL) is the operator of the Helvellyn gas field, located in United Kingdom Continental Shelf (UKCS) Block 47/10a in the SNS, approximately 48 km east of the Spurn Point on the East Riding of Yorkshire coast / Dimlington Gas Terminal and approximately 136 km west of the UK/Netherlands transboundary line. WPRL has a 100% equity interest in Helvellyn.

The Helvellyn gas field is accessed via a single subsea well (47/10-7y), which is tied back to the Perenco UK Limited (PUK) operated Amethyst A2D platform. PUK has commenced Cessation of Production (CoP) from Amethyst A2D such that Helvellyn no longer has a connected export route for the production gas and the Helvellyn subsea well is shut-in. Prior to this production from Helvellyn had been in decline and the remaining reserves are not sufficient to support an alternative export route investment. WPRL will therefore submitted a CoP notification to the NSTA and in accordance with the Petroleum Act 1998, and the Section 29 holders are now applying to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to obtain approval for decommissioning the Helvellyn infrastructure.

2.2 Overview of the Helvellyn Infrastructure

The Helvellyn gas field was discovered in 1985 and is located within Production Licence P001 in UKCS Block 47/10a. The field was developed and first production commenced in 2004. WPRL is the Licence Operator of the Helvellyn field and the Well and Pipeline Operator for the asset. Production has steadily been in decline for a number of years and due to liquid loading issues, in 2017 the field was shut-in. In 2020, PUK informed WPRL of their decision to decommission the Amethyst A2D platform as the Amethyst field is no longer economic.

The Helvellyn field is accessed via a single subsea well (47/10-7y) completed with a subsea production tree protected by a wellhead protection structure (WHPS), which is made up of a Flow Base and Protection Cover (see Figure 2.1). Details of the Helvellyn WHPS are provided in Table 2.1. For the purposes of decommissioning, the WHPS is classified as a subsea installation under OSPAR decision 98/3.

Table 2.1. Helvellyn Subsea Installation Details

Well	Status	Subsea Structure	Weight (tonnes)	Dimensions (m)	Block	Location (ED50 31)	Water Depth (m)
47/10-7y	Shut-in	Wellhead (and xmas tree)	14	8m x 6.3m x 4m high	47/10a	53° 43' 54.18" N 0° 50' 31.67" E	27
		WHPS [1] (Flow Base and Protection Cover)	100				

[1] The WHPS is not piled or pinned to the seabed. The flow base includes manifold pipework.

The well is tied back to the PUK operated Amethyst A2D platform located in UKCS Block 47/14 via a 15.7 km, 8 inch carbon steel gas export pipeline (PL1956). When the field was in production, following metering on the Amethyst A2D platform, the gas was exported via the Amethyst export trunkline (PL649) to the Dimlington terminal at Easington. Chemicals for hydrate and corrosion inhibition were supplied to Helvellyn from the Amethyst A2D platform via a 15.7 km, 3 inch umbilical (PLU1957). Details of the Helvellyn export pipeline and umbilical are provided in Table 2.2 and a field schematic is provided in Figure 2.2. Approximately 97.8% of the route is trenched with the pipeline buried to 1.5-1.8m below the natural surrounding seabed level. Rock dump, concrete mattresses and gravel bags were used to protect pipeline sections laid on the seabed at the A2D platform and Helvellyn WHPS approaches that were not trenched. There are no crossings along the route of the pipeline and umbilical.

Table 2.2. Helvellyn Pipeline and Umbilical Details

Pipeline Number	Size, OD (mm)	Length (m)	Material	Wall Thickness (mm)	Corrosion Coating	Burial Status
PL1956	219.1	15,702	API 5L X65 carbon steel pipe with 3 micron Fusion Bonded Epoxy coating	12.7	0.3mm FBE	Trenched and buried up to tie-in spools*
PLU1957	76.2	15,700	Cores; 2 off ½" x 0.49" wall, 316L stainless tubes, 2 off 3/8" x 0.49" wall 316L stainless tubes with High Density Polyethylene (HDPE) jacket to 0.5" diameter, 4 off 3/8" x 0.49" wall 316L stainless tube, 1 off 5/8" x 0.65" seacat 19D alloy tube with zinc anode coating to 0.725". All cores wrapped with HDPE sheath jacket	Each tube is 1.65-1.24	Rubber sheath	Trenched and buried up to tie-in spools*

*97.8% of the pipeline is trenched with 2.2% surface laid. Of the surface laid sections ~43% is mattress protected and ~57% is rock dump protected. In total 9.9% of the route is rock protected either within or outside the trenched sections.

Figure 2.1. The Helvellyn Well

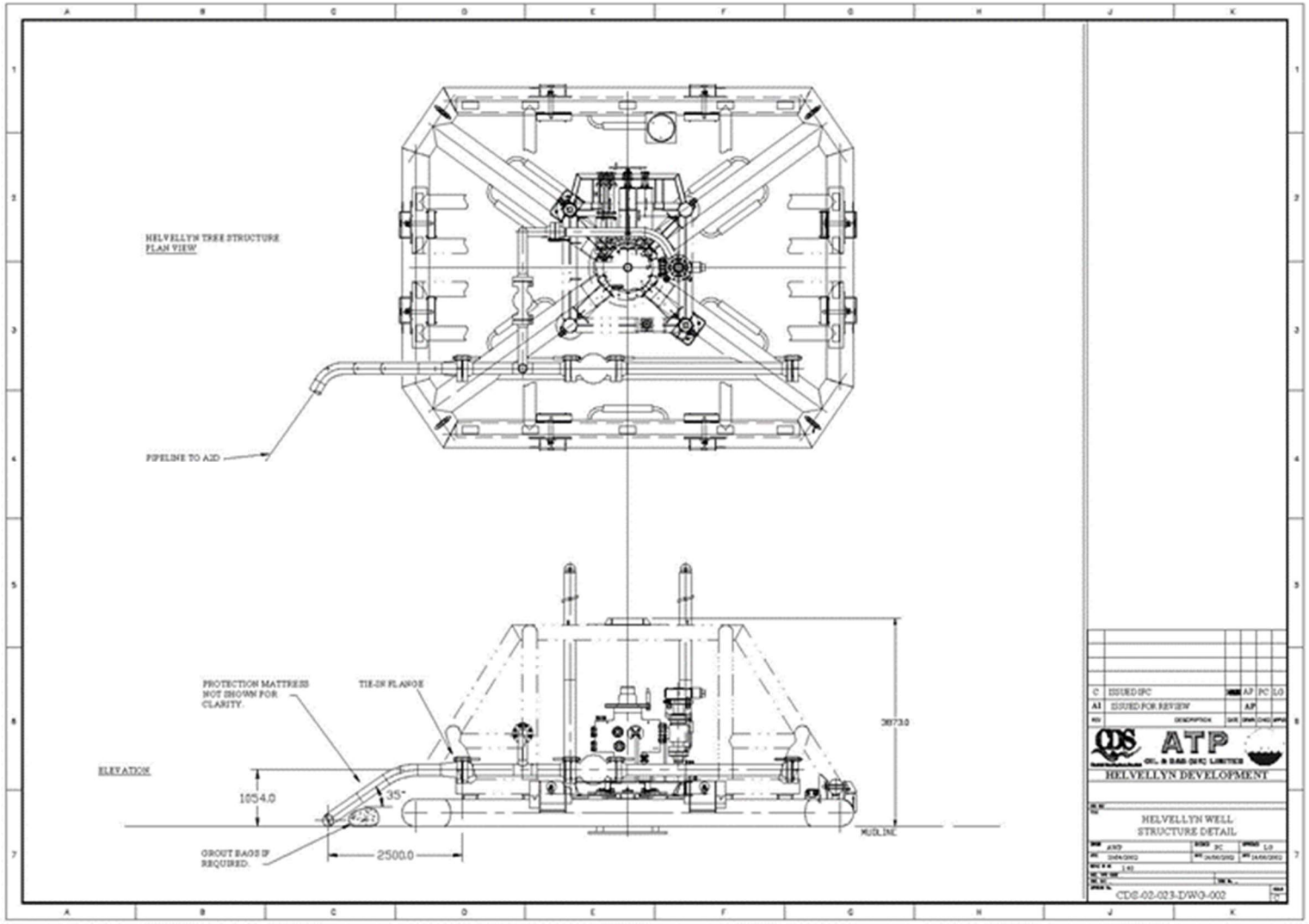
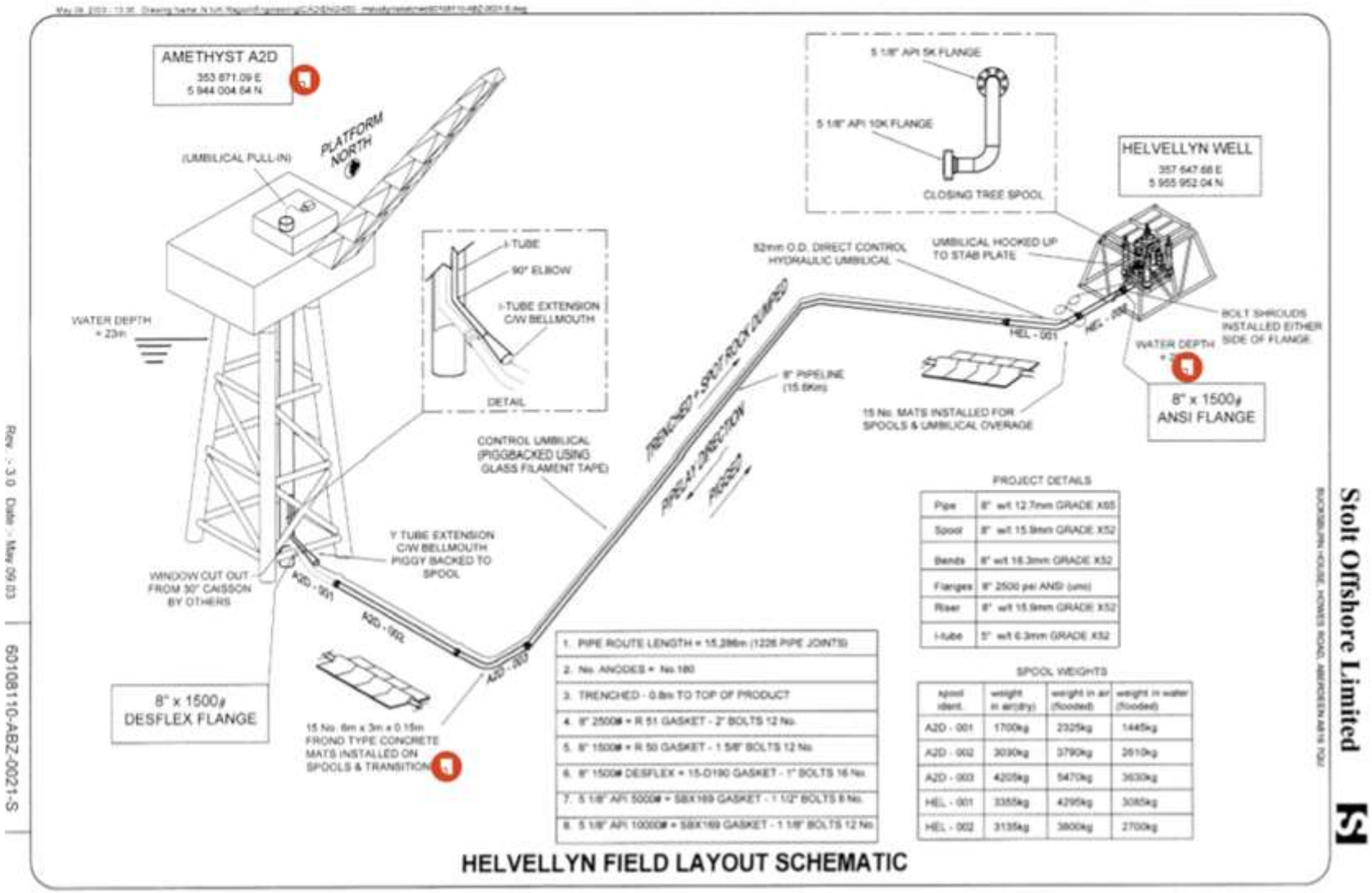


Figure 2.2. Helvellyn Field Schematic



The umbilical was installed simultaneously to the pipeline into the same protection trench (to a depth of approximately 1.5m) for the majority of the route, the two only separate at the final approaches to the Amethyst A2D platform and the Helvellyn subsea well. Where the pipeline and umbilical were not trenched at the platform and the subsea well approaches, either concrete mattresses or rock dump were installed over the lines to provide protection, as described below. Additionally, multiple locations along the route were rock dumped as well as being trenched, in order to provide down force on the pipelines, to prevent upheaval bucking (UHB) on the pipelines during their operational life.

At the Helvellyn approaches, the export pipeline has a short section of exposed goose neck pipe where the spools connect to the subsea protection structure. The spools are then laid on the seabed surface and protected with concrete mats and gravel bags up to the start of a section of protective rock dump. The connection location for the umbilical is on the opposite corner to the pipeline connection flange but on the same south west face of the subsea protection structure. There is a short section of shallow buried umbilical looped on the seabed before the umbilical joins the same route as the pipeline spools. Approximately 47 m of spool pipe and a further 23 m of welded pipe are covered by 15 concrete mattresses. The start of the rock dump protection is at KP 0.023 and runs for 200m until the pipeline and umbilical are protected within the trench.

The pipeline spool sections at the Amethyst A2D approaches are laid on the seabed surface and protected with concrete mattresses. At the riser to spool goose necks[1] the pipeline and umbilical are supported with grout bags. Beyond the spool sections running away from the platform, there is a short section of the pipeline and umbilical (ca. 20 m) that is also laid on the seabed and protected with concrete mattresses. At KP 15.261, the pipeline and umbilical have been rock dumped to provide a minimum of 0.9 m cover. This continues through the trench transition section for approximately 84 m, following which the pipeline and umbilical are then buried 1.5 m below the adjacent seabed level.

In addition, during the initial trenching of the pipeline and umbilical a number of the cathodic protection anodes were damaged at the northern end of the pipeline route during the ploughing process. In order to ensure sufficient cathodic protection still remained, four additional anode sleds were placed within the trench and attached to the pipeline with continuity straps. These were at KP 1.295, KP 0.945, KP 0.586 and KP 0.245. From the 2022 visual inspection survey the sled at KP 0.945 (sled 2) appears to be marginally exposed whilst sleds at KP 0.586 and KP 0.245 (sleds 3 and 4) are fully buried and rock dumped within the trench. The sled at KP 1.295 (sled 1) appears fully buried under natural backfill material and some rock within the trench.

A summary of the stabilisation material associated with the Helvellyn infrastructure is provided in Table 2.3.

Table 2.3. Helvellyn Stabilisation Material Details

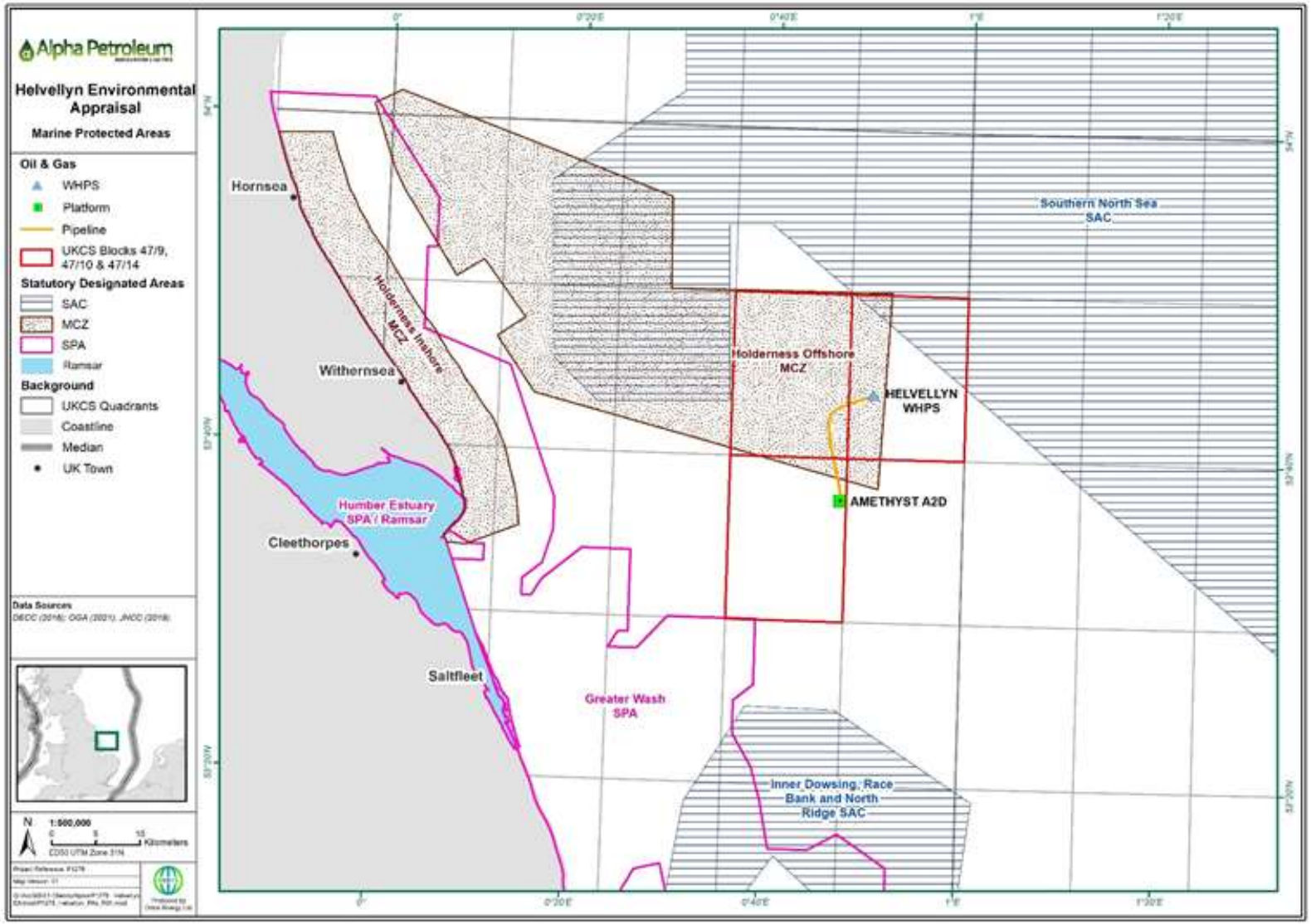
Stabilisation Feature	No.	Weight (Te)	Location	Status
Concrete mattresses (6m x 3m x 0.15m)	30	141.6	Amethyst A2D and Helvellyn ends of pipeline (15 at each end)	Exposed at the platform ends. Fronds on mats appear to have partially been lost over time with only some remaining.
Gravel bags (25 kg bags)	40	25kg	Various locations around the concrete mattresses and riser spool goose necks	Exposed at the platform ends

[1] Term used to describe the bends on pipework that lifts the pipe off the seabed to a connection point above it (usually a riser flange).

Stabilisation Feature	No.	Weight (Te)	Location	Status
Rock dump	42 locations	9,817	Total combined length of 1,530m over the pipeline. Of which ~800m is at the Helvellyn approach and ~84m is at the Amethyst A2D platform approach with 40 spot locations along the route	Rock dump located on the seabed
Anode sleds	4	6 (1.5 Te each)	KP 1.295, KP 0.945, KP 0.586 and KP 0.245.	Three fully buried / rock dumped, one marginally exposed

The Helvellyn subsea well and approximately 12.5 km of the pipeline route is located within the boundary of the Holderness Offshore Marine Conservation Zone (MCZ) designated for the protection of three broad-scale habitat types (A5.1: Subtidal coarse sediment, A5.2: Subtidal sand and A5.4: Subtidal mixed sediments), ocean quahog (*Arctica islandica*) and North Sea glacial tunnel valleys (see Figure 2.3 and Section 4.5.6 for further details).

Figure 2.3. Location of Helvellyn Infrastructure and MPAs



2.3 Regulatory Context

The Petroleum Act 1998 (as amended by the Energy Act 2008 and 2016) is the principal legislation governing decommissioning in the UKCS. The responsibility for ensuring the requirements of the Petroleum Act are complied with rests with OPRED, which sits within Department for Energy Security & Net Zero.

The Petroleum Act requires the operator of an offshore installation or pipeline to submit a draft Decommissioning Programme (DP) for statutory and public consultation and to obtain approval of the DP from OPRED before initiating decommissioning work. The DP outlines in detail the infrastructure being decommissioned and the method by which the decommissioning will take place and is supported by an Environmental Appraisal (EA).

OPRED is also the competent authority on decommissioning in the UK for OSPAR (international regulations) purposes. OSPAR decision 98/3 specifically prohibits the dumping or leaving in place of installations in the marine environment and requires that all steel installations with a jacket weight less than 10,000 tonnes in air, which is the case for the Helvellyn WHPS, must be completely removed for re-use, recycling or final disposal on land.

OSPAR decision 98/3 does not include the decommissioning of pipelines, and there are no international guidelines on the decommissioning of disused pipelines. However, the Petroleum Act and Pipeline Safety Regulations 1996 provide a framework for the safe decommissioning of disused pipelines. Due to the recognition that each pipeline may have its own specific characteristic and be situated in varying environmental conditions, the OPRED decommissioning guidelines (OPRED, 2018) require all feasible pipeline decommissioning options to be considered and a 'Comparative Assessment' made of the available options.

The Marine Coastal Access Act 2009 introduced a number of measures to deliver the United Kingdom Government's vision of "clean, healthy, safe, productive and biologically diverse oceans and seas", including the introduction of marine plan areas. The Helvellyn well and pipelines lie within the East Offshore Marine Plan area. WPRL considers that the proposed Helvellyn decommissioning activities are in broad alignment with the objectives and policies of the plan (see Appendix A).

2.4 Scope and Purpose of this Environmental Appraisal Report

This EA report has been written by WPRL to support the combined Helvellyn Subsea Installation DP and Helvellyn Pipeline and Umbilical DP and has been prepared in accordance with the regulatory guidelines (OPRED, 2018). It sets out to describe, in a proportionate manner, the potential environmental and societal impacts resulting from the decommissioning of the Helvellyn subsea installation and pipelines and demonstrate the extent to which these impacts will be mitigated and controlled to an acceptable level.

Pipeline and umbilical cleaning operations preceding the proposed decommissioning activities will be consented under appropriate environmental permits and consents.

3 Project Description

3.1 Proposed Decommissioning Solution

In accordance with OSPAR decision 98/3, WPRL is proposing to completely remove the Helvellyn subsea installation and return it shore for re-use, recycling, and final disposal to landfill as appropriate. Prior to this, the well will be plugged and abandoned in line with regulations. The conductor will be cut internally by high pressure water jet or mechanical cutter at least 3 m below the seabed, removed either by rig or by vessel and returned to shore for reuse or recycling. This solution meets HSE regulatory requirements and is in accordance with OEUK and NSTA guidelines.

For the pipeline and umbilical and associated protective material, WPRL has undertaken a Comparative Assessment (CA) in order to arrive at an optimal decommissioning solution. The selected decommissioning options derived from the CA, based on consideration of safety, environmental, technical, societal and economic factors, are summarised in Table 3.1. For further details refer to the Helvellyn Pipeline and Umbilical (PL1956 and PLU1957) Decommissioning Options Comparative Assessment Report (APR_HV_PMGT_005) (WPRL, 2021).

Table 3.1. Summary of Decommissioning Solution for the Helvellyn Pipeline, Umbilical & Stabilisation Materials

Installation	Proposed Decommissioning Solution	Reason for Selection
Gas Export Pipeline (PL1956)	Pipeline left cleaned and main trenched and buried sections, including those sections protected by rock dump to be left in situ. Pipeline tie-in spools not buried by rock dump (under mats) will be removedby cutting and lifting back to a vessel	The pipeline and piggybacked umbilical are already trenched and buried to > 0.6m, is in a stable state and no snagging events or damage has been reported during the operational life of the pipeline. In a flooded condition (as would be the decommissioned left in situ state) the pipeline and umbilical are both negatively buoyant and so no upward movement of the lines would be expected. No significant seabed (sandwave, megaripples) migration has been experienced during the life of the field.
Chemical Injection Umbilical (PLU1957)	Umbilical left cleaned (with the exception of the power cores) and main trenched and buried sections, including those sections protected by rock dump to be left in situ.	
Mattresses and gravel bags at Helvellyn and Amethyst approaches	Concrete protection mattresses (fronded and non-fronded) and gravel bags at the Helvellyn well and Amethyst platform approaches to be removed and returned to shore for recycling or disposal. If any practical difficulties are encountered WPRL will consult OPRED.	Although the seabed will be temporarily disturbed by the recovery work, this option allows the seabed surface to be returned to its natural status, apart from in those areas where rock dump overlies the pipelines. The equipment and technologies required to recover and break up the materials are well known to the industry and are not technically challenging.
Anode sleds	Anode sleds to be left in situ. If any individual anodes at the anode sled location 2 can be seen on the seabed surface at the time of decommissioning these will be cut and recovered.	Three anode sleds are fully buried within the 1.5-1.8 m deep trench by a rock and natural deposition. The fourth anode sled is marginally exposed. The rock dumped section are of graded rock with profiled side slopes, therefore there are no snagging concerns.

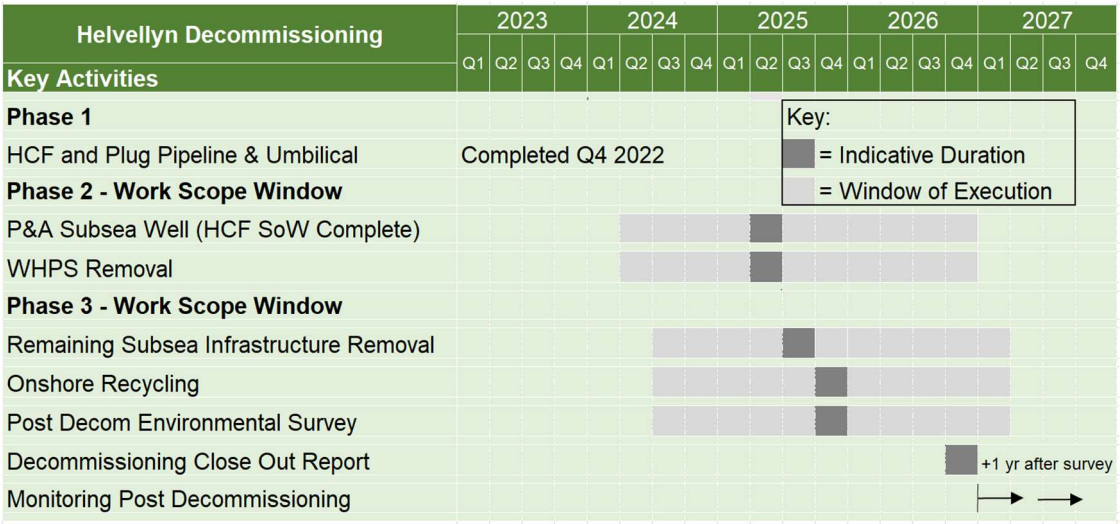
3.2 Potential for Alternative Uses

WPRL has explored alternative uses for the Helvellyn facilities, including the possibility for in situ re-use or redevelopment; however, given the limited amount of infrastructure (subsea tie back where host platform is operated by others) and the age of the infrastructure no alternative solutions have been identified.

3.3 Project Schedule

WPRL anticipates executing the Helvellyn decommissioning activities between 2022 and 2025. An indicative schedule for the work is shown in Figure 3.1, which is subject to approval of the DPs and unavoidable constraints such as contractor availability (e.g. vessel availability).

Figure 3.1. Indicative Decommissioning Schedule



3.4 Decommissioning Activities

3.4.1 Facilities Making Safe

In preparation for removal of the Helvellyn facilities, WPRL will clean the export pipeline and umbilical chemical injection cores followed by disconnection from the Amethyst A2D platform. The subsea development well will also be plugged and abandoned in accordance with HSE regulatory requirements and OEUK guidelines. These activities will be consented via appropriate environmental permits and consents under the OPRED PETS UK Energy Portal

3.4.2 Subsea Installation Removal

A jack-up rig or other suitable vessel will be used to plug and abandon (P&A) the well, with the conductor cut internally at least 3m below the seabed. The WHPS, wellhead and xmas tree will then be recovered with the top 3m section of the well either by the rig/vessel, if the pipeline and umbilical has been cut prior to the P&A operations commencing or by a Multi-Purpose Support Vessel (MSV). No external excavation will be required and there are no plans to use explosives.

To allow access to the well during the P&A operations, the protection cover (8m x 6.3m x 4m high) forming part of the WHPS will be removed. It will either be lifted to the rig/vessel or, if the WHPS is to be recovered by MSV at a later date, the protection cover will be temporarily wet stored then redeployed (depending on final decommissioning work timings) before final recovery with the full WHPS.

3.4.3 Pipeline, Umbilical and Stabilisation Material Removal

The recommendation from the CA (WPRL, 2021) is that a partial removal option be adopted for both the gas export pipeline and umbilical, with the majority of the lines to be left in situ.

At the Helvellyn subsea well and Amethyst 2AD platform approaches, WPRL proposes to cut and remove the riser to spool goose neck sections of pipeline and remove the concrete protection mattresses and gravel bags and cut and remove the underlying pipeline sections up until the point where the pipelines are either rock dumped or buried to a depth greater than 0.6m. At the Helvellyn end of the pipeline a section approximately 100m in length will be removed. At the Amethyst A2D end the pipeline a section 84 m in length will be removed. The tie-in spools and

pipeline stabilisation features (mattresses and gravel bags) which are located under the rock dump will remain in situ.

The pipelines will be cut using mechanical cutting tools such as hydraulic shears or diamond wire cutters, the latter of which are more likely to be used where access is limited. The cut ends will not be capped but could be covered by reutilising a mattress. In order to recover the mattresses and cut sections of pipework a DSV will be required. It is anticipated that the mattresses will be lifted individually as a worst case scenario, however, where possible they will be stacked subsea and bulk lifted to the deck of the vessel reducing the number of lifts required and the risk of break-up of individual mats during the recovery process. The recovered pipeline sections, tie-in spools and associated mattresses and gravel bags will be returned to shore for recycling or disposal. However, in the event of practical difficulties during the removal operations, WPRL will consult with OPRED and an alternative method of decommissioning will be examined through a comparative assessment.

The remaining sections of the pipelines, left in their current state, would be marked on sea charts and notifications issued to fishermen / other users of the sea. If the cut ends of the pipelines are exposed at the seabed, then a mattress or gravel bags will be deposited over the ends to prevent a possible snagging point.

3.4.4 Vessel Requirements

Table 3.3 summaries the types of vessels likely to be used to decommission the Helvellyn infrastructure, their anticipated duration on location and typical fuel consumption rates.

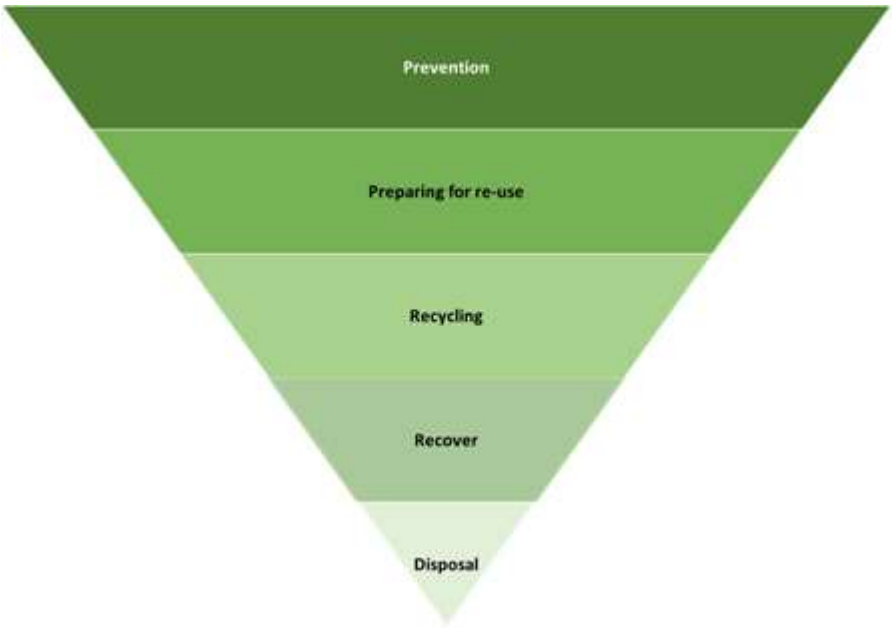
Table 3.3. Vessel Requirements for Subsea Installation Removal

Vessel	Days on Location	Fuel Consumption Rate	Total Fuel Consumption
Jack-up Rig	35	10 tonnes per day	350 tonnes
DSV	7	20 tonnes per day	140 tonnes
MSV	12	20 tonnes per day	240 tonnes
Survey Vessel	4 days	12 tonnes per day	48 tonnes
ERRV	35	8 tonnes per day	280 tonnes

3.5 Waste Management

The Helvellyn decommissioning project will have a Waste Management Plan (WMP) in place which will describe and quantify the waste arising from the proposed decommissioning activities and identify available disposal options. The WMP will adhere to the waste hierarchy of reduce, reuse and recycle and disposal to landfill will be the last resort (see Figure 3.1).

Figure 3.1. Waste Hierarchy (EU Waste Framework Directive)



Recyclable metals, predominantly steel and concrete mattresses, are estimated to account for the greatest proportion of the materials inventory. The current plan is to transport the subsea installation to an onshore decommissioning facility for re-use, recycling and disposal using an appropriately licenced contractor. The mattresses will also be recovered to shore, assessed for re-use or if their condition is unfavourable, recycled.

WPRL will ensure that the licensed waste contractor and chosen onshore dismantling site has a proven track record with regards to the waste stream management and can demonstrate compliance with the waste hierarchy and all applicable waste regulations. Contractor and site selection process is in early stages and thus the potential trans-frontier shipment of waste cannot be dismissed for certainty. Should any structures be considered for removal and disposal outside of the UK, an application under the Transfrontier Shipment of Waste Regulations shall be made to the EA.

All other wastes generated offshore during decommissioning will be segregated by type, before being transported to onshore waste facilities.

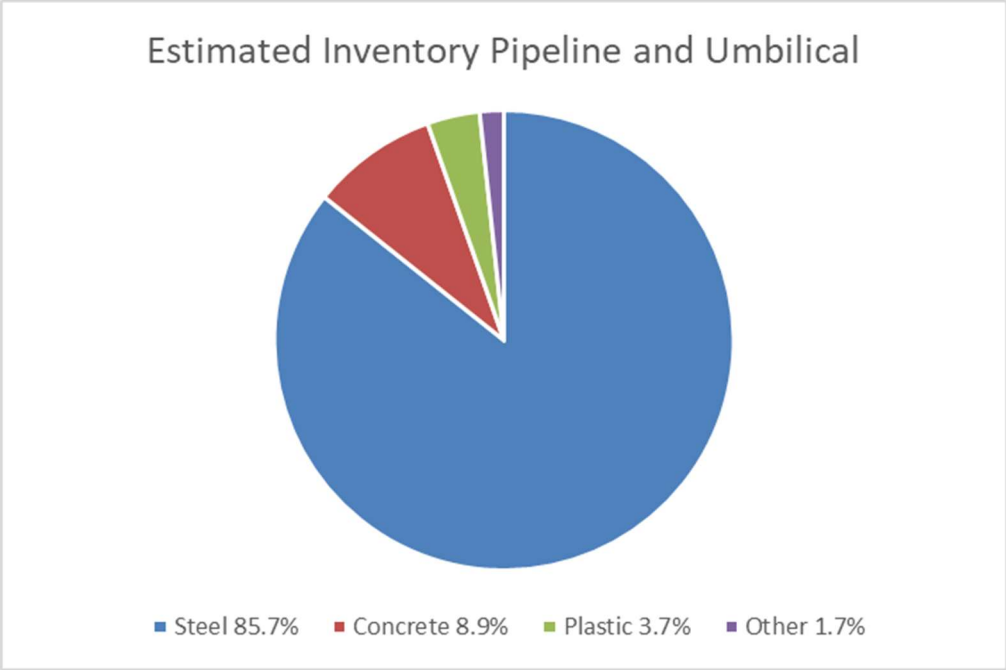
Figure 3.2 summarises the estimated breakdown of materials relating to Helvellyn subsea installation to be removed, which equates to 114 tonnes. This weight includes the xmas tree.

Figure 3.3 summarise the estimated breakdown of materials relating to the Helvellyn pipeline and umbilical, which equates to 1,194 tonnes (this excludes the rock material detailed in Table 2.3). It is proposed that approximately 112.06 tonnes of this material will be removed, with the remainder of material left *in situ*, as discussed in Section 3.1.

Figure 3.2. Pie Chart of Estimated Subsea Installation Waste Inventories[1]

[1] Total Subsea Installation weight is 114 tonnes, (WHPS 100Te, wellhead and tree 14Te)

Figure 3.3. Pie Chart of Estimated Pipeline and Umbilical Waste Inventories[1]



[1] Total Pipeline and Umbilical weight is 1,194 tonnes

No naturally occurring radioactive material (NORM) has been encountered on Helvellyn to date, but as a worst-case, it is anticipated that equipment contaminated with NORM scale or sludge may be encountered during the decommissioning project. WPRL will ensure tests for NORM are undertaken offshore by a Radiation Protection Supervisor. If NORM is encountered, WPRL will ensure appropriate Radioactive Substance Regulation (RSR) permits are in place and conditions that dictate the management and control of radioactive waste are met.

3.6 Post Decommissioning

A post decommissioning site survey will be carried out within a 500m radius of the former Helvellyn installation site and a (minimum) 100m corridor (50m either side) along the route of the Helvellyn pipeline where decommissioning activities have taken place to identify any oil and gas debris. Any

seabed debris related to offshore oil and gas activities will be recovered for onshore disposal or recycling in line with existing disposal methods.

WPRL will provide a verification of seabed clearance to OPRED following completion of the Helvellyn decommissioning activities. If non-intrusive methods are deemed inconclusive during verification alternative methods will be discussed and agreed with OPRED. This will be included in the Close Out Report and will also be sent to the Seabed Data Centre (Offshore Installations) at the Hydrographic Office.

A post decommissioning environmental seabed survey will also be conducted taking similar soil samples and habitat reviews in the same locations to the pre decommissioning environmental survey which will then be compared with the pre-decommissioning environmental baseline survey data.

A post-decommissioning monitoring programme covering the pipelines and associated stabilisation features remaining in situ will then be agreed with OPRED.

4 Environmental Baseline

This section describes the environmental and societal receptors, which could be affected by the proposed Helvellyn decommissioning activities. The description is largely based on data provided in the OPRED Offshore Energy Strategic Environmental Assessment (SEA) Reports (2003-2016), as well as other published data sources. The Helvellyn facilities are located within 'Regional Sea 2' as defined within the Offshore Energy SEA3 (DECC, 2016).

In addition, site specific data gathered during the pre-decommissioning environmental baseline survey (EBS) and habitat assessment carried out by Fugro on behalf of WPRL in August 2022 has been referenced, where relevant (Fugro, 2022a, Fugro 2022b). The surveys consisted of geophysical, habitat investigation and environmental work scopes.

During the pre-decommissioning EBS survey and habitat assessment six environmental sampling stations were sampled, arranged in a cruciform centred on the Helvellyn subsea well, and aligned with the predominant current (Figure 4.1). At each environmental sampling station, it was planned to acquire video and stills photography prior to the collection of one chemical (CA), one particle size distribution (PSD) and two macrofaunal (FA/FB) grab samples. Video and stills photographic data were successfully acquired along all six proposed stations (Table 4.1). Stations suffixed with 'A' or 'B' were reruns due to tides. A complete suite of samples (two macrofauna, one PSD and one CA sample) were retained at four of the stations (Table 4.2). No CA sample was obtained at station HST06 and no FB sample at station HST03 due to coarse sediment.

Seabed samples were acquired using a 0.1 m^2 Hamon grab for the macrofaunal and PSD samples and a 0.1 m^2 Day grab for CA samples. Sediment samples were analysed for their PSD using a combination of two techniques; sieve analysis for all material retained by a 1.0 mm sieve followed by laser diffraction analysis of the finer material.

A herring spawning ground survey (Gardline, 2001) was conducted in the Helvellyn field prior to development, with PSD data collected. The PSD data from this survey has been compared to the data collected during the pre-decommissioning survey. In addition, two surveys were conducted at the nearby Amethyst B1D and West Sole C field in 2000 with the data available on UK Benthos. Amethyst B1D is 19 km south east and West Sole C is 16 km north east of the Helvellyn well. Six stations were sampled in each of these fields. The methodology for PSD and sediment hydrocarbon content were similar to the methodologies used in this study and consequently the data have been included for comparison to the wider area.

The data collected during the pre-decommissioning survey has also been compared to United Kingdom Offshore Operators Association (UKOOA) mean background levels of organic and inorganic substances (UKOOA, 2001) to provide more general information on the typical range of environmental conditions that may be encountered in the SNS. Comparisons have also been made with the mean concentrations estimated from Area 1 (Sandbanks), as reported in the second Strategic Environmental Assessment (SEA2) conducted in 2001, as these provide more up to date and spatially comparable background concentrations (ERT, 2003a; 2003b). In addition, comparison has been made to Oslo and Paris Commission (OSPAR) background values that were derived from data collected from pristine marine sediments in the wider north-east Atlantic (OSPAR, 2014). The OSPAR background concentrations (BCs) reflect contaminant concentrations at "pristine" or "remote" sites, while background assessment concentrations (BACs) are statistically derived from background data and are defined as "values for testing whether the concentrations at a location are at or close to background" (OSPAR, 2005; 2009a).

Table 4.1. Completed Transects

Station		Easting	Northing	Depth (m) BSL	Length	Data
HST01	SOL	357 500.9	5 955 857.9	27	43	1 min 20 sec 12 stills
	EOL	357 509.3	5 955 815.8	28		
HST02	SOL	357 329.4	5 956 217.0	28	47	1 min 14 sec 12 stills
	EOL	357 359.2	5 956 181.3	29		
HST02A	SOL	357 412.6	5 956 237.8	29	79	1 min 30 sec 13 stills
	EOL	357 353.8	5 956 184.8	29		
HST02B	SOL	357 320.9	5 956 218.2	29	56	1 min 20 sec 13 stills
	EOL	357 369.2	5 956 189.5	29		
HST03	SOL	357 603.9	5 955 685.6	29	55	1 min 55 sec 11 stills
	EOL	357 610.7	5 955 630.9	28		
HST03A	SOL	357 636.8	5 955 583.5	29	82	1 min 17 sec 13 stills
	EOL	357 604.0	5 955 659.1	29		
HST04	SOL	357 643.2	5 955 810.4	27	46	1 min 14 sec 12 stills
	EOL	357 645.1	5 955 764.7	28		
HST04A	SOL	357 612.6	5 955 767.7	29	63	0 min 53 sec 10 stills
	EOL	357 668.0	5 955 797.2	28		
HST05	SOL	357 458.2	5 955 731.6	28	23	0 min 31 sec 9 stills
	EOL	357 452.5	5 955 709.3	29		
HST06	SOL	357 755.6	5 955 319.7	29	56	1 min 21 sec 12 stills
	EOL	357 777.3	5 955 268.1	29		

Notes
BSL = Below sea level
SOL = Start of line
EOL = End of line
Geodetic Parameters: WGS 84, UTM Zone 31N, CM 3°E [m]

Table 4.2. Completed Sediment Sampling Stations

Station	Easting*	Northing*	Depth (m) BSL	Sample Acquisition
HST01	357 517.4	5 955 823.8	28	FA/FB, PSD, CA
HST02	357 340.1	5 956 188.0	28	FA/FB, PSD, CA
HST03	357 594.1	5 955 641.8	29	FA, PSD, CA
HST04	357 649.6	5 955 778.6	28	FA/FB, PSD, CA
HST05	357 469.4	5 955 718.5	28	FA/FB, PSD, CA
HST06	357 774.6	5 955 277.7	29	FA/FB, PSD

Notes * = Coordinate presented for the FA grab sample
BSL = Below sea level
CA = Chemical sample
FA/FB = Faunal sample A or B
PSD = Particle size distribution sample
Geodetic Parameters: WGS 84, UTM Zone 31N, CM 3°E [m]

Figure 4.1. Environmental Stations Sampled at the Helvellyn Well

4.1 Physical Environment

4.1.1 Geography

The Helvellyn subsea well is located in UKCS Block 47/10a in the SNS, approximately 48 km east of Spurn Point on the East Riding of Yorkshire coast and approximately 136 km west of the UK/Netherlands transboundary line. The Amethyst A2D platform is located in UKCS Block 47/14, approximately 42 km east of the East Riding of Yorkshire coast and approximately 144 km west of the UK/Netherlands transboundary line. The pipeline and umbilical route additionally crosses UKCS Block 47/9. Hereafter, UKCS Blocks 47/10a, 47/9 and 47/14 are referred to as the blocks of interest.

4.1.2 Bathymetry

The water depth at the Helvellyn subsea well is approximately 27 m LAT (Lowest Astronomical Tide) and at the Amethyst A2D platform is 26m LAT. Along the pipeline route, water depths vary from around 26m to 44m with the deepest section around 3.5km from Helvellyn and 27m and 26m respectively at the Helvellyn and Amethyst A2D ends (GEBCO, 2014).

4.1.3 Seabed Sediments

Seabed sediments within the SNS generally comprise coarse sands with gravels in some areas. Sediments are highly mobile largely due to the increased near seabed currents (DECC, 2016).

The Helvellyn infrastructure is situated in an area of seabed mainly of coarse sand and gravels with sand ripples. The Helvellyn pipeline and umbilical run along a route of predominantly dense shelly sand and gravels which overlies a stiffer sandy clay (0.2-0.5m below the top sand layer). The sand ripples along the pipeline route are of less than 0.2m in height, and there is no evidence from various surveys that the ripples are migrating along the seabed surface.

A summary of sediment characteristics and sediment hydrocarbons analysis from the 2022 pre-decommissioning survey is provided in Table 4.3. It can be seen from this that four stations conformed to Folk classifications of ‘Sandy gravel’, one station as ‘Gravelly sand’ and one station as ‘Gravel’. Sand content ranged from 11.35 % at station HST01 to 74.91 % at station HST03 with a mean of 40.23 % and moderate variation (Relative standard deviation (RSD) 60 %). Gravel content ranged from 23.33 % at station HST03 to 87.11 % at station HST01 with a mean of 57.18 % and moderate variation (RSD 43 %). The fines content ranged from 0.79 % at station HST04 to 4.48 % at station HST02 with a mean of 2.59 % and moderate variation (RSD 56 %). Stations HST02, HST05 and HST06 had a fines content higher than the SNS mean background value (3.07 %; UKOOA, 2001). The mean fines content was higher than the mean recorded across the Amethyst B1D (0.31 %; OGUK, 2021a) and West Sole C (0.13 %; OGUK, 2021b) fields(Fugro, 2022a), but lower than the mean recorded in the Helvellyn field in a previous survey (2.83 %; Gardline, 2001).

The median particle size (µm) ranged from 729 µm at station HST03 to 70,036 µm at station HST01 with a mean of 18,532 µm and high variability (RSD 147 %). The Wentworth description, assigned from mean particle size, categorised one station as very coarse pebble, one station as medium pebble, one station as fine pebble, one station as granule, one station as very coarse sand, and one station as coarse sand (Fugro, 2022a).

The Total Organic Carbon (TOC) values across the survey stations were low and typical of this region of the SNS. TOC ranged from 0.18 % at station HST05 to 0.55 % at station HST04, with a mean of 0.32 % and moderate variability (RSD 44 %) (Fugro, 2022a). Due to the low values observed, TOC content was unlikely to influence macrofaunal distribution across the survey area.

The Total Hydrocarbon Content (THC) values ranged from 10.4 µg/g at station HST03 to 37.6 µg/g at station HST01, with a mean of 18.2 µg/g and moderate variation (RSD 62 %). The mean THC value recorded across the Helvellyn survey area was higher than the mean from the Amethyst B1D (6.8 µg/g; OGUK, 2021a), West Sole C (2.6 µg/g; OGUK, 2021b) and the SEA2 Area 1 survey (1.6 µg/g; ERT, 2003a). THC values exceeded the SNS mean background concentration (4.34 µg/g; UKOOA, 2001) at all stations, while stations HST01, HST02 and HST04 exceeded the SNS 95th percentile

(11.39 µg/g; UKOOA, 2001. The elevated THC levels compared to background values are most likely to originate from shipping or other diffuse sources compared to operational discharges) (Fugro, 2022a). There was no evidence of THC levels impacting the macrofaunal community.

The unresolved complex mixture (UCM) concentrations ranged from 6.5 µg/g at station HST03 to 22.7 µg/g at station HST01, with a mean of 11.2 µg/g and moderate variation (RSD 60 %). The mean concentration (11.2 µg/g) was higher than the mean recorded in the SEA2 Area 1 survey (1.0 µg/g; ERT, 2003a) (Fugro, 2022a).

Total n-alkane (nC12 to nC36) concentrations ranged from 1.25 µg/g at station HST03 to 4.67 µg/g at station HST01, with a mean of 2.18 µg/g and moderate variation (RSD 65 %). The mean concentration (2.18 µg/g) was higher than the mean concentrations recorded at Amethyst B1D (0.83 µg/g; OGUK, 2021a), West Sole C (0.45 µg/g; OGUK, 2021b) and in the SEA2 Area 1 survey (0.16 µg/g; ERT, 2003a). At all stations, the total n-alkane concentrations exceeded the SNS 95th percentile (0.78 µg/g; UKOOA, 2001) (Fugro, 2022a).

Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) concentrations ranged from 0.364 µg/g at station HST05 to 2.27 µg/g at station HST01 with a mean of 0.912 µg/g and high variation (RSD 82 %). The mean concentration was higher than the mean value recorded in the SEA2 Area 1 survey (0.058 µg/g; ERT, 2003a). The total 2 to 6 ring PAH concentrations exceeded the SNS mean background concentration (0.208 µg/g; UKOOA, 2001) at all stations with stations HST01 and HST02 further exceeding the SNS 95th percentile (0.741 µg/g; UKOOA, 2001). Total United States Environmental Protection Agency's (US EPA) 16 PAH concentrations ranged from < 60.6 ng/g at station HST05 to < 331 ng/g at station HST01 with a mean of 145 ng/g and high variation (RSD 75 %) (Fugro, 2022a).

However, there was no evidence of drilling fluids in the GC-FID profiles which correlates with WBM being predominantly used at Helvellyn, along with the bulk of drill cuttings being skipped and shipped back to shore (Fugro, 2022a). Therefore, the elevated PAH levels recorded in the Helvellyn survey area compared to background and regional PAH concentrations (UKOOA, 2001; ERT, 2003a) are most likely to originate from shipping or other diffuse sources compared to operational discharges.

Results for heavy and trace metal analysis are provided in Table 4.4. Sediments were collected from five stations across the Helvellyn survey area. The majority of metals were comparable to, or slightly higher than, their respective SNS mean background concentrations (Fugro, 2022a).

Total Barium concentrations were broadly comparable across the Helvellyn survey area. Barium concentrations ranged from 137 µg/g at station HST02 to 182 µg/g at station HST01, with a mean of 164 µg/g and low variability (RSD 10 %). Concentrations were below the SNS mean background concentration (70.14 µg/g; UKOOA, 2001) at all stations. The total barium levels present do not indicate deposition of drilling muds and, when considered with the hydrocarbon (GC-FID profiles, THC and PAH concentrations), the data indicate that the survey area has not been impacted by operational discharges (Fugro, 2022a).

The low variation in the data is more likely to be related to sediment composition. All stations had metals concentrations below their respective ERLs and are therefore unlikely to cause adverse effects on the macrofaunal communities present (Fugro, 2022a).

Overall, the physico-chemical data obtained from the pre-decommissioning survey at Helvellyn indicated that the seabed sediments were considered to be above background for the SNS but there was no evidence of an impact on the macrofaunal community.

Table 4.3. Summary of Sediment Characteristics and Sediment Hydrocarbons

Station	Distance (m)*	Bearing (°)*	TOC (%)	Fractional Composition			Folk Description (BGS modified)	Mean Particle Size			THC[3]	n-alkanes[3]			Pr/Ph Ratio
				Gravel (%)	Sand (%)	Fines (%)		(µm)[1]	(phi)[1]	Wentworth (1922) Description[2]		nC12-20	nC21-36	nC12-36	
HST01	100	335	0.32	87.11	11.35	1.54	Gravel	38524	-5.27	Very coarse pebble	37.6	2.34	2.33	4.67	2.37
HST02	500	335	0.32	53.15	42.37	4.48	Sandy gravel	2138	-1.1	Granule	15.1	0.77	0.80	1.57	2.38
HST03	100	155	0.23	23.33	74.91	1.76	Gravelly sand	894	0.16	Coarse sand	10.4	0.66	0.59	1.25	2.05
HST04	100	65	0.55	79.86	19.35	0.79	Sandy gravel	11571	-3.53	Medium pebble	17.0	1.00	0.96	1.95	2.02
HST05	100	245	0.18	36.25	59.98	3.78	Sandy gravel	1159	-0.21	Very coarse sand	10.9	0.70	0.74	1.44	2.02
Minimum			0.18	23.33	11.35	0.79		894	-5.27		10.4	0.66	0.59	1.25	2.02
Maximum			0.55	87.11	74.91	4.48		38524	0.16		37.6	2.34	2.33	4.67	2.38
Mean			0.32	57.18	40.23	2.59	-	9932	-2.06	-	18.2	1.09	1.08	2.18	2.17
Standard deviation			0.142	24.69	24.14	1.44		14567	2.09		11.2	0.709	0.709	1.42	0.189
RSD [%]			44	43	60	56		147	-		62	65	65	65	9
Amethyst B1D 2000 (OGUK, 2021a)†															
Mean			-	-	-	0.31	-	-	-	-	6.8	-	-	0.83	-
RSD [%]			-	-	-	137	-	-	-	-	58	-	-	62	-
West Sole C 2000 (OGUK, 2021b)‡															
Mean			-	-	-	0.13	-	-	-	-	2.6	-	-	0.45	-
RSD [%]			-	-	-	152	-	-	-	-	47	-	-	69	-
Southern North Sea (UKOOA, 2001)#															
Mean			-	-	-	3.07	-	2.04	-	-					
95th Percentile			-	-	-	12.59	-	-	-	-					
SEA2 Area 1 (ERT, 2003a)∓															
Mean											1.6	0.06	0.09	0.16	2.51
RSD [%]											106	200	156	163	31
Helvellyn Herring Spawning Ground Survey (Gardline, 2001) ^															
Mean			-	38.35	-	2.83	-	-	-	-	4.34	-	-	0.33	-
RSD [%]			-	52	-	106	-	-	-	-	11.39	-	-	0.78	-

Notes
TOC = Total organic carbon, THC = Total hydrocarbon content, Pr/Ph = Ratio of pristane to phytane, RSD = Relative standard deviation, SNS = Southern North Sea
* = Distance and bearing from the Helvellyn subsea well
† = Mean and relative standard deviation values from an environmental survey in the Amethyst field (OGUK, 2021a)
‡ = Mean and relative standard deviation values from an environmental survey in the West Sole C field (OGUK, 2021b)
# = Mean and 95th percentile estimated from data reported at stations farther than 5 km from nearest platform in the central North Sea from 1975 to 1995 (UKOOA, 2001)
^ = Mean and relative standard deviation values from a herring spawning ground survey in the Helvellyn field (Gardline, 2001)
∓ = Mean and relative standard deviation value from the regional SEA2 Area 1 (Sandbanks) survey (ERT, 2003a)
[1] Folk and Ward method (Gradistat statistics), [2] Wentworth description (Wentworth, 1922), [3] Concentrations expressed as µg/g of dry sediment

Table 4.4. Sediment Metals Analysis

Station	Distance (m)*	Bearing (°)*	Al	As	Ba	TBa†	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Sn	V	Zn
HST01	100	335	9410	18.3	27.6	182	0.06	17.4	5.1	17300	< 0.03	11.9	13.9	0.25	38.2	34.1
HST02	500	335	9690	18.4	48.2	137	0.05	23.1	5.6	19600	< 0.03	16	14.5	0.23	41	36.5
HST03	100	155	7510	15.5	57.7	160	0.03	20.2	4.2	21900	< 0.03	13.5	11.7	0.25	53.2	35
HST04	100	65	6660	15.8	32.5	169	0.07	14.3	3.5	15500	< 0.03	10.7	12.3	0.15	36.1	25.2
HST05	100	245	8400	23.8	65.5	172	0.06	20.8	4.6	25700	< 0.03	16.9	13.4	0.24	55.1	51.3
Minimum			6660	15.5	27.6	137	0.03	14.3	3.5	15500	< 0.03	10.7	11.7	0.15	36.1	25.2
Maximum			9690	23.8	65.5	182	0.07	23.1	5.6	25700	< 0.03	16.9	14.5	0.25	55.1	51.3
Mean			8330	18.4	46.3	164	0.05	19.2	4.6	20000	-	13.8	13.2	0.22	44.7	36.4
Standard deviation			1270	3.33	16.1	17	0.015	3.39	0.81	4000	-	2.63	1.15	0.042	8.81	9.42
RSD [%]			15	18	35	10	28	18	18	20	-	19	9	19	20	26
SEA2 Area 1 (ERT, 2003b)‡																
Mean			-	10.9	-	-	-	4	-	8246	-	-	-	-	17	10
RSD [%]			-	75	-	-	-	38	-	51	-	-	-	-	43	52
Southern North Sea (UKOOA, 2001)#																
Mean			-	-	70.14	-	0.16	10.7	3.83	7595.33	0.02	5.47	8.39	-	18.53	15.88
95th Percentile			-	-	272.4	-	0.72	44.77	13.86	18555	0.05	21.45	21.03	-	35.76	35.8
CEMP Assessment Criteria (OSPAR, 2014)																
ERL			-	-	-	-	1.2	81	34	-	0.15	-	47	-	-	150

Notes
Concentrations expressed in µg/g dry sediment
Al = Aluminium As = Arsenic Ba = Barium TBa = Total barium Cd = Cadmium Cr = Chromium Cu = Copper Fe = Iron Hg = Mercury Ni = Nickel Pb = Lead Sn = Tin V = Vanadium Zn = Zinc
RSD = Relative standard deviation ERL = Effects Range Low OSPAR = Oslo and Paris Commission
CEMP = Coordinated Environmental Monitoring Programme
* = Distance and bearing from the Helvellyn subsea well
† = Determined by alkali fusion
‡ = Mean and relative standard deviation values estimated from the regional SEA2 Area 1 (Sandbanks) survey (ERT, 2003b)
# = Mean and 95th percentile estimated from data reported at stations farther than 5 km from nearest platform in the SNS from 1975 to 1995 (UKOOA, 2001)

Key: Light Yellow cell = Above SNS background mean Orange cell = Above SNS background 95th percentile Red cell = Above ERL

4.1.4 Seabed Features

During the 2022 survey, MBES images of the pipeline route clearly showed seabed features including ripples and slight mounds. Stable rock dump locations within the trench were noted and a slight infilling of the trench was seen. North Sea tunnel valleys, a feature of the Holderness Offshore MCZ, were not observed by the analysis of the photographic data taken during the pre-decommissioning survey (Fugro, 2022b).

4.1.5 Oceanography

Tides in the SNS are predominately semi-diurnal and tidal waters offshore in this area of the SNS flood southwards and ebb northwards (DECC, 2016). Surface tidal streams flow in a south easterly direction and switch to a northerly direction at high water (Hydrographer of the Navy, 2011). Surface tidal streams in the vicinity of the Helvellyn infrastructure are a maximum of 1.4 and 0.8 m/s respectively for spring and neap tides (Hydrographer of the Navy, 2011).

As the tidal front keeps the water column permanently vertically mixed, preventing the development of thermoclines (OSPAR, 2010), there is little variation between sea surface and bottom temperatures, as well as in the annual mean temperatures, which are approximately between 5^{o}C and 15^{o}C (NMPi, 2022).

The annual mean significant wave height in the vicinity of the Helvellyn infrastructure ranges from 1.21 m to 1.50 m (NMPi, 2022).

4.1.6 Meteorology

Winds in this region of the SNS are generally from between south and north-west. The prevailing winds in the region vary with the seasons. North-easterly winds and south-westerly winds are both common in winter and early summer. From July to September south-westerly winds dominate. Wind strengths are generally between Beaufort scale 1- 6 (1 – 11 m/s) in the summer months, with a greater proportion of strong to gale force winds of Beaufort scale 7 – 12 (14 – 32 m/s) in winter (UKHO, 2013).

4.2 Biological Environment

4.2.1 Plankton

The collective term plankton describes the plants (phytoplankton) and animals (zooplankton) that live freely in the water column and drift passively with the water currents. Plankton form the base of the food chain, therefore changes in the abundance and composition of the planktonic community can have impacts on higher consumers. Typically in the SNS a phytoplankton bloom occurs every spring, generally followed by a smaller peak in the autumn (DECC, 2016).

The SNS is characterised by shallow, well-mixed waters, which undergo large seasonal temperature variations (JNCC, 2004). The region is largely enclosed by land and as a result the marine environment is highly dynamic with considerable tidal mixing and nutrient-rich run-off from the land (eutrophication). Under these conditions, nutrient availability is fairly consistent throughout the year, therefore organisms with high nutrient uptake that thrive in dynamic waters, such as diatoms, are particularly successful (Leterme *et al.*, 2006). The phytoplankton community in the Regional Sea 2 area is dominated by the dinoflagellate genus *Tripos (T. fusus, T. furca, T. lineatus)*, along with higher numbers of the diatom, *Chaetoceros* (subgenera *Hyalpchaete* and *Phaeoceros*) than are typically found in the northern North Sea. From November to May when mixing is at its greatest, diatoms comprise a greater proportion of the phytoplankton community than dinoflagellates (DECC, 2016).

The zooplankton community is dominated by copepods including *Calanus helgolandicus* and *C. finmarchicus* as well as *Paracalanus* spp., *Pseudocalanus* spp., *Acartia* spp., *Temora* spp. and cladorcerans such as *Evadne* spp. There has been a marked decrease in copepod abundance in the

SNS, which has been linked to changes in global weather phenomena (DECC, 2016). However, the planktonic assemblage in the vicinity of the Helvellyn infrastructure is not considered unusual.

4.2.2 Seabed Communities

4.2.2.1 Habitat Classification

Data from the EMODnet broad-scale seabed habitat map for Europe (EUSeaMap2), indicates that the following European Nature Information System (EUNIS) habitat classifications are predicted to be present in the vicinity of the Helvellyn infrastructure (EMODnet, 2021):

- **A4.2: Atlantic and Mediterranean moderate energy circalittoral rock –** This habitat type contains a broad range of biological subtypes, from echinoderms and crustose communties (A4.21) to Sabellaria reefs (A4.22) and circalittoral mussel beds (A4.24).
- **A5.14: Circalittoral coarse sediment** – characterised by robust infaunal polychaetes, mobile crustacea and bivalves. Certain species of sea cucumber (e.g. Neopentadactyla) may also be prevalent in these areas along with the lancelet *Branchiostoma lanceolatum*;
- **A5.15: Deep Circalittoral Coarse Sediment** – Animal communities in this habitat are closely related to offshore mixed sediments and in some areas settlement of *Modiolus modiolus* larvae may occur and consequently these habitats may occasionally have large numbers of juvenile *M. modiolus*. In areas where the mussels reach maturity their byssus threads bind the sediment together, increasing stability and allowing an increased deposition of silt leading to the development of the biotope A5.622;
- **A5.25: Circalittoral Fine Sand** – Characterised by a range of echinoderms including the pea urchin *Echinocyamus pusillus*, polychaetes and bivalves. This habitat is generally more stable than infralittoral fine sand and subsequently supports a more diverse faunal assemblage;
- **A5.26: Circalittoral Muddy Sand** – Characterised by a variety of polychaetes, bivalves (*Abra alba* and *Nucula nitidosa*) and echinoderms (*Amphiura* spp., *Ophiura* spp. and *Astropecten irregularis*). These circalittoral habitats tend to be more stable than their infralittoral counterparts and as such support a richer infaunal community;
- **A5.27: Deep Circalittoral Sand** – Very little data is available on these habits however they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms.
- **A5.44: Circalittoral mixed sediments –** Characterised by wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones such as *Cerianthus lloydii* are often present. The presence of hard substrata (shells and stones) on the surface enables epifaunal species to become established, particularly hydroids such as *Nemertesia* spp and *Hydrallmania falcata.*
- **A5.45: Deep circalittoral mixed sediments –** Such habitats are often highly diverse with a high number of infaunal polychaete and bivalve species. Animal communities in this habitat are closely related to offshore gravels and coarse sands and in some areas populations of the horse mussel *Modiolus modiolus* may develop.

As previously noted, the Helvellyn subsea well and approximately 12.5 km of the pipeline route is located within the boundary of the Holderness Offshore MCZ (refer to Section 4.2.6 for further details) (JNCC, 2022a). The site is designated for the varied subtidal sediments that are present, which support a wide range of animals, both on and in the sediment, including worms, bivalves, starfish and crustaceans. As part of the assessment process for the site, seabed surveys have been undertaken. Stations closest to the Helvellyn infrastructure recorded benthic species that are often recorded in offshore mixed sediment including a range of polychaetes and molluscs, such as *Lumbrineris gracilis, Glycera lapidum, Abra nitida and Nuculana minuta*, as well as amphipods (*Urothoe elegans* and *Leptocheirus hirsutimanus*) (JNCC, 2016). A single sample station also recorded the presence of the ocean quahog (*Articia Islandica*), which is listed on the OSPAR List of Threatened and / or Declining Species and Habitats (OSPAR, 2021). Of note, *A. islandica* were not observed during the Helvellyn 2022 pre-decommissioning survey (Fugro, 2022b).

The seabed obseverd during the pre-decommissioning Habitat Assessment was largely homogeneous. The main sediment type observed in photographic data was gravelly sand, with varying proportions of shell fragments, pebbles, and cobbles. This sediment type has been classified as the EUNIS biotope complex 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) (JNCC Classification 'SS.SCS.CCS') (Fugro, 2022b).

The habitat classification 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) is described as tide-swept circalittoral coarse sands, gravel, including shingle, generally in depths of over 15 m or 20 m, characterised by robust infaunal polychaetes, mobile crustacea, and bivalves (EEA, 2022). The classification was assigned along all drop-down camera stations. These stations were characterised by 'gravelly sand'/ 'sandy gravel' (Folk 1954) in water depth of approximately 30.0 m BSL. Characterising taxa included the soft coral *Alcyonium digitatum* and anemones including *Urticina spp*. Faunal turf (Hydrozoa/Bryozoa), including the bryozoan *Flustra foliacea* and the hydroids *Nemertesia spp*. and *Abietinaria spp*., was infrequently present. The *urchin Echinus esculentus* and crustaceans of the family Paguridae and the crab *Necora puber* also occurred. Faunal burrows were also present. Figure 4.2 presents example seabed photographs of the habitat classification (Fugro, 2022b).

The identified habitat classification 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) may occur within the broad-scale habitat 'Subtidal coarse sediment' and within the Habitat of Principal Importance (HPI) and Habitat of Conservation Importance (HOCI) 'Subtidal sands and gravels' (JNCC, 2018; Fugro, 2022a).

Possible solitary and low-lying encrusting small aggregations of tubes of the ross worm *Sabellaria spinulosa* were observed on drop-down camera stations at HST01, HST02 and HST02A. However, a full reef assessment was not required, as the protected Annex I habitat and the Feature of Conservation Importance (FOCI) 'reef' was not observed.

Individuals of the Ocean quahog (*Arctica islandica*) were also not observed by the analysis of the photographic data (Fugro, 2022b).

The presence of stony reef was investigated across the survey area. The criteria for stony reef assessment were based on the Irving (2009) methodologies. The seabed at the majority of the stations was classed as 'Not a reef' due to the composition of the sediment and a percentage cover of cobbles and boulders < 10 %. However, areas at four drop-down camera stations (HST01, HST02A, HST02B, and HST03A) were classed as 'Low reef' due to a percentage cover of cobbles and boulders between 10 % and 40 % (see Table 4.5 and Figure 4.3). Areas of 'Medium reef' or 'High reef' were not observed (Fugro, 2022b). According to Golding et al. (2020), areas of the seabed described as having a 'low resemblance' to stony reef, where 'low' was scored in any of the criteria (composition, elevation, extent, or biota), requires a strong justification for the area to be considered as Annex I stony reef.

No other Annex I habitats or Annex II species, OSPAR threatened and/or declining species and habitats, UK Biodiversity Action Plan (BAP) priority habitats and species, or FOCI (OSPAR, 2008; Biodiversity Reporting and Information Group [BRIG], 2011, JNCC, 2018; JNCC, 2019c; 2019d, JNCC, 2014) were observed within the survey area.

Table 4.5. Stony Reef Assessment

Date	Station	Time	Easting	Northing	Length (m)	Area (m^2)	Still Nos.	Sediment Description	Stony Reef Characteristic			Overall
									Composition (% cover cobbles and boulders)	Elevation	Biota (% cover)	
22/08/2022	HST01	07:31:33	357 501.3	5 955 858.6	23	23	HST01_01 - HST01_02	Gravelly sand (pebbles and cobbles) with shell fragments	< 10	< 64 mm	< 80	Not a reef
		07:32:08	357 507.0	5 955 836.0								
	HST01	07:32:08	357 507.0	5 955 836.0	21	21	HST01_03 - HST01_12	Gravelly sand (pebbles and cobbles) with shell fragments	10-40	64 mm – 5 m	< 80	Low
		07:32:59	357 507.6	5 955 814.9								
22/08/2022	HST02A	06:29:46	357 414.1	5 956 240.0	40	28	HST02A_01 - HST02A_04	Gravelly sand (pebbles, cobbles and boulder) with shell fragments	< 10	< 64 mm	< 80	Not a reef
		06:30:23	357 384.0	5 956 214.0								
		06:30:23	357 384.0	5 956 214.0	3	27	HST02A_05 - HST02A_10		10-40	64 mm – 5 m	< 80	Low
		06:31:08	357 356.7	5 956 187.1								
		06:31:08	357 356.7	5 956 187.1	7	5	HST02A_11 - HST02A_12		< 10	< 64 mm	< 80	Not a reef
		06:31:27	357 351.0	5 956 182.7								
22/08/2022	HST02B	06:37:48	357 318.1	5 956 221.4	31	21	HST02B_01 - HST02B_04	Gravelly sand (pebbles, cobbles and boulder) with shell fragments	< 10	< 64 mm	< 80	Not a reef
		06:38:26	357 342.6	5 956 202.5								
		06:38:26	357 342.6	5 956 202.5	32	22	HST02B_05 - HST02B_13		10-40	64 mm – 5 m	< 80	Low
		06:39:16	357 372.1	5 956 189.9								
22/08/2022	HST03A	06:19:49	357 639.5	5 955 577.9	17	12	HST03A_01 - HST03A_02	Gravelly sand (pebbles, cobbles and boulders) with shell fragments	10-40	64 mm – 5 m	< 8	Low
		06:20:05	357 632.0	5 955 593.0								
		06:20:05	357 632.0	5 955 593.0	81	59	HST03A_03 - HST03A_05	Gravelly sand (pebbles) with shell fragments	< 10	64 mm – 5 m	< 80	Not a reef
		06:21:19	357 600.0	5 955 667.5								
22/08/2022	HST04A	06:22:51	357 611.0	5 955 766.5	65	87	HST04A_01 - HST04A_10	Gravelly sand (pebbles and cobbles) with shell fragments	< 10	< 64 mm	< 80	Not a reef
		06:23:48	357 668.0	5 955 797.1								

Date	Station	Time	Easting	Northing	Length (m)	Area (m^2)	Still Nos.	Sediment Description	Stony Reef Characteristic			Overall
									Composition (% cover cobbles and boulders)	Elevation	Biota (% cover)	
22/08/2022	HST05	07:35:54	357 459.6	5 955 735.5	29	31	HST05_01 - HST05_09	Gravelly sand (pebbles and cobbles) with shell fragments	< 10	< 64 mm	< 80	Not a reef
		07:36:30	357 450.8	5 955 708.0								
22/08/2022	HST06	06:12:53	357 754.2	5 955 323.7	61	43	HST06_01 - HST06_12	Gravelly sand (pebbles and cobbles) with shell fragments	< 10	< 64 mm	< 80	Not a reef
		06:14:23	357 777.1	5 955 267.0								
Key:	Not a Reef				Low Reef				Medium Reef			

Figure 4.2. Example seabed photographs of 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) at the Helvellyn Field

A

A: Photograph 220318_HST01_06

Gravelly sand with shell fragments and pebbles

Anemone (*Urticina* sp.)
Hydroid (*Nemertesia* sp.)
Faunal turf (Hydrozoa/Bryozoa)
Soft coral (*Alcyonium digitatum*)
Faunal burrows

B

B: Photograph 220318_HST05_08

Gravelly sand with shell fragments, pebbles and cobbles

Bryozoan (*Flustra foliacea*)
Faunal turf (Hydrozoa/Bryozoa)
Soft coral (*Alcyonium digitatum*)
Faunal burrows

C

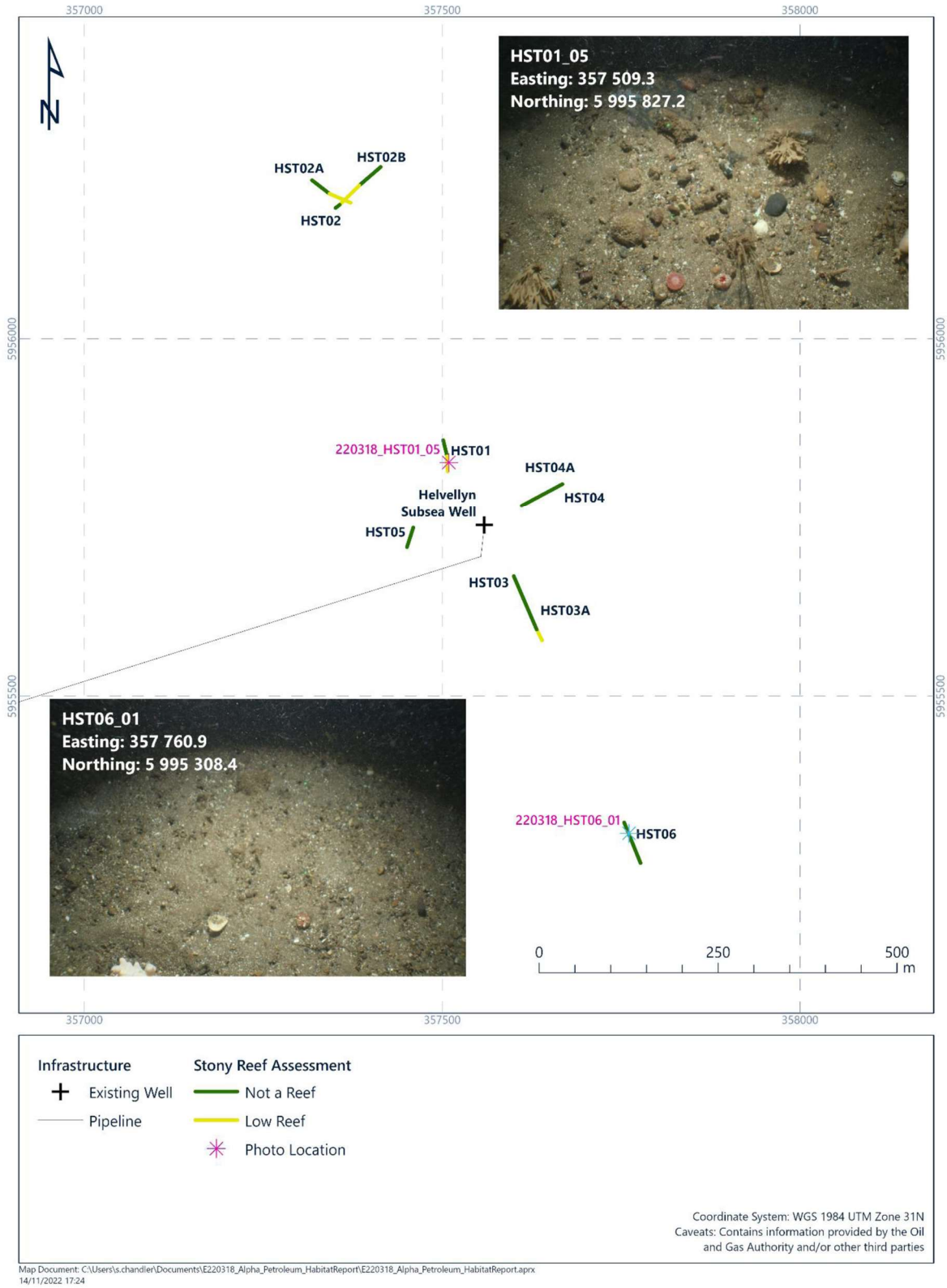
C: Photograph 220318_HST03A_04

Gravelly sand with shell fragments, pebbles and cobbles

Anemone (*Urticina* sp.)

Notes Laser distance (green) is 23 cm

Figure 4.3. Stony reef assessment at the Helvellyn Field



4.2.2.2 Macrofaunal Analysis

Seabed sediments provide support, protection, and the food source for many macrofaunal species. The sediment macrofauna, most of which are infaunal (living within the sediment), are therefore particularly vulnerable to external influences that alter the sediments' physical, chemical or biological nature. Such infaunal animals are largely sedentary and are thus unable to avoid unfavourable conditions.

Analysis of sediment macrofauna from the 2022 pre-decommissioning survey found that the composition of macrofauna was relatively consistent between stations. The data comprised 136 benthic taxa, of which 76 (55.9 %) were annelids (including *Sabellaria spinulosa, Phyllodoce maculate, Syllis garciai* and *Ophelia borealis*), 32 (23.5 %) were arthropods (including *Urothoe marina* and *Ampelisca spinipes*), 19 (14.0 %) were molluscs, 2 (1.5 %) were echinoderms and 7 (5.1 %) were other phyla (specifically chordata, cnidarians, hemichordata, nemerteans, phoronids and platyhelminthes).

A total of 1,337 individuals was identified, of which 1,005 (75.2 %) were annelids, 208 (15.6 %) were arthropods, 77 (5.8 %) were molluscs, 6 (0.4 %) were echinoderms and 41 (3.1 %) were other phyla (specifically chordata, cnidarians, hemichordata, nemerteans, phoronids and platyhelminthes) (Fugro, 2022a).

The proportion of taxa was relatively consistent between stations with annelida and arthropoda making up the majority and all stations recording all five different groups except HST04 where no echinodermata were recorded. The proportion of individuals was also relatively consistent between stations with annelids dominating at all stations apart from station HST03 where annelids and arthropoda were more evenly balanced, though HST03 only had one fauna sample (Fugro, 2022a).

The most abundant species recorded was the annelid *Sabellaria spinulosa*. This species can be found in high abundances in mixed sediment, where it typically forms loose agglomerations of tubes in a matrix of sand, gravel, and mud (JNCC, 2015). These biogenic habitats are often found to contain greater numbers of taxa and individuals when compared with areas without *Sabellaria* (Tillin *et al.,* 2022). Although no *Sabellaria spinulosa* reefs were identified within the survey area, the presence of *Sabellaria* crusts at some locations could be potentially influencing the increase in taxa and individuals at these stations. However, univariate analysis highlighted that the mean diversity for the survey area was high with low interstation variability.

At each station, the top ten most abundant taxa comprised 53.3 % to 69.7 % of the total number of taxa, showing that these taxa are generally representative of the macrofaunal community. The most abundant taxa were different at each station with the annelid *Syllis garciai* the second most abundant taxa at half of the stations (Fugro, 2022a). The number of taxa was lowest at station HST03 with 20 taxa where only one grab sample was recovered (0.1 m^2). At all other stations with two grab samples, the lowest number of taxa per station (0.2 m^2) ranged from 32 (station HST04) to 80 (station HST01). With all stations, there was a mean of 56 taxa and moderate variability (RSD 45 %). The mean number of taxa from the current survey (mean 56) was comparable to that observed in nearby surveys at Amethyst B1D (68; OGUK, 2021a) and West Sole C (37; OGUK, 2021b).

Although elevated levels of hydrocarbons and some metals (> SNS mean and 95th percentile) were found at all stations, these levels were not considered to be affecting the macrofaunal communities. (Fugro, 2022a).

4.2.3 Fish

4.2.3.1 Spawning and Nursery Grounds

Fish are separated into pelagic and demersal species, as follows:

- Pelagic species occur in shoals swimming in mid-levels of the water, typically making extensive seasonal movements or migrations between sea areas. Pelagic species include herring, mackerel, blue whiting and sprat;
- Demersal species live on or near the seabed and include haddock, cod, plaice, sandeel, sole and whiting.

The international Council for the Exploration of the Seas (ICES) standardise the division of sea areas for the statistical analysis. The Helvellyn infrastructure is located within ICES Statistical Rectangle 36F0. Species that spawn within ICES Rectangles 36F0 include cod (*Gadus morhua*), herring (*Clupea harengus*), lemon sole (*Microstomus kitt*), plaice (*Pleuronectes platessa*) (high intensity), sandeels, (*Ammodytidae* spp.) sole (*Solea solea*) and sprat (*Sprattus Sprattus*) (Table 4.6; Coull *et al*., 1998; Ellis *et al*., 2012). ICES Rectangle 36F0 is also used as a nursery ground for cod, herring, horse mackerel (*Trachurus trachurus*), lemon sole, mackerel (*Scomber scombrus*), plaice, sandeels, sole (*Solea solea*), sprat and whiting (*Merlangius merlangus*) (Table 4.6; Coull *et al*., 1998; Ellis *et al*., 2012).

Table 4.6. Fish Spawning and Nursery Species within ICES Rectangles 36F0 (Coull et al., 1998; Ellis et al., 2012)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Cod	N	N	N	N	N	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	N	N	N	N	N
Horse Mackerel[1]	N	N	N	N	N	N	N	N	N	N	N	N
Lemon sole	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	N	N	N	N	N	N	N	N
Plaice	N	N	N	N	N	N	N	N	N	N	N	N
Sandeels	N	N	N	N	N	N	N	N	N	N	N	N
Sole	N	N	N	N	N	N	N	N	N	N	N	N
Sprat	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	N	N	N	N	N	N	N	N	N	N	N	N

Spawning | Peak Spawning | N Nursery | N High Intensity Nursery

[1] Viviparous species (gravid females can be found all year) (*Ellis et al., 2012*).

Spatial modelling of 0 group fish (aggregations of fish in the first year of their life) indicates that the area in the vicinity of the blocks of interest is generally not considered to be of high importance to juvenile fish species in their first year of development. Of the species mapped, there is a moderate probability of 0 group aggregations of sprat, plaice, horse mackerel and herring in the vicinity of the blocks of interest, and a low probability of 0 group aggregations of whiting, sole, Norway pout (*Trisopterus esmarkii*), mackerel, hake (*Merluccius merluccius*), haddock (*Melanogrammus aeglefinus*), cod, blue whiting (*Micromesistius poutassou*) and anglerfish (Aires *et al.,* 2014).

Of note is that cod, herring, horse mackerel, lesser sandeel (*Ammodytes marinus*) mackerel, plaice, sole and whiting are all listed as UK BAP priority marine species. Cod is also listed on the OSPAR List of Threatened and / or Declining Species and Habitats. In addition, cod and horse mackerel are

listed as Vulnerable on the Global International Union for the Conservation of Nature (IUCN) Red List of Threatened Species and should therefore be considered as a priority for protection (IUCN, 2021; OSPAR, 2021). All other species are listed as 'Least Concern', aside from sole which is listed as 'Data Deficient' (IUCN, 2022).

4.2.3.2 Elasmobranchs

Elasmobranchs encompass species of sharks, skates and rays. These species differ from other fish by having a skeletal structure made out of cartilage as opposed to bone. They typically have a slow growth rate and low fecundity, leaving their populations vulnerable to over-fishing, habitat degradation and pollution events however, their distribution is wide throughout the world's oceans (Baxter *et al.*, 2011).

A survey of the distribution of elasmobranch species were recorded throughout the North Sea and surrounding waters. Species which have been recorded in the SNS at various times throughout the year, and may therefore be present in the vicinity of the proposed Helvellyn infrastructure, are listed in Table 4.7 (Ellis *et al.*, 2004; IUCN, 2021).

Table 4.7. Elasmobranch Species Likely to be found in the Vicinity of the Proposed Decommissioning Work (Ellis et al., 2004; IUCN, 2022)

Common name	Latin name	Depth range (in metres)	Global IUCN Status [1]	European IUCN Status [1]
Cuckoo skate	*Leucoraja naevus*	20 -500	Least Concern	Least Concern
Thorny skate / Starry ray	*Amblyraja radiata*	18 – 1400	Vulnerable	Least Concern
Small spotted catshark	*Scyliorhinus canicula*	< 400	Least Concern	Least Concern
Spiny dogfish	*Squalus acanthias*	15 – 528	Vulnerable	Endangered
Spotted skate	*Raja montagui*	< 530	Least Concern	Least Concern
Starry smooth-hound	*Mustelus asterias*	0 – 100	Near Threatened	Near Threatened
Thornback skate	*Raja clavata*	10 – 300	Near Threatened	Near Threatened
Tope shark	*Galeorhinus galeus*	0 – 2000	Critically Endangered	Vulnerable

[1] Status as of August 2022

Of these species listed in the table above, tope shark, spiny dogfish, thorny skate, starry smooth-hound and thornback skate are of most concern due to their unfavourable conservation status (IUCN, 2022). In addition, spotted skate, thornback skate, and spiny dogfish are listed on the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR, 2022).

4.2.4 Seabirds

4.2.4.1 Distribution Offshore

Species that breed on the Humberside and Lincolnshire coasts (including Flamborough Head), which is the coastline closest to the Helvellyn infrastructure, include fulmar (*Fulmarus glacialis*), gannet (*Morus bassanus*), black-headed gull (*Chroicocephalus ridibundus*), lesser black-backed gull (*Larus argentatus*), kittiwake (*Rissa tridactyla*), common tern (*Strena hirundo*), little tern (*S. albifrons*), guillemot (*Uria aalge*), razorbill (*Alca torda*) and puffins (*Fratercula arctica*) (DECC, 2016). These species widely use the adjacent offshore waters for foraging.

The abundance, distribution and assemblage of seabird species varies seasonally. Between December and March, large numbers of auks (guillemots and razorbills) are present in the offshore waters of the SNS and around Flamborough Head. Large numbers of terns are present in the area

during April and May and in coastal waters in August. The breeding season for most seabird species begins in April and continues through to June. During this and during the annual moult in July, most species are found in coastal waters and forage closer to their colonies (DECC, 2016).

A number of sites along the adjacent coastline have been designated as Special Protection Areas (SPAs), the closest of which is the Greater Wash SPA, located approximately 29 km south-west of the Helvellyn infrastructure (see Section 4.2.6). The site protects important foraging areas of red-throated diver (*Gavia stellata*), common scooter (*Melanitta nigra*), and little gull (*Hydrocoloeus minutus*) during the non-breeding season, and Sandwich tern (*Sterna sandvicensis*), common tern and little tern (*Sternula albifrons*) during the breeding season (JNCC, 2018).

The European Seabirds at Sea (ESAS) database is the most complete and longstanding dataset detailing the distribution of seabirds at sea, compiling a range of boat and transect data over a period of 29 years. The data indicates that the Helvellyn infrastructure is not within a hotspot area, defined as an important area of high seabird density at sea. The predicted at-sea seabird density in the blocks of interest is shown in Table 4.8, with the data indicating a density of less than 39 seabirds per km^2 during the breeding season (March – September) and less than 11 seabirds per km^2 in winter (November – March). The most abundant species present are kittiwake in the breeding season, guillemot, kittiwake, great black-backed gull and herring gull (*Larus argentatus*) over winter, and guillemot during the post breeding dispersal period (JNCC, 2019; Kober *et al.,* 2010).

Of the species listed in Table 4.8, the global and European populations of kittiwake are listed as Vulnerable on the IUCN Red List, and the global and European populations of sooty shearwater (*Ardenna grisea*) are listed as Near Threatened. Fulmar is listed as Least Concern globally, however, are Vulnerable globally. Atlantic puffin is listed as Vulnerable globally and is listed as Endangered in Europe. Globally, Arctic skua (*Stercorarius parasiticus*) are of Least Concern, however their European populations are Endangered. The global and European populations of guillemot, herring gull, razorbill, Manx shearwater, gannet, pomarine skua (*Stercorarius pomarinus*), great skua, great black-backed gull (*Larus marinus*), common gull (*Larus canus*), lesser black-backed gull, common tern and little auk (*Alle alle*) are of Least Concern (IUCN, 2022).

Table 4.8. Predicted At-Sea Seabird Density in the Blocks 47/10, 47/14 and 47/9 (number of individuals per km²) (JNCC, 2019; Kober et al., 2010)

Species	Season	Predicted Density in the Blocks of Interest [1]												Predicted Density Range Across UK Waters [1]
		J	F	M	A	M	J	J	A	S	O	N	D	
Fulmar	Breeding			0.2										0 – 582.6
	Winter	2.3							2.3					0 – 239.2
Sooty shearwater	Winter							0.2						0 - 16.3
Manx shearwater	Breeding					0.7								0 - 190.2
Leach's petrel	Breeding						0.06							0 - 28.0
Gannet	Breeding					0.5								0 - 110.5
	Winter	0.1									0.1			0 - 24.9
Pomarine skua	Other – spring			< 0.01										0 - 2.2
	Other –autumn								< 0.01					0 - 2.2
Arctic skua	Breeding					1.0								0 - 2.4
	Other									0.3				0 - 1.1
Great skua	Breeding					0.07								0 - 1.6
	Winter	0.3								0.3				0 - 4.3
Kittiwake	Breeding					34.8								0 - 185.0
	Winter	4.5									4.5			0 - 306.8
Black-headed gull	Breeding				0.01									0 - 12.0
Little gull	Other								< 0.01					0 - 5.2
Great black-backed gull	Breeding				0.06									0 - 4.8
	Winter	3.0								3.0				0 - 19.5
Common gull	Breeding					0.01								0 - 2.6
	Winter	0.1								0.1				0 - 39.9
Lesser black-backed gull	Breeding					< 0.01								0 - 351.7
	Winter	0.04								0.04				0 - 368.8
Herring gull	Breeding				< 0.01									0 - 44.8
	Winter	2.4								2.4				0 - 101.9
Sandwich tern	Breeding					0.1								0 - 1.1
Common tern	Breeding					1.9								0 - 6.5
Arctic tern	Breeding					0.4								0 - 31.2
Guillemot	Breeding					2.9								0 - 713.4
	Winter	2.2									2.2			0 - 62.7
	Other								20.6					0 - 254.8
Razorbill	Breeding					0.3								0 - 22.0
	Winter	1.3									1.3			0 - 15.8
	Other								2.0					0 - 64.6
Little auk	Winter	0.08										0.08		0 - 13.4
Atlantic Puffin	Breeding				0.6									0 - 162.4
	Winter	1.4							1.4					0 - 0.14

Key (Number of individuals per km²)

	10.0 - ≤ 35		1.0 - < 10.0		0.01 - < 1.0		< 0.01		No Occurrence

[1] The predicted at-sea seabird density for each seabird species/season was calculated from ESAS transect data using the spatial interpolation technique Poisson kriging (Kober *et al.*, 2010).

4.2.4.2 Seabird Sensitivity to Oiling

Seabird sensitivity to oiling varies considerably throughout the year and is dependent on a variety of factors, including time spent on the water, total biogeographical population, reliance on the marine environment and potential rate of population recovery (DECC, 2016). The Seabird Oil Sensitivity Index (SOSI) (Webb *et al.*, 2016) combines seabird data collected between 1995 and 2015 and individual seabird species index values to create a single measure of seabird sensitivity to oil pollution. The SOSI score for each UKCS Block is ranked into sensitivity categories, from 1 (extremely high sensitivity) to 5 (low sensitivity). An assessment of the median SOSI scores for the blocks of interest indicate that sensitivity is generally low between April and July, medium to extremely high between August and December, and very high to medium between January and March (Table 4.9).

Table 4.9. Assessment of Seabird Oil Sensitivity Index (SOSI) Scores for UKCS Blocks 47/9, 47/10, 47/14 and the Surrounding Area (Webb et al., 2016)

Block	J	F	M	A	M	J	J	A	S	O	N	D
47/3	4	2	2	5	4	2	3	3	3	3	3	4
47/4	5	1	2	2	5	2	4	3	3	3	4	4
47/5	1	1	2	2	5	2	3	2	3	1	1	1
48/1	1	2	2	2	5	1	3	2	1	1	1	1
47/8	4	3	2	5	5	3	5	3	3	1	3	4
47/9	**4**	**2**	**2**	**5**	**5**	**4**	**5**	**3**	**4**	**1**	**2**	**3**
47/10	**2**	**2**	**2**	**2**	**5**	**5**	**4**	**3**	**4**	**2**	**2**	**1**
48/6	2	2	2	2	5	5	3	3	2	2	2	1
47/13	4	3	2	5	5	5	5	3	4	1	2	3
47/14	**3**	**3**	**2**	**5**	**5**	**5**	**5**	**3**	**5**	**2**	**1**	**2**
47/15	3	3	2	5	5	5	5	3	5	3	1	2
47/18	4	4	2	5	5	5	5	4	4	1	2	2
47/19	3	3	2	5	5	5	5	4	4	3	1	2
47/20	3	4	2	5	5	5	5	4	4	3	1	2
48/11	3	3	2	2	5	5	5	3	5	4	2	2

Key: 1 = Extremely High; 2 = Very High; 3 = High; 4 = Medium; 5 = Low; 'N' = No Data.
SOSI sensitivity category in red and underlined indicates an indirect assessment of SOSI scores, in light of coverage gaps.
Rows in bold indicate the UKCS blocks within which the proposed decommissioning activity will be taking place.

4.2.5 Marine Mammals

4.2.5.1 Cetaceans

Cetacean abundance in the SNS is relatively low compared to the northern and central North Sea, with the exception of harbour porpoise (*Phocoena phocoena*). Ten species of cetacean have been sighted in the SNS, however only the harbour porpoise and the white-beaked dolphin (*Lagenorhynchus albirostris*) are considered to be regularly occurring. Minke whale is a frequent seasonal visitor, whilst bottlenose dolphin and white-sided dolphin are considered uncommon visitors (DECC, 2016).

Harbour porpoise are found in persistently high densities year round at the inner Silver Pit, in summer at the north-western edge of Dogger Bank, and in winter in offshore areas east of Norfolk and east of the outer Thames estuary. The SNS SAC has been designated to protect these areas and

the Helvellyn infrastructure lies approximately 7 km north east of the SAC (refer to Section 4.2.6 for further details).

The relative abundance of the most common species of cetaceans in this area of the SNS can be derived from data obtained during the Small Cetacean Abundance of the North Sea (SCANS-III) aerial and ship-based surveys. This project identified the abundance of cetacean species within predefined sectors of the North Sea and North-East Atlantic. The Helvellyn infrastructure is located within SCANS-III Block O in which harbour porpoise, minke whale and white-beaked dolphin have been recorded (see Table 4.10; Hammond *et al.,* 2021). It should be noted that although density estimates are shown in Table 4.10, they are only an example of what densities could be encountered in the area due to the wide-scale nature of the SCANS-III survey and the fact the data was only collected in July 2016.

Table 4.10. Cetacean Abundance and Density Recorded in SCANS-III Aerial Survey Area Block O (Hammond et al., 2021)

Species	SCANS-III Block 'O'		Total (Aerial Survey Blocks)	
	Abundance	Density [1]	Abundance	Density [1]
Harbour porpoise	53,485	0.888	424,245	0.351
White-beaked dolphin	143	0.002	36,287	0.030
Minke whale	603	0.010	13,101	0.011

[1] Density is the number of individuals per km^2.

The UK Statutory Nature Conservation Bodies (SNCBs) have defined Management Units (MUs) for seven cetacean species (harbour porpoise, common dolphin, bottlenose dolphin, white-beaked dolphin, white-sided dolphin, Risso's dolphin and minke whale) in UK waters in order to provide an understanding of the geographical range and abundance of marine mammal populations, and subpopulations, to aid conservation and management purposes. The MUs within which the Helvellyn infrastructure is located, along with the corresponding abundance of animals within these units, are listed Table 4.11 below (IAMMWG, 2021).

Table 4.11. Estimates of Cetacean Abundance in the Relevant MMMUs (IAMMWG, 2021)

Species	Management Unit	Abundance of Animals	95% Confidence Interval	Density [1]
Bottlenose dolphin	Greater North Sea (639,886 km^2)	2,022	548 – 7,453	0.003
Harbour porpoise	North Sea (678,206 km^2)	346,601	289,498 – 419,967	0.511
Risso's dolphin	Celtic and Greater North Seas (1,560,875 km^2)	12,262	5,227 – 28,764	0.007
Common dolphin		102,656	58,932 – 178,822	0.065
Minke whale		20,118	14,061 – 28,786	0.012
White-beaked dolphin		43,951	28,439 – 67,924	0.028
White-sided dolphin		18,128	6,049 – 54,323	0.011

[1] Density (individuals per km) was calculated using the total area of the MU and the abundance of animals within that MU.

It is evident that harbour porpoise is the most abundant species in the North Sea compared to other species identified in Table 4.11, despite its MU being smaller in area. Common dolphins are the next most abundant within the UK sector of its MU, however this species was not recorded in significant numbers in other surveys (refer to Table 4.10 and Table 4.12).

To provide a more localised indication of the seasonal distribution of cetaceans in the area of the Helvellyn infrastructure, data from the JNCC Atlas of Cetacean Distribution in north-west European

Waters is shown in Table 4.12. Overall, cetacean presence is considered to be low and mainly concentrated in the summer months, except for common dolphin which has been observed in December and harbour porpoise where sightings have occurred throughout the year (Reid *et al.*, 2003).

Table 4.12. Cetacean Sightings in ICES Rectangles 36F0 (Reid et al., 2003)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Bottlenose dolphin												
Common dolphin												
Harbour porpoise												
White-beaked dolphin												
White-sided dolphin												
Key (Number of individuals per hour of sightings effort)												
High (>100)	Medium (10 – 100)	Low (0.01 – 10)	V. Low (0 – 0.01)	No sightings								

It is important to note that the lack of recorded sightings does not necessarily preclude the presence of other species. In addition, the highly mobile nature of cetaceans means that species that are found within the area in general, such as harbour porpoise and white-beaked dolphin, may be present at other times of the year.

All cetaceans (whales, dolphins and porpoises) are protected under Annex IV of the Council Directive 92/43/EEC (also known as the Habitats Directive). In addition, harbour propose is also listed on the OSPAR List of Threatened and/or Declining Species (OSPAR, 2021) and under Annex II of the EC Habitats Directive. All of the species that may occur in the vicinity of the blocks of interest are listed as UK BAP priority species (JNCC, 2007), but are of least concern on the IUCN Red List (IUCN, 2022).

4.2.5.2 Pinnipeds

Two species of seals; grey seal (*Halichoerus grypus*) and the harbour (or common) seal (*Phoca vitulina*) are found along the English coast. Important numbers of grey and harbour seals are present off the east coast of England, particularly around The Wash where harbour seals forage over a wide area.

Grey and harbour seals are both listed under Annex II of the EU Habitats Directive, requiring the designation of SACs in order to protect these species. In addition, harbour and grey seals are protected under the Conservation of Seals Act 1970 and are listed as UK BAP priority marine species (JNCC, 2007).

Grey Seal

The UK hosts around 40% of the world population of grey seals and 95% of the EU population. Several colonies exist on the east coast of England, including Donna Nook, Blakeney Point, Horsey, Flamborough Head and The Wash. A total of 8,677 grey seals were counted between Donna Nook and Dover in August 2018 (DECC, 2016; SCOS, 2020).

Grey seals forage in the open sea and return regularly to haul out on land where they rest, moult and breed. Grey seal foraging movements are on two geographical scales: long and distant trips from one haul-out site to another; and local repeated trips to discrete foraging areas (McConnell *et al.,* 1999). Foraging areas can be up to 100 km offshore and connected to haul-out sites by prominent high-usage corridors (Jones *et al.*, 2015). The distribution of grey seals in the vicinity of the Helvellyn infrastructure is moderate (< 50 individual per 25 km^2) (Russel *et al.*, 2017). Densities at sea are lower during pupping and breeding season, which in south-east Britain occurs between August and September, and during the moulting season (February to March) (SCOS, 2020).

Harbour Seal

Around 30% of EU harbour seals are found in the UK. Their distribution on the east coast of the UK is restricted, concentrating in major estuaries including the Thames, The Wash and the Moray Firth. The south-east coast of England hosts several harbour seal colonies and haul-out sites, and total count for the region was 3,081 in 2019. The largest colony in the UK is The Wash, with an estimated 2,415 individuals counted in 2019(SCOS, 2020).

In general, the harbour seal tends to forage within 40 – 50 km of its haul out sites (SCOS, 2018). Tagging studies, however, have demonstrated that individuals from haul-out sites in The Wash forage for much greater distances than individuals from elsewhere in the UK (Sharples *et al*., 2012), although given the distance offshore, the distribution of harbour seals in the vicinity of the Helvellyn infrastructure is relatively low (< 5 individual per 25 km^2) (Russel *et al*., 2017). Harbour seals spend more time ashore at haul-out sites from June to July during breeding and in August during moulting season, and thus densities at sea are lower during this time (SCOS, 2020).

Management Units

The UK SNCBs have defined MUs for grey and harbour seals in inshore UK waters in order to provide an understanding of their geographical range, and abundance of their populations and subpopulations, to aid conservation and management purposes. The proposed decommissioning work is not located within a MU for seals as these are specific to inshore waters (IAMMWG, 2013). However, it is noted that the seaward extent of these MUs is illustrative and not definitive, as seals will cross MU boundaries on a regular basis. Table 4.13 lists the seal count for the South East England MU, along with the corresponding abundance of animals within this unit.

Table 4.13. Marine Mammal Management Units for Pinnipeds in UK Waters (IAMMWG, 2013)

Species	Management Unit	Seal Count	Estimated Population Size [1]	Survey Year
Harbour seal	South East England	3,567	-	2011
Grey seal		3,103	10,350	2010, 2011

[1] An independent population estimate for grey seals was calculated using counts obtained during the 2007 and 2008 summer surveys (Lonergan *et al*., 2011). This estimate was not available for harbour seals.

4.2.6 Marine Protected Areas

The Helvellyn subsea well and approximately 12.5km of the pipeline route is located within the boundary of the Holderness Offshore Marine Conservation Zone (MCZ). Four other MPAs are located within 40 km of the Helvellyn infrastructure. Figure 2.3 (see Section 2.2) shows the location of these MPAs in relation to the Helvellyn infrastructure and the qualifying features and site description are detailed in Table 4.14.

Table 4.14. Marine Protected Areas within 40 km of the Proposed Decommissioning Work

Site Name	Distance & Direction		Qualifying Features and Site Description
	Amethyst A2D Platform	Helvellyn WHPS	
Holderness Offshore MCZ	3 km NW	Within	**Features:** Three broad-scale habitats types.(A5.1: Subtidal coarse sediment, A5.2: Subtidal sand and A5.4: Subtidal mixed sediments), Ocean quahog (*Arctica islandica*) and North Sea glacial tunnel valleys **Description**: Located 11 km offshore from the Holderness coast, this area ranges between 10 - 50 metres in depth. The seafloor consists of mixed and coarse sediment interspersed with small cobbles and ross worm reef, creating a mosaic of habitats for attaching and burrowing creatures. This area is significant for crustaceans,

Site Name	Distance & Direction		Qualifying Features and Site Description
	Amethyst A2D Platform	Helvellyn WHPS	
			including edible crabs and common lobster. To the south of the site is the Inner Silver Pit, a deep canyon with sloping walls covered in a living turf of brittlestars. Harbour porpoises and grey and harbour seals are regularly seen here foraging for food.
Southern North Sea SAC	15 km NE	7 km NE	**Features:** Annex II species; Harbour porpoise (*Phocoena phocoena*) (1351). **Description:** The site has been identified as an area of importance for harbour porpoise, and supports 17.5% of the UK North Sea MU population. This site covers an area of 36,951 km^2. The majority of this site lies offshore, though it does extend into coastal areas of Norfolk and Suffolk. The northern two thirds of the site (within which the Helvelly infrastcuture are located) are recognised as important for porpoises during the summer season (April – September), whilst the southern part supports persistently higher densities during the winter (October – March).
Greater Wash SPA	16 km SW	29 km SW	**Features:** Four Annex I Species (Red-throated diver, Little gull, Sandwich tern, Little tern & Common tern) and Regularly occurring migratory species (Common scoter). **Description:** This site protects important foraging areas for the largest breeding populations of little tern in the UK marine SPA network (798 pairs), and important areas used by the second largest non-breeding populations of red-throated diver (1,407 individuals) and little gull (1,255 individuals) within the UK SPA network. The boundary of the Greater Wash SPA extends beyond 12 nautical miles; hence it is a site for which both Natural England and JNCC have responsibility to provide statutory advice. The SPA lies along the east coast of England in the mid-SNS and extends between the counties of Yorkshire (to the north) and Suffolk (to the south).
Inner Dowsing, Race Bank and North Ridge SAC	23 km SW	36 km SW	**Features: Annex I Habitat:** Sandbanks which are slightly covered by sea water all the time (1110) and Reefs (1170). **Description:** The Inner Dowsing, Race Bank and North Ridge site is located off the south Lincolnshire coast in the vicinity of Skegness, extending eastwards and north from Burnham Flats on the North Norfolk coast, occupying The Wash Approaches. Abundant *Sabellaria spinulosa* agglomerations have consistently been recorded within the boundary of the SAC. Survey data indicate that reef structures are concentrated in certain areas of the site, with a patchy distribution of crust-forming aggregations across the site.

Site Name	Distance & Direction		Qualifying Features and Site Description
	Amethyst A2D Platform	Helvellyn WHPS	
Holderness Inshore MCZ	36 km NW	> 40 km	**Features:** Three broad-scale habitat types, Species Feature of Conservation Importance and Feature of Geological Interest **Description:** Holderness Offshore MCZ covers an area of 1176 km2 and is located approximately 11 km offshore from the Holderness coast in the SNS region. The seabed is dominated by Subtidal coarse sediment and hosts Subtidal sand, Subtidal mixed sediments and part of a glacial tunnel valley. The diverse seabed allows for a wide variety of species which live both in and on the sediment such as, crustaceans (crabs and shrimp), starfish and sponges. This site is also a spawning and nursing ground for a range of fish species for example lemon sole (*Microstomus kitt*), plaice and European sprat (*Sprattus sprattus*). Therefore, the species living both in and on the sediment may benefit from the protection afforded to the habitat features within this site.

4.3 Human Environment

4.3.1 Commercial Fishing

The North Sea is one of the world's most important fishing grounds, and major UK and international fishing fleets operate in the SNS, including vessels from England, Scotland, Belgium, Holland, Denmark and France (DECC, 2009).

Fishing effort and landings are recorded by ICES Rectangle on a monthly and annual basis. As previously noted the proposed decommissioning work is located within ICES Rectangles 36F0. Fishing effort and landings data is available between 2017 and 2021 for ICES Rectangle 36F0. Fishing effort is relatively high in ICES Rectangle 36F0, which is an area targeted by both UK and international vessels). The average annual fishing effort between 2017 and 2021 was 2,737 days in ICES Rectangle 36F0 (Figure 4.4), with effort highest between May and November (peaking in July and August). The most frequently used gear type is trawls, traps and dredges. Commercial fisheries in the area largely target shellfish species, comprising 99% of the average landings value from 2017 to 2021. The dominant species caught in this period were crabs, lobsters, scallop and whelks (Marine Scotland, 2022). The mean total fish landings (by weight) between 2017 and 2021 were 3,674 tonnes, with a mean value of £11,610,074 (Figures 4.5 and 4.6).

Figure 4.4. Total Fishing Effort (Days Fished) between 2017 and 2021 within ICES Rectangles 36F0 (Marine Scotland, 2022)

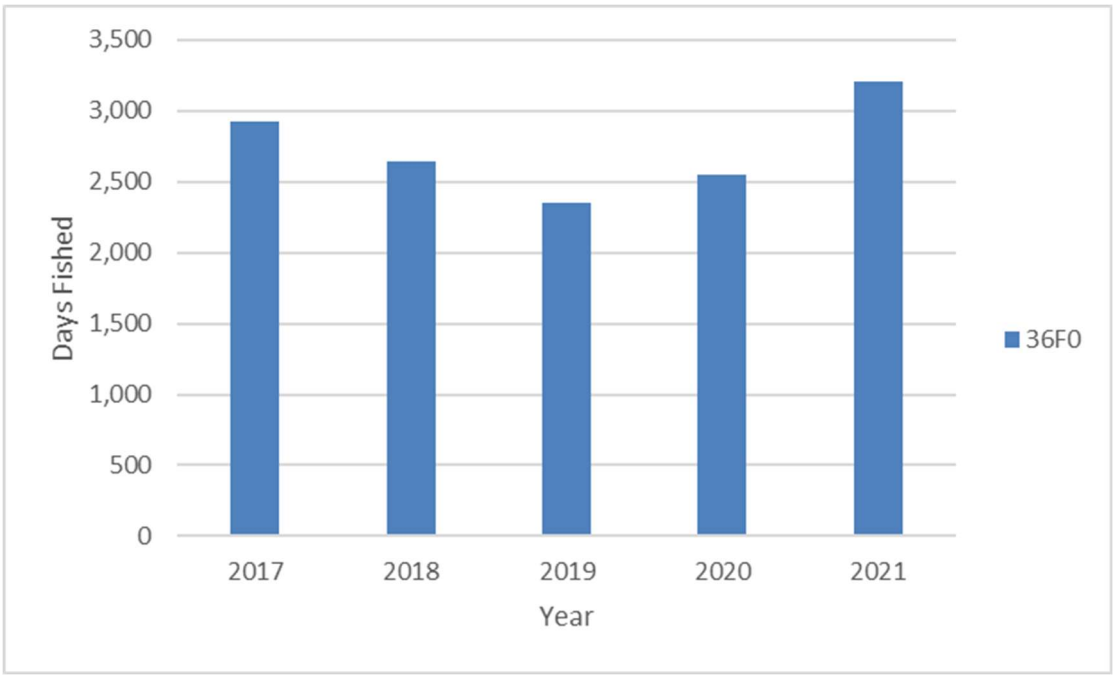


Figure 4.5. Total Annual Fishing Landings (tonnes) between 2017 and 2021 within ICES Rectangle 36F0 (Marine Scotland, 2022)

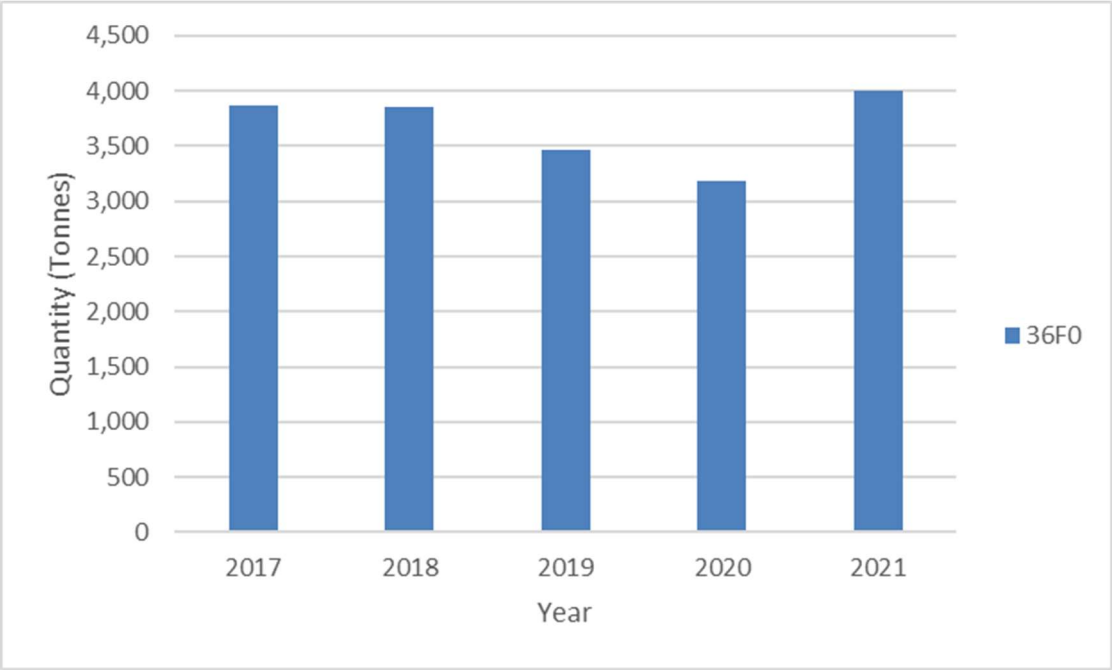


Figure 4.6. Total Annual Catch by Value (£) between 2017 and 2021 within ICES Rectangle 36F0 (Marine Scotland, 2022)

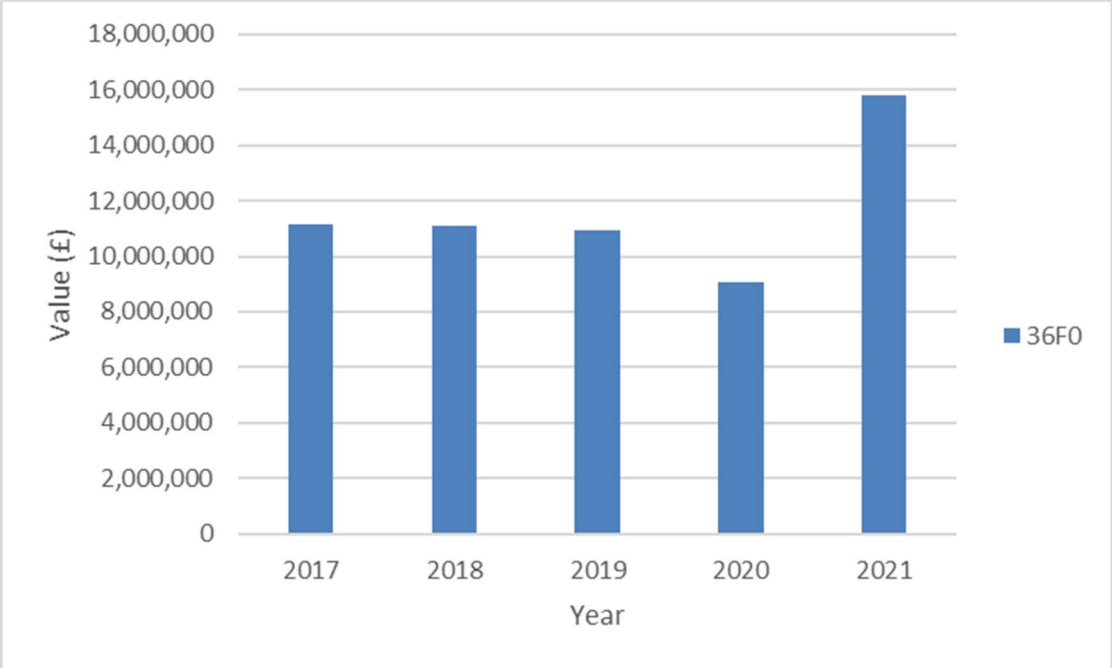


Table 4.15 provides a summary of UK Fleet landings over a five-year period (2016-2020). It can be seen from this that there has been a general decline since 2017 in ICES rectangle 36F0 (MMO, 2022).

Table 4.15. UK Fleet Landings within ICES Rectangles 35F0 (MMO, 2022)

ICES Rectangle	Year	Landed Weight (tonnes)	Value (£)
36F0	**2016**	3,733	9,449,023
	2017	3,821	11,139,815
	2018	3,785	11,120,246
	2019	3,431	10,925,889
	2020	3,147	9,012,544

4.3.2 Shipping

The density of shipping traffic in the SNS is relatively high due to the presence of fishing vessels, some ferries between the UK and the rest of Europe, and cargo and offshore support vessels (DECC, 2016). Shipping activity is considered to be very high within Block 47/9 and high within Block 47/10 and 47/14 (DECC, 2016; DECC, 2014).

4.3.3 Oil and Gas Activities

There is a high level of existing oil and gas activity in this region of the SNS, as illustrated in Figure 4.7. Facilities adjacent to the Helvellyn WHPS are listed in Table 4.16. A total of 67 wells have previously been drilled within Blocks 47/9, 47/10 and 47/14, of which 4 are operational, 21 have been shut-in, 8 the reservoir has been permanently isolated, 4 the wellbore has been suspended and 30 have been fully abandoned (NSTA, 2021).

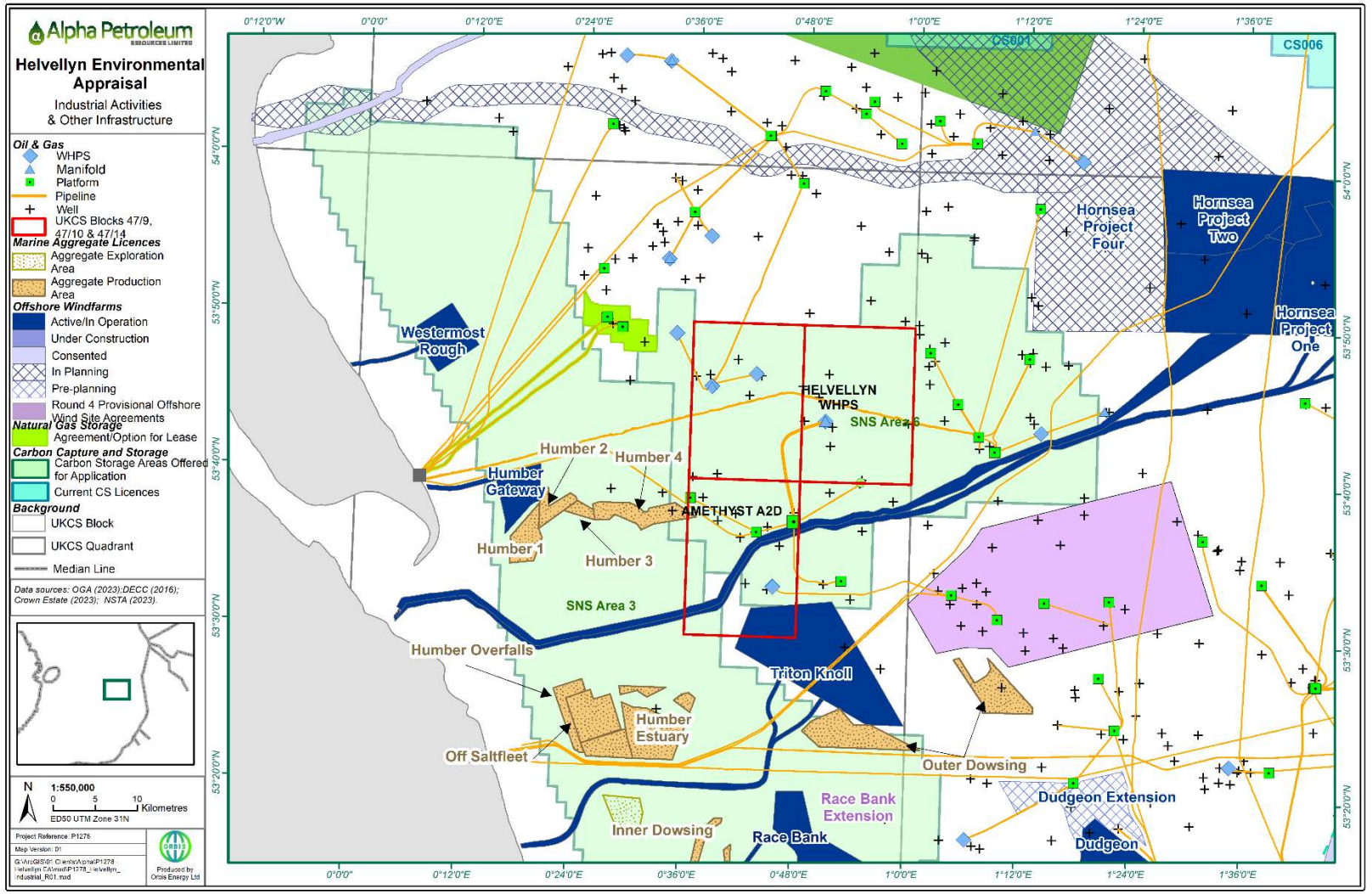
Table 4.16. Oil and Gas Infrastructure Adjacent to the Helvellyn WHPS (NSTA, 2022)

Ref	Field Operator	Name	Type	Distance/ Direction[1]	Information	Status
1	Perenco (UK) Limited	Amethyst West. A1D, A2D, B1D	Platforms	13km South Southwest, 195°	Third party installation	Non-Operational
2	Perenco (UK) Limited	Amethyst West. C1D	Platform	18km Southwest, 239°	Third party installation	Non-Operational
3	Perenco (UK) Limited	Mercury	Subsea wells	40km Northwest, 300°	Third party installation	Operational
4	Premier Oil E&P UK EU Limited	Johnston	Subsea wells	41km Northeast, 60°	Third party installation	Operational
5	Perenco (UK) Limited	Ravenspurn	Platforms	33km – 44km North northeast, 30°	Third party installation	Operational
6	Perenco (UK) Limited	Whittle	Subsea well	45km Northwest, 330°	Third party installation	Operational
7	NEO	Babbage	Platform	36 km Northeast, 30°	Third party installation	Operational
8	Perenco (UK) Limited	Cleeton CC, PQ, WLTR	Platforms	34 km Northwest, 330°	Third party installation	Operational
9	Perenco (UK) Limited	Galahad	Platform	40 km Southeast, 120°	Third party installation	Operational
10	Perenco (UK) Limited	West Sole	Platform	16 km East, 90°	Third party installation	Operational
11	Perenco (UK) Limited	Hoton	Platform	25 km Northeast, 60°	Third party installation	Operational
12	Perenco (UK) Limited	Hyde	Platform	15 km Northeast, 30°	Third party installation	Operational
13	Perenco (UK) Limited	Malory	Platform	34 km Southeast, 130°	Third party installation	Operational
14	Perenco (UK) Limited	Minerva	Platform	26 km Northwest, 320°	Third party installation	Operational
15	Perenco (UK) Limited	Neptune	Platform	28 km Northwest, 350°	Third party installation	Operational
16	Perenco (UK) Limited	Pickerill A	Platform	25 km Southeast, 150°	Third party installation	Non-Operational
17	Perenco (UK) Limited	Pickerill B	Platform	30 km Southeast, 130°	Third party installation	Non-Operational
18	Spirit Energy	Ceres	Subsea well	10 km Northwest, 320°	Third party installation	Operational
19	Perenco (UK) Limited	Minerva	Subsea well	25 km Northwest, 330°	Third party installation	Operational
20	Spirit Energy	Eris	Subsea well	37 km Northeast, 40°	Third party installation	Operational
21	Perenco (UK) Limited	West Sole pipelines PL28, PL145	Pipelines	3 km North	Third party installation	Operational
22	Harbour Energy	Tolmount	Subsea manifold and appraisal well	44 km Northwest, 330°	Third party installation	Operational

23	Harbour Energy	Tolmount	Pipeline	42 km Northwest, 330°	Third party installation	Operational

[1] *Measured from the Helvellyn WHPS*

Figure 4.7. Oil and Gas Infrastructure, Offshore Renewable Energy and Industrial Activities in the Vicinity of the Proposed Helvellyn Decommissioning Work



4.3.4 Telecommunication Subsea Cables

No telecommunication cables cross the Helvellyn infrastructure or the blocks of interest (Figure 4.7) (KIS-ORCA, 2022).

4.3.5 Offshore Renewable Activities

The nearest offshore windfarm to the Helvellyn infrastructure is the Tritan Knoll windfarm (Under Construction), located approximately 10 km south of the Amethyst A2D platform. The windfarm is operated by RWE Npower Renewables and is expected to be operational by 2022 (RWE, 2021).

The nearest active wind farm is the Humber Gateway windfarm (operated by E.ON Climate & Renewables UK Humber Wind Limited), which is located approximately 30 km west of the Helvellyn infrastructure (see Figure 4.7).

The active Hornsea Project 1 and the Hornsea Project 2 wind export cables run through UKCS Block 47/14, located approximately 400 m and 700 m south of the Amethyst A2D platform respectively (Crown Estate, 2022).

4.3.6 Carbon Storage

The Helvellyn infrastructure is located within the SNS Area 6 carbon storage licence area offered for application (Figure 4.7; NSTA, 2023).

The Rough Gas Storage Facility and pipelines is located approximately 22 km northwest of the Helvellyn infrastructure (Figure 4.7; Crown Estate 2022).

4.3.7 Aggregate Activities

The nearest licensed active marine aggregate extraction or disposal site to the Helvellyn infrastructure is the Humber 4 aggregate production area (Area no.: 514/4) operated by CEMEX UK Marine Ltd, located approximately 11 km from the Amethyst A2D platform and 19 km south west of the Helvellyn subsea well (Crown Estate, 2022). The corresponding active Humber 1, Humber 2 and Humber 3 sites (514/1, 514/2 & 514/3) are also located to the south west, between 30 – 40 km from the Helvellyn subsea well (Crown Estate, 2022). In addition, there are a number of aggregate production areas within 40 km of the Helvellyn infrastructure to the south including: Outer Dowsing 1 & 2, Off Saltfleet, Humber Overfalls and Humber Estuary, these are located between 32 km and 40 km from the Helvellyn subsea well (Crown Estate, 2022).

4.3.8 Military Activities

The blocks of interest lie within a Ministry of Defence (MoD) Royal Airforce Practice and Exercise Area (PEXA) (DECC, 2016).

4.3.9 Wrecks

There are charted wrecks located in the vicinity of the Helvellyn infrastructure; however, none of these wrecks are protected. The closest wrecks to the Helvellyn subsea well are the Keynes wreck located approximately 6 km to the south west and the Pilsudski wreck located approximately 6.5 km to the north west (Hydrographer of the Navy 2011; DECC, 2016; MMO, 2021b).

5. Environmental Assessment Methodology

This section describes the process followed by WPRL to identify and screen the relative significance of the potential environmental impacts associated with the proposed Helvellyn decommissioning activities.

5.1 Stakeholder Engagement

Table 5.1 provides a summary of the key issues raised during the informal consultations which have been held to date and identifies where these issues have been considered in the EA report. Further details are provided in Section 5 of the Helvellyn DPs.

Table 5.1. Summary of Stakeholder Comments

Stakeholder	Summary of Comments	Addressed in EA Report
Joint Nature Conservation Committee (JNCC)	JNCC stated that they see the Helvellyn decommissioning project as a potential net benefit project in terms of benthic impacts. They would like to understand the frequency of pipeline surveys that will take place before and after decommissioning. The JNCC had concerns about the camera drops along the pipeline and if there were enough. JNCC suggested that photos may be better than grab samples and will be available sooner. They suggested considering going for more photos. JNCC would like to see more details of the rock dumps along the pipeline and what the fishing industry's opinions of them are. The JNCC would like to see the survey data being used to avoid an over trawl survey later on whereas the fishing industry may argue for it. JNCC would like include an assessment of the Greater Wash SPA in the CA process. Suggesting to include red-throated diver in the ES and considerations for observing best practise in that respect e.g. directing marine traffic to use the defined shipping lanes as much as possible to avoid disruption.	Assessment of Greater Wash SPA and mitigation measures for red-throated diver have been included in Section 7.3.
National Federation of Fishermen's Organisations (NFFO)	NFFO's view on non-intrusive post decommissioning surveys is that they prefer full over trawl trials with bottom gear only (no nets involved so no risk of damage to nets). This is not in agreement with JNCC's view and ongoing discussions with JNCC/ OPRED are continuing. Some incidents of post decommissioning snagging after non-intrusive surveys have been noted. Fishing activity on the shoulder of the trench running parallel to Helvellyn pipeline and umbilical is mainly static gear. Pipelines left in situ are unlikely to cause any issues. NFFO view is that rock dump can be left in place as higher %age of fishing activity is with static gear that is not impacted by rock dump.	-
Scottish Fishermen's Federation (SFF)	SFF have been consulted and are content given the geographical location of Helvellyn to let NFFO consult with regards to any fishing interaction with the decommissioning activities.	-
Global Marine Group (GMG)	GMG have confirmed there are no cables within 50km of the decommissioning works.	-

5.2 Environmental Impact Identification

In order to identify the potential environmental issues and impacts on the marine environment, which may arise from the proposed Helvellyn decommissioning activities (both from planned (routine) activities and unplanned (accidental) events), the WPRL decommissioning team has undertaken a preliminary scoping exercise.

The activities (or aspects) identified during this exercise are summarised in the receptor based activity and events matrix in Table 5.2. An initial high-level assessment of the aspects identified

has been undertaken against the significance criteria defined in Section 4.3 to determine whether there is the potential for any of the impacts to result in significant effects on the environment. Impacts are defined as changes to the environment as a direct result of an activity or event and can be either positive or adverse. Effects are defined as the consequences of those impacts upon receptors.

As a final decision on the removal methods associated with the Helvellyn DPs will be made following an engineering feasibility and commercial tendering process (refer to Section 2), the worse-case scenario in terms of the potential environmental impact has been considered in all instances.

The scoping exercise identified that the following sources of impact could potentially result in significant effects:

- Physical presence;
- Seabed disturbance;
- Underwater noise.

A comprehensive assessment has therefore been undertaken for these aspects, using the significance criteria defined in Section 4.3, the results of which are documented in Section 6. The potential for significant cumulative, in-combination and transboundary impacts has also been assessed in Section 6.

For the following sources of impact, it was considered that none of the resulting effects are likely to be significant:

- Energy use and atmospheric emissions;
- Waste management;
- Marine discharges;
- Accidental events.

These aspects have therefore been scoped out from detailed assessment, as justified in Section 5.4.

In addition, as the Helvellyn infrastructure is located within the Holderness Offshore MCZ and lies within 40 km of four other MPAs (refer to Section 4.5.6), an assessment has been undertaken to determine whether there will be any likely significant effects on the conservation objectives of these MPAs as a result of the proposed Helvellyn decommissioning activities, either alone or in-combination with other plans or projects. This assessment is documented separately within Section 7.

Table 5.2. Impact Identification Matrix

Assessment Topic	Project Activity / Unplanned Event	Physical Receptors				Biological Receptors						Human Receptors											
		Seabed Sediments & Features	Water Quality	Air Quality	Climate	Plankton	Benthic Communities	Fish & Shellfish	Seabirds	Marine Mammals	Marine Protected Areas	Shipping	Commercial Fisheries	Oil & Gas Activity	Subsea Cables	Renewable Energy Activity	Cultural Heritage	Military Activity	Disposal, Dredging & Aggregate Activity	Seascape	Tourism & Leisure	Population & Human Health
Physical Presence	- Presence of vessels on location and transiting to / from site								A			A	A									
	- Removal of Helvellyn WHPS and associated 500m safety zone										P	P	P									
	- Legacy of infrastructure decommissioned in situ										A		A									
Seabed Disturbance	- Footprint of jack-up vessel (including hold back anchors when coming on / off location)	A	A				A	A			A											
	- Removal of subsea installation, including disturbance from wet storage	A	A				A	A			A											
	- Cutting of pipeline ends and removal of exposed pipeline sections / tie-in spools / potential removal of any exposed anode sled sections	A	A				A	A			A											
	- Removal of mattresses and gravel bags	A	A				A	A			A											
	- Leaving in situ of rock dump along the pipelines	A					A	A			A											
Underwater Noise Emissions	- Use of propellers / Dynamic Positioning thrusters on vessels							A		A	A		A									
	- Use of underwater cutting tools and ROV							A		A	A		A									
	- Use of geophysical equipment (MBES & SSS) during post decommissioning survey							A		A	A		A									

Assessment Topic	Project Activity / Unplanned Event	Physical Receptors				Biological Receptors						Human Receptors										
		Seabed Sediments & Features	Water Quality	Air Quality	Climate	Plankton	Benthic Communities	Fish & Shellfish	Seabirds	Marine Mammals	Marine Protected Areas	Shipping	Commercial Fisheries	Oil & Gas Activity	Subsea Cables	Renewable Energy Activity	Cultural Heritage	Military Activity	Disposal, Dredging & Aggregate Activity	Seascape	Tourism & Leisure	Population & Human Health
Energy Use & Atmospheric Emissions	- Power generation on vessels			A	A																	
	- Recycling of materials returned to shore and loss of materials left in situ for future use			A	A																	
Marine Discharges	- Routine vessel discharges to sea		A			A		A	A		A											
	- Potential for introduction of alien species (from ballast water)		A			A		A	A		A											
	- Discharge of residual amounts of chemicals/condensate during pipeline cutting operations		A				A	A			A											
	- Discharge overtime of contaminants contained within the pipeline material		A				A	A			A											
Waste Management	- Onshore disposal of waste transferred to shore																			A		A
	- Marine growth removal (onshore)	A	A				A	A														
Accidental Events	- Vessel collision (loss of diesel inventory)	A	A			A	A	A	A	A	A	A	A									
	- Dropped objects	A	A				A				A		A									
	- Leak of hydraulic fluid from cutting equipment	A	A			A	A	A	A	A	A		A									

Key:

	Potentially significant effects (aspects scoped in for further assessment)		No potential for significant effects (aspects scoped out from assessment, see Section 5.4)	A	Adverse effect	P	Positive effect		No interaction

5.3 Evaluation of Significance Criteria

5.3.1 Planned Activities

For planned activities, the significance of environmental effects has been evaluated by considering the sensitivity of the receptor affected in combination with the magnitude of impact that is likely to arise.

Sensitivity is a function of the value of the receptor (a measure of its importance, rarity and worth), its capacity to accommodate change when a pressure is applied (resistance or tolerance), and its subsequent recoverability (resilience). The criteria presented in Table 5.3 has been used as a guide to determine the sensitivity of receptors.

Table 5.3: Determining Sensitivity

		Resistance and Resilience			
		Very High	*High*	*Medium*	*Low*
Value	*Low*	Low	Low	Medium	Medium
	Medium	Low	Medium	Medium	High
	High	Low	Medium	High	Very High
	Very High	Medium	High	Very High	Very High

Definitions:

Resistance and Resilience	
Very High:	Highly adaptive and resilient to pressure. High recoverability in the short-term.
High:	Some tolerance / capacity to accommodate pressure. High recoverability in the medium-term.
Medium:	Limited tolerance / capacity to accommodate pressure. Recoverability is slow and/or costly.
Low:	Very limited or no tolerance / capacity to accommodate pressure. Recovery is unlikely or not possible.
Value	
Very High:	Very high value and/or of international importance.
High:	High value and/or of national importance.
Medium:	Moderate value and/or of regional importance.
Low:	Low value and/or of local importance.

The **magnitude of impact** considers the characteristics of the change that is likely to arise (e.g. a function of the spatial extent, duration, reversibility and likelihood of occurrence of the impact) and can be adverse or positive. The criteria presented in Table 5.4 has been used as a guide to define the magnitude of impact.

Table 5.4: Determining Magnitude of Impact

Magnitude	Definition
Substantial	Permanent or long-term (>5 years) change in baseline environmental conditions, which is certain to occur. Impact may be one-off, intermittent or continuous and/or experienced over a very wide area (i.e. international and/or transboundary in nature). Impact is likely to result in environmental quality standards or threshold criteria being routinely exceeded.
Major	Medium to long-term (1 – 5 years), reversible change in baseline environmental conditions, which is likely to occur. Impact may be one-off, intermittent or continuous and/or experienced over a wide area (i.e. national in scale). Impact could result in one-off exceedance of environmental quality standards or threshold criteria.
Moderate	Short to medium-term (< 1 year), temporary change in baseline environmental conditions, which is likely to occur. Impact may be one-off, intermittent or continuous and/or regional in scale (i.e. beyond the area surrounding the Project site to the wider region). Impact is unlikely to result in exceedance of environmental quality standards or threshold criteria.
Minor	Short-term (< 1 week), temporary change in baseline environmental conditions, which could possibly occur. Impact may be one-off, intermittent and/or localised in scale, limited to the area surrounding the proposed Project site. Impact would not result in exceedance of environmental quality standards or threshold criteria.
Negligible	Immeasurable or undetectable changes (i.e. within the range of normal natural variation).

The overall **significance** of an effect has been determined by cross referencing the sensitivity of the receptor with the magnitude of impact, using the matrix shown in Table 5.5.

Table 5.5: Significance Evaluation Matrix (Planned Activities)

		Magnitude of Impact				
		Negligible	**Minor**	**Moderate**	**Major**	**Substantial**
Receptor Sensitivity	**Low**	Negligible	Minor	Minor	Minor	Minor / Moderate[1]
	Medium	Negligible	Minor	Minor	Moderate	Moderate / Major[1]
	High	Negligible	Minor	Moderate	Major	Major
	Very High	Negligible	Minor / Moderate[1]	Moderate / Major[1]	Major	Major

[1] The choice of significance level is based upon professional judgement and has been justified in the assessment text.

In the context of this assessment, effects classed as **Major** or **Moderate** are considered to be significant and therefore mitigation measures are required to be identified in order to prevent, reduce or offset adverse significant effects or enhance positive effects. The overall significance of the effect is then re-evaluated, taking the mitigation measures into consideration, to determine the residual effect utilising the methodology outlined above.

Effects classed as **Minor** are not considered to be significant and are usually controlled through good industry practice.

Effects classed as **Negligible** are also not considered to be significant.

5.3.2 Unplanned Events

For unplanned events, such as accidental hydrocarbon releases, significance has been determined using a risk assessment approach, where the likelihood (probability) of the unplanned event occurring is considered against the consequence (significance of effect) if the event was to occur.

The **consequence (significance of effect)** has been determined using the methodology for planned events as described in Section 5.3.1 above. The likelihood of an unplanned event occurring has been determined using the criteria presented in Table 5.6 as a guide.

Table 5.6: Determining Likelihood of Occurrence

Likelihood	Definition
Extremely Rare	Event is extremely unlikely to occur during the Project, given good industry practice. Frequency of event: 1×10^{-4}.
Rare	Event is very unlikely to occur during the Project, given good industry practice. Frequency of event: 1×10^{-3}.
Unlikely	Event is unlikely to occur during the Project, given good industry practice. Frequency of event: 1×10^{-2}.
Possible	Event could occur during the Project, based on industry data. Frequency of event: 1×10^{-1}.
Likely	Event is likely to occur at least once during the Project. Frequency of event: > 1

A risk category (low, medium or high) has then been assigned to the unplanned event using the matrix shown in Table 5.7.

Table 5.7: Significance Evaluation Matrix (Unplanned Events)

		Consequence (Significance of Effect) [1]			
		Negligible	Minor	Moderate	Major
Likelihood of Event	Extremely Rare	LOW	LOW	MEDIUM	MEDIUM
	Rare	LOW	LOW	MEDIUM	MEDIUM
	Unlikely	LOW	LOW	MEDIUM	HIGH
	Possible	LOW	MEDIUM	MEDIUM	HIGH
	Likely	LOW	MEDIUM	HIGH	HIGH

In the context of this assessment, **High** risk events are considered to be significant and are unacceptable.

Medium risk events are also considered to be significant, unless it can be demonstrated that the risk has been reduced to as low as reasonably practicable (ALARP) through mitigation measures and good industry practice.

Low risk events are not considered to be significant, but should still be controlled through good industry practice.

5.4 Aspects Scoped Out From Detailed Assessment

5.4.1 Energy Use and Atmospheric Emissions

Atmospheric emissions will be produced during the proposed Helvellyn decommissioning activities as a result of the fuel consumed by offshore vessels, diesel-powered equipment and generators.

The main environmental effects of the emission of gases to the atmosphere are:

- Direct or indirect contribution to global warming (CO, CO_2, CH_4 and N_2O); and
- Contribution to photochemical pollutant formation and local air pollution (particulates, NOx, SO_2, VOCs).

Estimated emissions from the proposed decommissioning activities are summarised in Table 5.8.

Table 5.8. Estimated Atmospheric Emissions from Helvellyn Decommissioning Activities

Total Fuel Consumption [1]	Emissions (tonnes) [2]							
	CO_2	CO	NO_X	N_2O	SO_2	CH_4	VOC	CO_2e
1,058	3,385.60	16.61	62.85	0.23	4.23	0.19	2.12	3,460

[1] See assumptions relating to vessel types, timings and fuel consumption detailed in Section 3.4.4.
[2] Emissions factors from DECC (2008).

It is predicted that the atmospheric emissions generated will result in localised and short term impacts on air quality, with prevailing metocean conditions expected to lead to the rapid dispersion and dilution of the emissions.

The contribution to UKCS and global atmospheric emissions will be negligible. To place this in context, the estimated CO_2e emissions predicted to be generated by the proposed Helvellyn decommissioning operations equate to ~0.02% of the total UK offshore CO_2e emissions in 2020 (17,060,000 tonnes; OGUK, 2021) and 0.001% of the UK net total CO_2e emissions in 2019 (365,100,000; BEIS, 2021).

To minimise the emissions generated, WPRL will look to reduce vessel time in the field as far as practicable and will make use of vessel synergies where possible. In addition, WPRL's contractor selection process will aim to ensure that the engines, generators and other combustion plant on the vessels to be used during the proposed decommissioning activities are maintained and correctly operated to ensure that they work as efficiently as possible.

WPRL has therefore concluded that impacts arising from energy use and atmospheric emissions do not warrant further assessment.

5.4.2 Marine Discharges

Routine discharges to sea from the vessels used during the proposed decommissioning activities (e.g. the discharge of food waste, bilge water and grey water) has the potential to cause short-term, localised organic enrichment of the water column and an increase in biological oxygen demand. This could contribute to a minor increase in plankton and attract fish to the area. However, food waste will be macerated to increase the rate of dispersion and biodegradation at sea and waste water will be treated appropriately before being discharged to sea, in accordance with the requirements of the MARPOL convention.

Ballast water discharges will be in accordance with the International Maritime Organisation Ballast Water Management Convention, including a ballast water plan and log book.

During pipeline cutting operations there may be a small discharge of any residual chemicals / condensate remaining within the pipelines. However, as stated in Section 3.4.1, as part of the facilities making safe the export pipeline and chemical injection pipeline have already been flushed and depressurised. As such, any discharge of chemicals / condensate will be minimal and is anticipated to dissipate before it reaches the surface with no long-term persistence expected. Of

note is that the hydraulic power cores associated with the umbilical have not been flushed as the actuating fluid is fully biodegradable (AQUALINK HT804F VER2). Upon severance of the umbilical, the content of the power cores will be allowed to disperse to sea naturally. However, any discharge of AQUALINK HT804F will be rapidly dispersed in the marine environmental and the chemical will be readily broken down through natural biodegradation processes. In addition, as the pipeline and umbilical will be decommissioned in situ they will degrade overtime and contaminants contained within the pipeline material (e.g. coating) may be discharged. Any discharges are expected to occur in very small quantities and over a long period of time. Additionally, since the lines are fully trenched and buried, the pathway for contaminant discharges will be limited. Given the small quantities of contaminants expected to be discharged and the long-term degradation of the pipeline and umbilical left in-situ, no significant effects on the marine environment are predicted.

Given the above, WPRL has therefore concluded that impacts arising from marine discharges do not warrant further assessment.

5.4.3 Waste Management

The impacts of waste management are largely onshore and therefore outside the scope of this EA report; however, WPRL will ensure the principles of the Waste Management Hierarchy are followed during the proposed decommissioning activities, focusing on the reuse and recycling of wastes where possible, that licensed waste contractors are used and a project Waste Management Plan is in place to ensure compliance with relevant waste regulations. In addition, good housekeeping standards will be maintained on board all vessels.

Any waste disposed of outside of the UK will be in accordance with the Transfrontier Shipment of Waste Regulations 2007.

The presence of NORM is not expected, but if encountered WPRL will ensure appropriate Radioactive Substance Regulation (RSR) permits are in place and conditions that dictate the management and control of radioactive waste are met.

Marine growth will be removed by high pressure cleaning offshore, where necessary and practicable. The detached marine growth will fall to the seabed or be dispersed by currents and will degrade naturally. There may be a temporary increase in turbidity, nutrient enhancement and an increase in biological oxygen demand in the vicinity of the cleaning operations, but any effects will be localised and transient given the dispersive environment that exists offshore (OGUK, 2013). Remaining marine growth will be removed onshore at a dismantling yard, with appropriate odour control implemented through an odour management plan. However, given the limited tonnages being returned to shore the volume of marine growth and any subsequent odour is expected to be negligible.

On this basis, WRPL has concluded that no further assessment of waste management is necessary.

5.4.4 Accidental Events

5.4.4.1 Accidental Release of Hydrocarbons

Prior to the proposed decommissioning activities commencing, the Helvellyn facilities will be made hydrocarbon free (refer to Section 3.4.1). As such, the source of a worst case accidental release of hydrocarbons to sea will be from the loss of diesel inventory from a vessel in the unlikely event of a collision. All vessels apart from the jack-up rig will be operating on dynamic positioning when on location at Helvellyn. The fuel inventory of a jack-up rig is typically in the region of 800 m^3 of diesel, although this is likely to be split between several separate fuel tanks, significantly reducing the potential of an instantaneous release of the full inventory.

Oil spill response arrangements for the Helvellyn infrastructure are currently documented in PUK's Helvellyn (47/10-7y) Subsea Well Oil Pollution Emergency Plan (OPEP). This contains modelling of a well blowout at the Helvellyn (47/10-7y) subsea well with a worst case release of 267 m^3 condensate and a flow rate of 12.72 m^3 per day. The modelling indicates that the probability of condensate beaching on the UK coastline is low in all seasons (up to 4%), with the shortest arrival

time after 210 hrs (Norfolk coastline in Autumn). The maximum mass accumulated onshore across all beaching locations in any one season is 0.10029 m^3. There is no probability of a release of condensate crossing into international waters in any one season. A total of 14 marine protected areas may be subject to surface oiling (>0.3 µm) or beaching. However, any condensate release will be subject to high rates of evaporation upon release, as the Helvellyn condensate is an ITOPF Group 1 oil and is a low density, high volatility product. It is therefore not expected to persist in the marine environment for a prolonged period of time.

An approved OPEP will be in place for the proposed Helvellyn decommissioning activities, as required by the Merchant Shipping (Oil Pollution Preparedness, Response and Co-Operation Convention) Regulations 1998 (as amended). In addition, the risk of collision is low as the majority of vessels required for the proposed decommissioning activities will be present on location within the existing 500m safety exclusion zone surrounding the Helvellyn subsea well minimising the risk of a collision. This zone is clearly marked on navigation charts and has been in place for a number of years. In addition, all vessels apart from the jack-up rig will be operating on dynamic positioning. Notifications will also be made to regular users of the area via Notices to Mariners, NAVTEX/NAVAREA warnings and Kingfisher bulletins. Any spills from vessels in transit and working outside of existing 500m zones are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs).

Considering the above, WPRL has concluded that the potential impacts from an accidental release of hydrocarbons during the proposed decommissioning activities do not require further assessment.

5.4.4.2 Dropped Objects

The potential for dropped objects to occur is most likely to arise from lifting operations. However, dropped object procedures are industry-standard and will be employed throughout the proposed operations. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Post-decommissioning debris clearance surveys will aid in the identification of any dropped objects should they occur. As such, ARPL has concluded that impacts from unplanned loss of materials to the sea do not require further assessment.

5.4.4.3 Leak of Hydraulic Fluid from Cutting Equipment

The proposed Helvellyn decommissioning activities require the use of subsea hydraulic cutting tools that could fail and result in a release of a small number of litres of hydraulic fluid into the marine environment. However, in the event this did occur, it is anticipated that the hydraulic fluid would be rapidly dispersed in the marine environment given the highly dynamic nature of the area.

To minimise the risk of a release, appropriate maintenance and pre-use checks on hydraulic equipment will be undertaken. In addition, where possible equipment with automatic hydraulic shut-off will be used to minimise the volume of fluid released in the event of a hydraulic line failure. ARPL has therefore concluded that impacts from a leak of hydraulic fluid do not require further assessment.

6. Environmental Assessment

This section documents the detailed assessment undertaken for those impacts that were identified in the scoping exercise as potentially resulting in significant effects.

6.1 Physical Presence

6.1.1 Potential Impacts to Other Sea Users

The vessels required for the removal of the WHPS will be present on location within the existing 500 m safety exclusion zone surrounding the Helvellyn well. An existing 500 m safety exclusion zone also surrounds the Amethyst A2D platform. These zones are clearly marked on navigation charts and have been in place for a number of years. Once the Helvellyn WHPS has been removed, the 500 m safety exclusion zone surrounding the well will be withdrawn. This will result in a positive impact as an area of circa 0.79 km^2 will be made available to other sea users.

The potential for significant impacts to other sea users is therefore limited to the risk of fishing gear snagging on infrastructure that is being decommissioned in situ, particularly in the event free spans were to develop along the route of the pipelines. The sensitivity of commercial fishing to snagging is considered to be **Medium** in the vicinity of the Helvellyn infrastructure. The receptor has a medium value as fishing effort is relatively high for this region of the SNS and due to the potential significance of the threat associated with snagging resistance and resilience is medium. The magnitude of the impact is considered to be **Moderate** as snagging can result in damage to fishing gear, loss of fishing time/access, and risks to crew health and safety.

To minimise the risk of snagging, WPRL is proposing to remove any exposed subsea infrastructure. A mattress may be redeployed and deposited over the cut end of the pipelines, if exposed, to prevent a possible snagging point. Based upon the original as trenched surveys and operational life interim general inspection surveys it can be concluded that the full length of pipeline and umbilical are currently buried to a depth well in excess of 0.6m and normally between 1.0 and 1.5m deep, excluding the approaches at the subsea well and platform ends. The interim operational general inspection surveys conducted in 2013 and 2015 show a stable trench with natural backfill seen throughout the route when compared with the original 2002 as trenched surveys. The recent 2022 surveys have further confirmed the gradual trench infill and seabed stability. Water depth comparisons between the surveys also indicate no significant migration of the seabed is occurring. Additionally, of the four anode sleds present, three are fully buried, and rock dumped or buried under natural material, while the third is only marginally exposed. The rock dumped section are of graded rock with profiled side slopes, therefore there are no snagging concerns. If any anode sleds are seen on the seabed surface during the offshore decommissioning campaign these will be cut and removed, if possible.

Of note is that forty two locations along the route were rock dumped as well as being trenched, in order to provide down force to prevent UHB on the pipelines during their operational life. The profile at these locations is over-trawlable and no erosion or displacement has been noticed on or around these locations during the operational life of the Helvellyn field. In a flooded condition (as would be the decommissioned left in situ state) the pipeline and piggybacked umbilical are significantly negatively buoyant and so no upward movement of the lines would be expected. The likelihood of free spans developing or the stabilisation material decommissioned in situ becoming a snagging hazard is therefore considered to be **Extremely Rare**.

Given the above, the risk to commercial fishing from the legacy of the Helvellyn infrastructure decommissioned in situ is therefore predicted to be **Low**.

6.1.2 Mitigation Measures

WPRL will adopt the following measures to ensure the impacts to other sea users from the physical presence of the decommissioning vessels and legacy of infrastructure decommissioned in situ are minimised:

- Where required, Consent to Locate permits will be in place, existing collision risk management plans will be reviewed and notifications of the proposed decommissioning activities will be made to regular users of the area via Notices to Mariners, NAVTEX/NAVAREA warnings and Kingfisher bulletins;
- Details of any infrastructure decommissioned in situ will be publicised through Notices to Mariners and marked on navigation and fisheries charts;
- A post-decommissioning survey will be undertaken around the Helvellyn subsea well (1,000m x 1,000m grid centred on the well) and a (minimum) 100m corridor (50m either side) along the route of the pipeline and umbilical where decommissioning activities have taken place to identify and recover any oil and gas seabed debris and confirm the seabed has no trawling obstructions;
- If any individual anodes at the anode sled location 2 can be seen on the seabed surface at the time of decommissioning these will be cut and recovered. A post-decommissioning monitoring programme covering the pipelines and associated stabilisation features remaining in situ will be agreed with OPRED.

6.1.3 Residual Effects

Residual effects on other sea users (commercial fishing and shipping) resulting from the physical presence of vessels on location at Helvellyn and transiting to / from site are **Negligible** and not significant, particularly given the short duration of the proposed decommissioning activities and the operational control measures which will be in place. In addition, removal of the Helvellyn WHPS and associated 500 m safety exclusion zone will result in positive effects as the area will become available to other sea users again.

The risk to commercial fishing from the legacy of the Helvellyn pipeline, umbilical and stabilisation material decommissioned in situ is predicted to be **Low**, but ALARP as fishing effort is relatively low in the area and the generation of snagging risks such as free spans is very unlikely, considering the burial depth of the lines and the mitigation measures that will be in place.

6.2 Seabed Disturbance

6.2.1 Quantification of Seabed Disturbance

The following Helvellyn decommissioning activities have been identified as sources of potential seabed disturbance:

- Footprint of jack-up vessel used to P&A the well;
- Removal of WHPS, wellhead and xmas tree, including temporary wet storage of the protection cover;
- Cutting of pipeline ends, removal of exposed pipeline sections / tie-in spools, including mattresses and gravel bags at the approaches to the Helvellyn WHPS and Amethyst A2D platform, redeployment of mattresses to protect the cut ends of the pipelines, if exposed at the seabed, and potential removal of any exposed anode sled sections.
- Potential exposed anode section removal from anode sled, 2 if exposed at time of decommissioning work.

Table 6.1 provides an estimate of the total area of seabed likely to be temporary disturbed by the above listed decommissioning activities, which equates to ca. 2,714 m^2 (0.003 km^2).

In addition, there will be a legacy impact from the existing rock dump along the pipelines which will be decommissioned in situ, as well as any mattresses redeployed to cover the cut pipeline ends, if exposed at the seabed. The area of seabed currently covered by rock dump is estimated to be ca. 18,840 m^2 (0.02 km^2), assuming the rock is sitting in a 12m wide corridor, filling the nominal trench width. The redeployment of stabilisation material, if required, is likely to impact an area of ca. 36 m^2, on the assumption one (6 m x 3 m) mattress is left at the Helvellyn end and one (6 m x 3 m) mattresses are left at the Amethyst A2D end.

Of note is that there are no accumulations of historic drill cuttings associated with the Helvellyn well, as these have been dispersed by the energetic currents of the area.

Table 6.1. Estimated Area of Seabed Disturbed from Helvellyn Decommissioning Activities

Activity	Description of Impact	Estimated Area Impacted	
		(m^2)	(km^2)
Use of jack-up vessel to remove WHPS, wellhead and xmas tree	Although selection of a jack-up vessel is still to be made, it is assumed that the vessel will have four spud cans, each of which has a radius of 7 m, impacting an area of 154 m^2, equating to 616 m^2 for all four. In addition, four hold back anchors could be deployed when the rig comes on / off location. It is estimated that each anchor and associated anchor chain could impact an area of 10 m^2, equating to a total of 40 m^2 for all four. It is not considered that there will be a need to deposit stabilisation material around the spud cans, due to the underlying clay layer and the fact it has not previously been required at the Helvellyn location.	656	0.0007
Removal of WHPS, wellhead and xmas tree, including temporary wet storage of the protection cover	It is assumed that any disturbance to the seabed as a result of removal of the WHPS, wellhead and xmas tree, (the dimensions of which are 8m x 6.3m) will be within close proximity to the existing footprint of the WHPS. It is estimated that an area of 123 m^2 will be disturbed during the removal operations, based on a contingency buffer of 2m around the WHPS footprint. Once the WHPS has been removed, a depression may be temporarily left in the seabed, but this will rapidly refill with natural backfill given the highly dynamic nature of the area. Temporary storage of the protection cover (8m x 6.3m x 4m high) may result in a very short term disturbance to the seabed over an area of 50.4 m^2	173.4	0.0002
Cutting of pipeline ends, removal of exposed pipeline sections / tie-in spools, including mattresses and gravel bags at the approaches to the Helvellyn well and the Amethyst A2D platform, redeployment of mattresses to protect the cut ends of the pipelines and potential removal of any exposed anode sled sections	The Helvellyn and Amethyst A2D riser to pipeline spool sections will be cut (using either shear cutting or diamond wire cutting tools) and removed. The mattresses and gravel bags will be removed to allow access to cut the pipeline ends. The underlying pipeline sections up until the point where the pipelines are either rock dumped or buried to a depth greater will be cut and removed at the Helvellyn and Amethyst A2D ends of the pipeline. In total ca. 156 m of pipelines / tie in spool pieces will be removed. Based on the mattress size (6 m x 3 m) and a contingency buffer of 2 m around each mattress to account for potential disturbance during their removal, it is estimated that an area of ca. 1,880 m^2 will be disturbed. The removal of the pipeline / tie-in spool pieces underneath the mattresses and the redeployment of mattresses or gravel bags to protect the cut ends of the pipelines, if exposed, will not result in additional seabed disturbance. Minor seabed disturbance around 2 possibly exposed anode sled sections during their cutting and removal (likely using a hydraulic cutter) could result in an additional 5 m^2 disturbance.	1,885	0.0018
	Total Area of Seabed Impacted:	2,714.4	0.0027

6.2.2 Potential Impacts to Seabed Communities

Seabed disturbance will result in direct physical effects on benthic fauna, which may include mortality as a result of physical trauma and smothering by resuspension and settlement of natural seabed sediments.

Physical disturbance of the seabed resulting from the removal of infrastructure from the seabed, temporarily placing materials and equipment on the seabed is likely to cause displacement or mortality of benthic species. Mortality is more likely in non-mobile benthic organisms (e.g. attached epifauna, such as soft corals (*Alcyonium digitatum*), bryozoans (*Flustra foliacea*) or anemones (*Urticina felina*), all of which were recorded during the 2022 pre-decommissioning survey) (Budd, 2008), whereas mobile benthic organisms, such as the common sea urchin *Echinus esculentus* and crab *Necora puber*, may be able to move away from the area of disturbance.

The presence of stony reef was investigated across the Helvellyn pre-decommissioning survey area, with four drop-down camera stations (HST01, HST02A, HST02B, and HST03A) classed as 'Low reef' due to a percentage cover of cobbles and boulders between 10 % and 40 % (refer to Section 4.2.2.1). 'Stony reef' is listed as a protected habitat in Annex I of the EU Habitats Directive and has a limited tolerance to direct physical impact, with recovery not expected for an extended period, but is considered to be tolerant to light smothering (Hill, 2008; Tyler Watts, 2008). As the 'Low reef' stations are located away from the area that will be directly disturbed by removal of the infrastructure, significant impacts on this habitat type are not predicted.

With the exception of the legacy impact from the stabilisation material decommissioned in situ, the proposed Helvellyn decommissioning activities are transient and, as such, it is expected that recovery of affected areas of seabed will be relatively rapid once the activities have been completed. Tyler-Walters et al. (2004) report that offshore circalittoral mixed sediments have a high recoverability following disturbance. Recolonisation of the affected areas is anticipated to take place in a number of ways; including mobile species moving in from the edges of the area, juvenile recruitment from plankton or from burrowing species digging back to the surface.

The proposed decommissioning activities will also lead to an increase in turbidity through sediment resuspension resulting in smothering of sensitive benthic species. However, the Helvellyn subsea well is located within a highly dynamic area with strong near-seabed currents and highly mobile sediments (DECC, 2016). The fauna found here are therefore robust infauna that are adapted to frequent disturbances and natural fluctuations in sediment loading and resuspension.

Retrieval of mattresses and gravel bags at the approaches to the Helvellyn well and Amethyst A2D platform will result in hard / coarse substratum habitats being replaced by sediment habitats, more typical of this area of the SNS. As a result, there will be localised changes in benthic communities from epifaunal species that can colonise hard substrata to those that favour of soft sandy sediments.

Ocean quahog (*A. islandica*) is listed as an OSPAR Threatened and/or Declining species and are a limited mobility species. This species of bivalve mollusc is long-lived with a slow growth rate and late age of reaching reproductive maturity. It is generally found partially buried in sandy and muddy sediments. Although this species was not observed during the Helvellyn 2022 pre-decommissioning survey, it has been recorded in the wider area and is a qualifying feature of the Holderness Offshore MCZ (refer to Section 4.2.2.1).

Ocean quahog is thought to have a high sensitivity to sub-surface abrasions / penetration, as well as physical loss of habitat (Tyler-Walters and Sabatini, 2017). It is therefore important to conserve the extent and distribution of supporting habitats to provide the best chance of any potential settlement for new recruits and to retain existing individuals. High rates of siltation may also adversely affect ocean quahog (Tillin et al. 2010; Marine Scotland, 2013). Any impacts to this species from the proposed decommissioning activities will, however, be in a very localised area, such that any effects on the population of ocean quahog in the wider SNS region are not predicted to be significant.

Given the above, the sensitivity of seabed communities to seabed disturbance in the vicinity of the Helvellyn location is considered to be **Medium**, with a very high value as the biotope complex identified is contained within the protected habitat 'Subtidal sands and gravels', but with very high resistance and resilience. The majority of seabed species recorded from the area are known to have short lifespans (a few years or less) and relatively high reproductive rates, indicating the potential for rapid population recovery. The exception to this is ocean quahog, as the sensitivity of this bivalve species to sub-surface abrasions / penetration and high siltation rates is **Very High**; ocean quahog is on the OSPAR list of threatened and/or declining species and is therefore considered to have a very high value, with low resistance and resilience. However, the magnitude of impact from the decommissioning activities is considered to be **Minor**, due to the localised and temporary nature of the predicted impacts and the relatively small area of seabed disturbed (ca. 0.003 km^2). Therefore, physical effects on seabed communities due to seabed disturbance are predicted to be **Minor** and not significant.

In addition to the temporary impacts assessed above, there will be a legacy impact from the stabilisation material which will be decommissioned in situ, including the redeployment of any material required to protect the cut ends of the pipelines, if required. The sensitivity of seabed communities in the vicinity of the Helvellyn location to the legacy impact is considered to be **Very High**, with a very high value as the biotope complex identified is contained within the protected habitat 'Subtidal sands and gravels' and low resistance and resilience, given that the changes will be permanent. It is estimated that this will permanently disturbed an area of ca 0.02 km^2. Although the hard substrate will permanently change the habitat type and associated fauna present, the scale of the impact is **Negligible** considering the large extent of coarse sand and gravel sediment available in the SNS. Effects on seabed communities are therefore predicted to be **Negligible**.

In all cases, the scale of changes to the seabed and its fauna are such that effects on higher trophic levels (e.g. fish and marine mammals), and any related effect on species of commercial interest are **Negligible**.

6.2.3 Mitigation Measures

The following measures will be adopted to ensure that seabed disturbance and its impacts are minimised:

- Working areas will be minimised, as far as practicable;
- Where vessels are required to hold position for only short duration, dynamic positioning vessels will be used in favour of moored vessels;
- No new mattresses, gravel bags or rock dump will be placed on the seabed.

6.2.4 Residual Effects

Based on the nature of the seabed habitats and species present in the vicinity of the Helvellyn infrastructure and the comparatively small area of seabed that will be impacted by the proposed decommissioning activities (ca. 0.0003 km^2 will be temporary disturbed and ca. 0.02 km^2 will be subject to a legacy impact (permanent loss of habitat) from the stabilisation material decommissioned in situ), residual effects on seabed communities are predicted to be **Minor** to **Negligible** and not significant.

6.3 Underwater Noise Emissions

The potential effects of underwater noise emissions on marine organisms depends on the characteristics of the sound (e.g. type, intensity, spectra, duration), the physical characteristics of the environment in which sound propagates, the acoustic sensitivity of the receiver, and their interaction in space and time.

Marine fauna use sound for navigation, communication and prey detection (NMFS, 2016; Southall *et al.* 2007; Richardson *et al.* 1995). Therefore, the introduction of anthropogenic underwater sound has the potential to impact on marine animals if it interferes with the animal's ability to use

and receive sound. Potential effects range from masking biological communication and causing small behavioural reactions, to chronic disturbance, injury and mortality (OSPAR 2009).

The most sensitive marine fauna to underwater noise are fish and marine mammals. A range of fish species use the Helvellyn area for nursery and/or spawning grounds at different times of the year including cod, herring, horse mackerel, lemon sole, mackerel, *Nephrops*, plaice, sandeel, sole, sprat, and whiting (Coull *et al.*, 1998 and Ellis *et al.,* 2012). Harbour porpoise, common dolphin, white-sided dolphin, white-beaked dolphin and minke whale, as well as grey and harbour seals are marine mammals that have been observed or identified as most likely to be present in the Helvellyn area.

6.3.1 Sources of Underwater Noise Emissions

The potential sources of underwater noise from the Helvellyn decommissioning activities have been identified as:

- Vessel operations (e.g. use of propellers / dynamic positioning thrusters);
- Use of underwater cutting tools;
- Use of geophysical equipment during post decommissioning survey.

6.3.1.1 Vessel Operations

The Helvellyn decommissioning activities will mobilise a variety of vessels, including a jack-up rig, DSV, MSV, survey vessel and ERRV. Large vessels (greater than 100 m length) have sound pressure levels within the range of 180-190 dB re 1 µPa, whilst most support vessels, assuming a medium-size ship (50 – 100 m in length), have sound pressure levels within the range of 165-180 dB re 1 µPa (OSPAR 2009). The highest sound levels are expected from short-term energy-demanding activities, for example when using dynamic positioning thrusters to position vessels on location (Genesis, 2011). The majority of the acoustic energy from vessels is below 1 kHz, typically within the 50-300 Hz range, although cavitation from propellers produces sounds at frequencies of between 1 kHz and 125 kHz (Genesis 2011; Hermannsen *et al.,* 2014).

6.3.1.2 Underwater Cutting Tools

It is proposed that mechanical (shear or diamond wire) cutters will be used to server the Helvellyn pipelines, an abrasive cutting tool system will be used to internally cut the subsea well conductor. Hydraulic cutters are likely to be used to cut the anodes sled exposed sections. However, underwater noise emissions from cutting tools are unlikely to result in sufficient levels of noise to cause significant disturbance to marine fauna (DECC, 2016). For example, a recent paper reported that the noise from underwater diamond wire cutting, during the severance of a 30 inch diameter conductor at a platform in the North Sea, was barely discernible above background noise levels including the noise of associated vessel presence (Pangerc *et al.,* 2016). As the tool use episodes will be intermittent and of short duration, it is predicted that the noise generated will not be greater than that arising from vessel operations and therefore no additional impacts beyond that estimated from the noise arising from vessel operations are predicted to occur.

6.3.1.3 Geophysical Survey Equipment

The post decommissioning survey is likely to utilise a combination of multi-beam echo sounder (MBES) and side scan sonar (SSS), as well as an Ultra Short Baseline (USBL) beacon system to confirm positioning of the underwater survey equipment. On the whole, these are highly directional sources with expected low levels of horizontal sound propagation. The use of this equipment in shallow waters is unlikely to cause injury or significant disturbance to marine fauna as the equipment tends to operate within frequency ranges that are outside the hearing range of most sensitive species (Turnpenny and Nedwell, 1994; JNCC, 2010). As such, no potentially significant impacts on sensitive marine fauna are predicted from the underwater noise emissions generated during the post decommissioning survey and therefore this aspect has been scoped out of detailed assessment.

6.3.2 Potential Impacts to Fish

The sensitivity to noise differs among fish species, especially according to the anatomy of the swimbladder and its proximity to the inner ear. Species known to have a high-sensitivity to noise include herring and sprat and species known to have a medium-sensitivity to noise include gadoids, such as cod, haddock and whiting. All these species may be present within the vicinity of the Helvellyn location. In contrast, those species lacking a swim bladder altogether such as elasmobranchs (sharks and rays) and flatfish such as plaice and sole tend to be of relatively low auditory sensitivity.

Juvenile and larval fish, in their first year of life, are the most sensitive to environmental stressors, particularly anthropogenic noise (Aires *et al.,* 2014). Physiological damage is of particular concern for fish eggs and larvae, since unlike adult fish they are unable to move away from a noise source and are therefore at greater risk of mortality (Turnpenny & Nedwell, 1994). However, there is no direct evidence of mortality or potential mortal injury to fish from ship noise and no data available on injury to eggs and larvae (Popper *et al.,* 2014).

It is acknowledged that displacement is of particular concern for demersal spawning species, such as herring and sandeels, as these species are more restricted by habitat type, requiring a specific type of substrate on which to lay their eggs. However, although both species spawn over the Helvellyn location, the area which would be impacted represents only a small proportion of the spawning grounds available for these species in the SNS. In addition, this area of the SNS has a relatively high volume of vessel traffic and, as such, it is anticipated that the additional underwater noise generated by the proposed Helvellyn decommissioning activities is likely to be insignificant.

Given the above, the sensitivity of fish to underwater noise emissions from the proposed decommissioning activities is considered to be **Low**, with a high value due to fish being of national importance and very high resistance and resilience as fish have capacity to accommodate the pressure, with high recoverability in the short term. The magnitude of impact is predicted to be **Minor** as there is no potential for injury and any displacement from the area will be localised and temporary. Effects on fish from underwater noise emissions are therefore predicted to be **Minor** and not significant.

6.3.3 Potential Impacts to Marine Mammals

Not all marine mammal species have equal hearing capabilities, in terms of absolute hearing sensitivity and the frequency band of hearing and, consequently, vulnerability to impact from underwater noise differs between species (NOAA, 2018). Table 6.2 presents the marine mammal species that could be present within the vicinity of the Helvellyn location by their functional hearing group and associated estimated hearing range, as classified by Southall *et al.* 2019. It can be seen that odontocetes (toothed whales, dolphins and porpoises) have a wider hearing frequency range compared to mysticetes (baleen whales).

Table 6.2. Functional Marine Mammal Hearing Groups (Southall et al. 2019)

Hearing Group	Estimated Hearing Range	Species
Low-frequency cetaceans	7 Hz – 35 kHz	Minke whale
High-frequency cetaceans	150 Hz – 160 kHz	White-beaked dolphin, common dolphin and white-sided dolphin
Very high-frequency cetaceans	275 Hz - 160 kHz	Harbour porpoise
Phocid carnivores in water	50 Hz – 86 kHz	Harbour seal, grey seal

When marine mammals are exposed to intense sound, an elevated hearing threshold may occur, known as a threshold shift. If the hearing threshold returns to the pre-exposure level after a period of time, the threshold shift is known as a temporary threshold shift (TTS). If the threshold does not return to the pre-exposure level, it is known as a permanent threshold shift (PTS) (Finneran *et al.* 2000; Southall *et al.* 2007). Both TTS and PTS arise as a result of physiological changes to the

auditory systems of marine mammals. The PTS and TTS onset thresholds for each of the functional marine mammal hearing groups are provided in Table 6.3.

Table 6.3. Non-Impulsive PTS and TTS Onset Thresholds for Marine Mammals (Southall et al. 2019)

Hearing Group	PTS Criteria - Weighted SEL_{cum} (dB re 1 μPa^2s)	TTS Criteria - Weighted SEL_{cum} (dB re 1 μPa^2s)
Low-frequency cetaceans	199	179
High-frequency cetaceans	198	178
Very high-frequency cetaceans	173	153
Phocid carnivores in water	201	181

None of the noise sources associated with the proposed decommissioning activities will exceed any of the PTS / TTS thresholds, with the SEL from vessels in the region of 150 dB re 1 µPa. It is therefore concluded that marine mammals will not be injured or experience a temporary, recoverable reduction in hearing sensitivity as a result of the proposed Helvellyn decommissioning activities.

However there is still a possibility of behavioural disturbance. Due to the complexity and variability of marine mammal behavioural responses, guidance regarding the effects of anthropogenic sound on marine mammal behaviour is still being developed. In the absence of detailed behavioural disturbance in Southall *et al.* 2019, criteria of 120 dB re 1 µPa (unweighted SPL_{RMS}), which is applicable to all marine mammal hearing groups for behavioural disturbance from non-impulsive noise (NOAA, 2013), has been used in this assessment.

In order to determine the impact range within which marine mammals may exhibit behavioural changes, a simple sound propagation model has been used based on the equation by Richardson *et al.* (1995), which assumes spherical spreading as shown below:

$$\text{Transmission Loss} = 20\text{Log}(R/R_0)\ \text{dB}$$

R_0 = the reference range, usually 1 metre; R = the distance from the reference range.

This method provides a conservative estimate of sound propagation with distance as it struggles to extrapolate sound attenuation in the near field (within tens of metres of the noise source), due to interference between sound waves and reverberation. It therefore generally overestimates transmission of sound from the source, but in this instance is considered sufficient to examine a 'worst-case' scenario for behavioural impacts on marine mammals. Table 6.4 presents the predicted impact range within which marine mammals may exhibit behavioural changes as a result of the proposed Helvellyn decommissioning activities.

Table 6.4. Maximum Behavioural Impact Range to Marine Mammals (NOAA, 2013)

Hearing Group	Behavioural Criteria – unweighted SPL_{RMS} (dB re 1 µPa)	Noise Source (dB re 1 µPa)	Maximum Predicted Impact Range
Marine Mammals	120	190	3,163 m

It can be seen from Table 6.4 that behavioural responses may be elicited ca. 3 km from the noise source, although for the reasons provided above the distance quoted is conservative.

To determine the magnitude of impact in terms of the actual number of animals impacted, it is possible to calculate the number of animals likely to experience some sort of behavioural impact using the density and abundance estimates from the MMMUs (IAMMWG, 2021) as shown in Table 6.5. In addition, density data from Russel *et al.,* 2017 has been used for grey and harbour seals.

Table 6.5. Estimated Number of Marine Mammals Potentially Experiencing Behavioural Disturbance During the Helvellyn Decommissioning Activities

Species	Estimated Density in the Area (animals / km²)	Estimated Number of Animals that May Experience Behavioural Disturbance [3]	% of Reference Population Disturbed [1, 4]
Harbour porpoise [1]	0.511	< 15	0.004
White-beaked dolphin [1]	0.028	< 1	0.002
Minke whale [1]	0.012	< 1	0.005
White-sided dolphin [1]	0.011	< 1	0.006
Common dolphin [1]	0.065	< 2	0.002
Bottlenose dolphin	0.003	< 1	0.05
Risso's dolphin	0.007	< 1	0.008
Harbour seal [2]	0.2	< 6	0.2
Grey seal [2]	2	< 57	1.8

[1] Source: IAMMWG (2021)
[2] Source: Russel et al. (2017)
[3] Calculated as the estimated density x behavioural onset area
[4] Source: IAMMWG (2013)

It can be seen from Table 6.5 that only a relatively low number of individual animals are likely to exhibit some form of change in behaviour for the period in which they encounter noise from the proposed decommissioning activities and the percentage of reference population disturbed is very small.

All species of cetaceans are classified as European Protected Species (EPS), listed on Annex IV of the EU Habitats Directive, which is transposed into UK law in UK offshore waters through The Conservation of Offshore Marine Habitats and Species Regulations 2017 (OMR). It is an offence under the OMR to deliberately disturb, injure or kill a species designated as an EPS. The likelihood of an offence being committed is highly dependent on the temporal characteristics of the activity (JNCC, 2010). A disturbance offence is more likely where an activity causes persistent (sustained and chronic) noise in an area for long periods of time. For most cetacean populations in the UK, disturbance in terms of OMR is unlikely to result from single, short-term operations (JNCC, 2010). Considering the noise sources associated with the proposed Helvellyn decommissioning activities and the fact that only a low number of individuals are likely to experience behavioural disturbance, with no cetaceans are predicted to be injured, it is not considered that the proposed decommissioning activities would constitute an offence under OMR.

In conclusion, the sensitivity of marine mammals to underwater noise emissions from the proposed decommissioning activities is considered to be **Low**, with a very high value as marine mammals are of international importance and very high resistance and resilience. Reported responses of behavioural disturbance to marine mammals from vessel noise include avoidance, changes in swimming speed, direction and surfacing patterns, alteration of the intensity and frequency of calls (Erbe *et al.,* 2019). Harbour porpoises and minke whales have been shown to respond to vessels by moving away from them, while some other species, such as common dolphins, have shown attraction (Palka & Hammond, 2001). The magnitude of impact is considered to be **Minor** as while there is potential for some behavioural disturbance, the area of potential disturbance will be localised and any impacts will be temporary. Effects on marine mammals from underwater noise emissions are therefore predicted to be **Minor** and not significant, particularly relative to the underwater noise generated by existing levels of vessel traffic in the wider SNS area.

It is also acknowledged that during the proposed decommissioning activities there is the potential for indirect effects on marine mammals due to changes in prey (fish) species distribution and/or

abundance. However, as discussed in Section 6.3.2, impacts to fish from underwater noise emissions will be temporary and in a localised area, in close proximity to the source. As such, any impacts to marine mammals due to changes in prey resources are not predicted to be significant.

6.3.4 Mitigation Measures

The following measures will be implemented for the Helvellyn decommissioning activities to ensure that any adverse effects on noise-sensitive receptors are mitigated:

- Operations will be planned to reduce vessel movements and minimise the overall duration of the project.
- Where vessels are required to hold position for extended durations, a jack-up vessel will be used in favour of a dynamic positioning vessel.
- Internal cutting techniques will be utilised where possible, which do not produce any significant noise emissions. Where internal cuts are not possible, external cuts will be via mechanical methods as they produce significantly less noise than of abrasive methods.

6.3.5 Residual Effects

In summary, there is no evidence to suggest that the underwater noise emissions generated during the proposed Helvellyn decommissioning activities would result in injury or significant disturbance to marine fauna. Residual effects are therefore are predicted to **Minor** and not significant.

6.4 Cumulative and In-combination Impacts

Cumulative impacts may arise from incremental changes caused by other past, present or reasonably foreseeable projects/ proposals together with the proposed Helvellyn decommissioning activities.

The nearest aggregate area to the Helvellyn infrastructure is Humber 4 (Area no.: 514/4), located approximately 11 km west of the Amethyst A2D platform and 19 km south west of the Helvellyn subsea well (see Section 4.3.6).

There are a large number of existing oil and gas developments adjacent to the Helvellyn WHPS, the nearest of which is the Perenco operated West Sole platform located approximately 16 km to the east (see Section 4.3.3).

The nearest offshore windfarm to the Helvellyn infrastructure is the Tritan Knoll windfarm, located approximately 10 km south of the Amethyst A2D platform. The windfarm is operated by RWE Npower Renewables and is currently under construction, but is expected to be operational by 2022 (RWE, 2021). Construction work associated with the windfarm could therefore overlap with the proposed Helvellyn decommissioning activities.

However, given the limited area of seabed disturbed by the proposed Helvellyn decommissioning activities, coupled with the distance between the Helvellyn infrastructure and the developments listed above, no significant cumulative effects on seabed habitats and species are predicted.

The emissions and discharges from the developments listed above in conjunction with the proposed Helvellyn decommissioning activities are also not expected to result in any significant cumulative effects on marine receptors. Atmospheric emissions are predicted to rapidly disperse. In addition, the underwater noise emissions generated by the proposed Helvellyn decommissioning activities are predicted to be insignificant against the noise produced by the existing vessel traffic in this area of the SNS. As such, any emissions and discharges from the proposed Helvellyn decommissioning activities are unlikely to significantly overlap with emissions and discharges from other activities in the area and therefore no significant cumulative effects on marine receptors are predicted.

In addition to cumulative impacts, in-combination impacts may arise from different activities within the Helvellyn decommissioning project resulting in several impacts on the same receptor or where different receptors are adversely effected to the detriment of the entire ecosystem. An example

of this in the marine environment would be marine fauna, such as fish, experiencing habitat loss from both seabed disturbance and underwater noise emissions. Water quality may also be adversely impacted by an increase in turbidity through sediment resuspension during seabed disturbance activities, as well as routine marine discharges from vessels. However, given the localised nature of any impacts and the fact the majority will be temporary nature, no significant environmental effects are predicted as a result of in-combination impacts.

6.5 Transboundary Impacts

The Helvellyn subsea well and Amethyst A2D platform are located approximately 136 km and 144 km, respectively, west of the UK/Netherlands transboundary line. Any impacts arising from emissions, discharges and seabed disturbance generated as a result of the proposed Helvellyn decommissioning activities are predicted to be highly localised and are therefore not expected to result in any significant transboundary impacts.

As discussed in Section 5.4.5.1 The modelling predicts that condensate released from the Helvellyn subsea well will not cross the UK / Netherlands or any international transboundary line at the surface in any season.

In the event any waste from the Helvellyn decommissioning activities is disposed of outside of the UK, WPRL will ensure regulations governing transfrontier shipment of waste are complied with.

7. Potential Impacts to Marine Protected Areas

WPRL has identified that five MPAs, namely the Holderness Offshore MCZ, SNS SAC, Greater Wash SPA, Inner Dowsing, Race Bank and North Ridge SAC and Holderness Inshore MCZ located within 40 km of the proposed Helvellyn decommissioning activities (see Section 4.2.6). The following sections therefore assess whether the potential impacts from the proposed decommissioning activities, either alone or in-combination with other plans or projects, are likely to result in any significant effects to the qualifying features of the MPAs thereby affecting the integrity of the sites.

7.1 Holderness Offshore MCZ

7.1.1 Qualifying Features and Conservation Objectives

The Holderness Offshore MCZ is designated for the protection of three broad-scale habitats types (A5.1: Subtidal coarse sediment, A5.2: Subtidal sand and A5.4: Subtidal mixed sediments), ocean quahog (*Arctica islandica*) and North Sea glacial tunnel valleys.

The Helvellyn subsea well and approximately 12.5 km of the pipeline and umbilical (PL1956 / PLU1957) route is located within the boundary of the MCZ. The Helvellyn subsea well, where the majority of removal activities will take place, lies within biotope complex 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321), which may occur within the broad-scale habitat 'Subtidal coarse sediment' (refer to Section 4.2.2.1 for further details).

North Sea tunnel valleys and individuals of the ocean quahog (*Arctica islandica*) were not observed during analysis of the photographic data collected during the 2022 pre-decommissioing survey (Fugro, 2022b), although ocean quahog have been recorded in the wider area during site assessment surveys for the Holderness Offshore MCZ (refer to Section 4.2.2.1).

The Conservation Objective for the Holderness Offshore MCZ is that the protected features:

- So far as already in favourable condition, remain in such condition;
- So far as not already in favourable condition, be brought into such condition, and remain in such condition.

The site's conservation objectives apply to the MCZ and the individual species, habitats or geological features of interest for which the site has been designated as follows:

- Subtidal coarse sediment (Broad-scale habitat, EUNIS code: A5.1) – Recover to favourable condition;
- Subtidal sand (Broad-scale habitat, EUNIS code: A5.2) – Recover to favourable condition;
- Subtidal mixed sediments (Broad-scale habitat, EUNIS code: A5.4) – Recover to favourable condition;
- Ocean quahog (*Arctica islandica*) (Species Feature of Conservation Importance) – Recover to favourable condition.

Of the features which may be impacted by the proposed Helvellyn decommissioning activities this means the following:

1. With respect to the Subtidal coarse sediment (EUNIS code A5.1) within the MCZ:
    i. Its extent is stable or increasing; and
    ii. Its structures and functions, its quality, and the composition of its characteristic biological communities (which includes a reference to the diversity and abundance of species forming part or inhabiting that habitat) are such as to ensure that it remains in a condition which is healthy and not deteriorating.

Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.

2. With respect to the Ocean quahog (Arctica islandica) within the MCZ:

   i. the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive.

   Any temporary reduction of numbers is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.

7.1.2 Potential Impacts

The Holderness Offshore MCZ covers an area of 1,176 km^2. A detailed in Section 6.2.1 the use of a jack-up vessel and the proposed decommissioning operations to remove the Helvellyn WHPS, wellhead and xmas tree will result in ca. 0.003 km^2 seabed disturbance. This equates to less than 0.0003 % of the MCZ total area.

The disturbance resulting from the Helvellyn decommissioning operations will be temporary in nature. The seabed sediments in the Helvellyn field are comprised of coarse sands with gravels and therefore should drop out of suspension quickly, in the immediate vicinity of the disturbance area. In addition, material suspended would be the same as that currently present and the communities associated with the habitat are habituated to this sediment type. Once the WHPS has been removed, a depression may be temporarily left in the seabed, but this will rapidly refill with natural backfill given the highly dynamic nature of the area. The temporary seabed disturbance caused by the Helvellyn decommissioning activities will not change the structure, function, quality, or the composition of biological communities present within the seabed sediments.

Any impacts arising from the emissions and discharges generated by the proposed Helvellyn decommissioning operations are predicted to be highly localised and are therefore not expected to result in significant impacts to the qualifying features of the MCZ.

WPRL is not aware of any consented or planned offshore renewable, cable or aggregate and dredging activity within the Holderness Offshore MCZ. There are five active gas fields (York; Rough; Deris; Ceres; Mercury) within the Holderness Offshore MCZ, however, given the distance of the four platforms to the Helvellyn infrastructure (Rough A – 26 km NW; Rough B – 20 km NW; Rough CD – 29 km NW; York – 32 km NW), no in-combination effects from emissions and discharges are anticipated to impact the qualifying features. WPRL is not aware of any planned decommissioning activity or future development activity associated with these fields.

Therefore, in view of the conservation objectives of the MCZ, no likely significant effects (LSE) on the Holderness Offshore MCZ are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

7.2 Southern North Sea SAC

7.2.1 Qualifying Features and Conservation Objectives

The SNS SAC is designated for the protection of Annex II species harbour porpoise. The site covers an area of 36,951 km^2 and supports an estimated 17.5 % of the UK North Sea MU population of harbour porpoises. The northern two thirds of the site, covering an area of 27,000 km^2, is recognised as important for harbour porpoises during the summer season (April – September), whilst the southern part, covering an area of 12,687 km^2 as there is some overlap with the northern part, supports persistently higher densities during the winter (October – March) (JNCC & NE, 2019).

The conservation objectives of the SNS SAC are to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status

(FCS) for harbour porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that:

- Harbour porpoise is a viable component of the site;
- There is no significant disturbance of the species; and
- The condition of supporting habitats and processes, and the availability of prey is maintained.

7.2.2 Potential Impacts

As noted in Section 6.3.3, the underwater noise emissions generated during the proposed Helvellyn decommissioning activities are not predicted to result in injury to harbour porpoise, but do have the potential to cause disturbance out to a distance of ca. 3 km from the noise source. The Helvellyn subsea well and Amethyst A2D platform are located approximately 7 km and 15 km from the edge of the SNS SAC boundary, respectively. As such, it is not predicted that the site's qualifying feature (harbour porpoise) will be significantly impacted by the underwater noise emissions generated during the proposed Helvellyn decommissioning operations. Therefore, in view of the conservation objectives of the SAC, no LSE on the SNS SAC are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

7.3 Greater Wash SPA

The site's conservation objectives apply to the site and the individual species and/or assemblage of species for which the site has been classified (refer to the qualifying features listed in Table 4.13 in Section 4.2.6).

The objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the EU Birds Directive, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and
- The distribution of the qualifying features within the site.

The Greater Wash SPA covers an area of 3,536 km^2 and is located approximately 16 km from Amethyst A2D platform and 29 km from the Helvellyn WHPS. However, as the designation covers migratory species there may be some negligible interaction with the proposed decommissioning operations. As this region of the SNS is already subject to high densities of vessel traffic, the additional presence of project vessels for the duration of the proposed decommissioning operations are unlikely to cause significant disturbance to seabirds foraging inside or outside the SPA boundary.

Disturbance of the seabed may, however, have indirect impacts on seabirds due to the potential for adverse effects on their prey. The diet of red-throated diver consists primarily of fish, although sometimes feeds on molluscs, crustaceans, insects and fish spawn. Common scoter feeds on benthic bivalve molluscs, and little gull feeds mostly on insects but also eats brine shrimp and other crustaceans, small molluscs, marine worms and small fish (RSPB, 2022). Disturbance to the seabed, may thus reduce the availability of the prey on which these species feed; however, only a small area of seabed will be disturbed by the proposed decommissioning activities (0.003 km^2) and this is outside of the SPA boundary. Additionally, the proposed decommissioning activities are not expected to have a significant impact on fish populations. Thus any effect on seabird prey is considered to be negligible.

Seabird populations are also particularly vulnerable to surface pollution, however, there is insufficient liquid hydrocarbon inventory associated with the Helvellyn field to result in significant

damage to the environment. Spill prevention measures will also be in place as detailed in Section 5.4.4.1.

Of the bird species present within the SPA, common scoter and red-throated diver are vulnerable to disturbance by boats (Schwemmer *et al*., 2011), with common scoter flushing at distances of around 1,600 ± 777 m from approaching vessels and red-throated diver flushing at distances of about 750 ± 437 m (Fliessbach *et al*., 2019). Large aggregations of these species are present within the SPA between November and March.

In the event that vessels do transit through the SPA during the overwintering period, based on evidence of vessel displacement, it is assumed that all red-throated diver within 2 km of a vessel could be displaced (Burt *et al.,* 2017; Burger *et al.,* 2019) and all common scoter within 2.5 km of a vessel could be displaced (Fliessbach *et al.,* 2019). The total number of birds that could be displaced at any one point by a vessel transiting through the SPA is summarised in Table 7.1.

Table 7.1. Estimated Numbers of Red-Throated Diver and Common Scoter Potentially Disturbed at Any One Point Within the Greater Wash SPA during the Overwintering Period

Mob / Demob Port	Distance Through SPA[1]	Displacement Area at Any One Point[2]	Density of Birds Within SPA[3]	No. of Birds Disturbed at any One Point	% Population of SPA Disturbed at any One Point[4]
Red-throated Diver					
Hull	10 km	13 km^2	1.35 – 3.38 per km^2	18 - 44	1.3 – 3
Great Yarmouth	37 km	13 km^2	1.35 – 3.38 per km^2	18 – 44	1.3 – 3
Lowestoft	37 km	13 km^2	1.35 – 3.38 per km^2	18 - 44	1.3 – 3
Common Scoter					
Hull	10 km	20 km^2	0 – 0.7 per km^2	0 – 14	0 – 0.4
Great Yarmouth	37 km	20 km^2	0 – 0.7 per km^2	0 – 14	0 – 0.4
Lowestoft	37 km	20 km^2	0 – 0.7 per km^2	0 – 14	0 – 0.4

[1] Assumes a direct transit route through the SPA to the Helvellyn well.
[2] Based on displacement distance of 2km for red-throated diver and 2.5km for common scoter along the entire route within the SPA.
[3] Based on maximum predicted density of red-throated diver within the SPA. Highest densities of common scoter are present offshore The Wash therefore density range reflects the likely distribution along the transit routes (Lawson *et al.,* 2016)
[4] Based on the following count data: 1,407 red-throated diver and 3,449 common scoter (Natural England, 2018)

It can be seen from Table 7.1 that red-throated diver are most at risk of disturbance if vessels were transiting to / from Hull, Great Yarmouth or Lowestoft. Therefore to minimise disturbance, WPRL proposes to implement the following mitigation measures:

- Restricting, to the extent possible, vessel movements within the Greater Wash SPA to existing navigation routes when transiting to / from the Helvellyn location;
- Maintaining direct transit routes;
- Avoiding over-revving of engines;
- Briefing vessel crew on the purpose and implications of vessel management practices within the Greater Wash SPA.

Given the reasons outlined above, the proposed decommissioning activities will not significantly alter the extent, distribution, structure and function of the habitats of the qualifying bird species, the supporting processes on which these habitats rely, nor the population or distribution of the qualifying bird species. Therefore, in view of the conservation objectives of the SPA, no LSE on the

Greater Wash SPA are predicted, as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

7.4 Inner Dowsing, Race Bank and North Ridge SAC

The objectives for the Inner Dowsing, Race Bank and North Ridge SAC are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:

- the extent and distribution of qualifying natural habitats and habitats of the qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of the qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of each of the qualifying species;
- the distribution of qualifying species within the site.

The Inner Dowsing, Race Bank and North Ridge SAC is located approximately 23 km and 36 km from the Amethyst A2D and Helvellyn subsea well, respectively. Given the distance to the site and the fact that any impacts arising from the emissions and discharges generated by the proposed decommissioning operations are predicted to be highly localised, it is not predicted that the site's qualifying features will be significantly impacted. Therefore, in view of the conservation objectives of the SAC, no LSE on The Inner Dowsing, Race Bank and North Ridge SAC are predicted as a result of the proposed platform decommissioning activities either alone or in-combination with other plans or projects.

7.5 Holderness Inshore MCZ

The site's conservation objectives apply to the MCZ and the individual habitats or geological features of interest for which the site has been designated. These are listed below:

- High energy circalittoral rock (Broad-scale habitat, EUNIS code: A4.1) – Maintain in favourable condition;
- Intertidal sand and muddy sand (Broad-scale habitat, EUNIS code: A2.2) – Maintain in favourable condition;
- Moderate energy circalittoral rock (Broad-scale habitat, EUNIS code: A4.2) – Maintain in favourable condition;
- Subtidal coarse sediment (Broad-scale habitat, EUNIS code: A5.1) – Maintain in favourable condition;
- Subtidal mixed sediments (Broad-scale habitat, EUNIS code: A5.4) – Maintain in favourable condition;
- Subtidal sand (Broad-scale habitat, EUNIS code: A5.2) – Maintain in favourable condition;
- Subtidal mud (Broad-scale habitat, EUNIS code: A5.3) – Maintain in favourable condition;
- Spurn Head (subtidal) and "the Binks" (Feature of Geological Interest) – Maintain in favourable condition.

The Holderness Inshore MCZ is located approximately 36 km from the Amethyst A2D platform and is over 40km from the Helvellyn subsea well. Given the distance to the site and the fact that any impacts arising from the emissions and discharges generated by the proposed decommissioning operations are predicted to be highly localised, it is not predicted that the site's qualifying features will be significant impacted. Therefore, in view of the conservation objectives of the MCZ, no LSE

on the Holderness Inshore MCZ are predicted as a result of the proposed platform decommissioning activities either alone or in-combination with other plans or projects.

8. Conclusions

The Helvellyn Subsea Installation DP and the Helvellyn Pipeline and Umbilical DP involves the removal of the WHPS, wellhead and xmas tree, as well as the exposed tie-in spools and pipeline sections, mattresses and gravel bags, with recovery to shore. The pipeline and piggybacked umbilical will be left cleaned and decommissioned in situ, along with the associated stabilisation features. This EA report confirms that the Helvellyn DPs can be executed with no significant adverse effects on the marine environment.

An initial screening of the potential impacts to environmental and societal receptors from the proposed Helvellyn decommissioning activities concluded that the only aspects considered to be potentially significant and therefore requiring further assessment were physical presence, seabed disturbance and underwater noise. However, following further assessment and upon implementation of the identified mitigation measures, it is has been concluded that no significant residual effects are predicted to occur, with the majority of impacts being localised and temporary in nature.

Of note is that the Helvellyn infrastructure lies within the boundary of a marine protected areas, the Holderness Offshore MCZ, and is located within 40km of the boundary of four other marine protected areas, namely the SNS SAC, Greater Wash SPA, Inner Dowsing, Race Bank and North Ridge SAC and Holderness Inshore MCZ. However, the EA has concluded that there will not be any likely significant effects on the conservation objectives of these marine protected areas as a result of the proposed Helvellyn decommissioning activities, either alone or in-combination with other plans or projects.

The mitigation measures identified to reduce any adverse environmental effects arising from the proposed decommissioning activities are summarised in Table 8.1. WPRL operates under an integrated Safety and Environmental Management System (SEMS), certified to ISO 14001:2015, and has established contractor selection and management procedures. As a number of contractors will be involved in the detailed planning and execution of the proposed Helvellyn decommissioning activities, WPRL will produce a SEMS interface document for the project to help ensure the measures listed in Table 8.1 are successfully implemented.

Table 8.1. Helvellyn Decommissioning Mitigation Measures

Physical Presence
• Where required, Consent to Locate permits will be in place, existing collision risk management plans will be reviewed and notifications of the proposed decommissioning activities will be made to regular users of the area via Notices to Mariners, NAVTEX/NAVAREA warnings and Kingfisher bulletins; • Details of any infrastructure decommissioned in situ will be publicised through Notices to Mariners and marked on navigation and fisheries charts; • A post-decommissioning survey will be undertaken around the Helvellyn subsea well (1,000m x 1,000m grid centred on the well) and a (minimum) 100m corridor (50m either side) along the route of the pipeline and umbilical where decommissioning activities have taken place to identify and recover any oil and gas seabed debris and confirm the seabed has no trawling obstructions; • A post-decommissioning monitoring programme covering the pipelines and associated stabilisation features remaining in situ will be agreed with OPRED. • If any anode sleds are seen on the seabed surface during the offshore decommissioning campaign these will be cut and removed, if possible. • To minimise disturbance within the Greater Wash SPA, WPRL proposes to restrict, to the extent possible, vessel movements within the SPA to existing navigation routes when transiting to / from the Helvellyn location, maintain direct transit routes, avoid over-revving of engines, brief vessel crew on the purpose and implications of vessel management practices within the Greater Wash SPA.
Seabed Disturbance
• Working areas will be minimised, as far as practicable;

- Where vessels are required to hold position for only short duration, dynamic positioning vessels will be used in favour of moored vessels;
- No new mattresses, gravel bags or rock dump will be placed on the seabed.

Underwater Noise Emissions

- Operations will be planned to reduce vessel movements and minimise the overall duration of the project.
- Where vessels are required to hold position for extended durations, a jack-up vessel will be used in favour of a dynamic positioning vessel.
- Internal cutting techniques will be utilised where possible, which do not produce any significant noise emissions. Where internal cuts are not possible, external cuts will be via mechanical methods as they produce significantly less noise than of abrasive methods.

Energy Use and Atmospheric Emissions

- WPRL will look to reduce vessel time in the field as far as practicable and will make use of vessel synergies where possible;
- WPRL's contractor selection process will aim to ensure that the engines, generators and other combustion plant on the vessels to be used during the proposed decommissioning activities are maintained and correctly operated to ensure that they work as efficiently as possible.

Marine Discharges

- Food waste will be macerated and waste water will be treated appropriately before being discharged to sea, in accordance with the requirements of the MARPOL convention;
- Ballast water discharges will be in accordance with the International Maritime Organisation Ballast Water Management Convention, including a ballast water plan and log book.

Waste Management

- WPRL will ensure the principles of the Waste Management Hierarchy are followed during the proposed decommissioning activities, that licensed waste contractors are used and a project Waste Management Plan is in place to ensure compliance with relevant waste regulations;
- Any waste disposed of outside of the UK will be in accordance with the Transfrontier Shipment of Waste Regulations 2007;
- If NORM is not encountered, WPRL will ensure appropriate Radioactive Substance Regulation permits are in place and conditions that dictate the management and control of radioactive waste are met.

Accidental Events

- An approved Oil Pollution Emergency Plan will be in place for the proposed Helvellyn decommissioning activities, as required by the Merchant Shipping (Oil Pollution Preparedness, Response and Co-Operation Convention) Regulations 1998 (as amended);
- All unplanned losses (dropped objects) in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out;
- Where possible equipment with automatic hydraulic shut-off will be used to minimise the volume of fluid released in the event of a hydraulic line failure.

9. References

Aires, C., González-Irusta, J.M. and Watret, R. (2014) Updating Fisheries Sensitivities Maps in British Waters. Scottish Marine and Freshwater Science Report. Vol. 5, No. 10. Available at: http://www.gov.scot/Topics/marine/science/MSInteractive/Themes/fish-fisheries/fsm [Accessed August 2022].

ALARP (2021) Helvellyn Pipeline and Umbilical (PL1956 and PLU1957) Decommissioning Options Comparative Assessment Report, July 2022.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B. and Moffat, C.F. (eds) (2011) Scotland's Marine Atlas: Information for the National Marine Plan. Edinburgh: The Scottish Government. Available from: http://scotgov.publishingthefuture.info/publication/marine-atlas [Accessed August 2022].

BEIS (2021) 2019 UK Greenhouse Gas Emissions: Final Figures - data tables. Aberdeen: The Department for Business, Energy and Industrial Strategy. Available from: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2019 [Accessed August 2022].

Biodiversity Reporting and Information Group [BRIG]. (2011). Biodiversity Action Plan: Priority Habitat Descriptions. Joint Nature Conservation Committee [JNCC]. Peterborough. https://hub.jncc.gov.uk/assets/2728792c-c8c6-4b8c-9ccd-a908cb0f1432

Budd, G.C. (2008) Alcyonium digitatum Dead man's fingers. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: https://www.marlin.ac.uk/species/detail/1187

Burger, C., Schuber, A., Heinanen, S., Dorsch, M., Kleinschmidt, B., Zydelis, R., Morkunas, J., Quillfeldt, P., Nehls, G. (2019) A novel approach for assessing effects of ship traffic on distributions and movements of seabirds, Journal of Environmental Management, Volume 251,2019,109511.

Burt, M.L., Mackenzie, M.L., Bradbury, G. & Darke, J. 2017. Investigating effects of shipping on common scoter and red-throated diver distributions in Liverpool Bay SPA. Report number: CREEM-15198-2017-2. Provided to Natural England (Project red. 23732) August 2017 (Unpublished).

Coull, K.A., Johnstone, R. and Rogers, S.I. (1998) Fisheries Sensitivity Maps in British Waters. Aberdeen: UKOOA Ltd.

Crown Estate (2022) Maps and GIS data. Available from: https://www.thecrownestate.co.uk/en-gb/resources/maps-and-gis-data/ [Accessed August 2022].

Dauvin, J. C., Alizier, S., Rolet, C., Bakalem, A., Bellan, G., Gesteira, J. L. G., Grimes, S., de-la-Ossa-Carretero, J. A., & Del-Pilar-Ruso, Y. (2012). Response of different benthic indices to diverse human pressures. Ecological Indicators, 12(1), 143–153. https://doi.org/10.1016/j.ecolind.2011.03.019

DECC (2009) UK Offshore Energy Strategic Environmental Assessment. Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil & Gas Storage. Environmental Report. Aberdeen: Department of Energy and Climate Change (DECC).

DECC (2014) 28th Licencing Round Information – Shipping Density Table (Version dated 20th February).

DECC (2016) UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3). Aberdeen: Department of Energy and Climate Change (DECC). Available from: https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3-oesea3 [Accessed August 2022].

Ellis, J.R., Cruz-Martínez, A., Rackham, B.D. and Roger, S.I. (2004) The Distribution of Chondrichthyan Fishes around the British Isles and Implications for Conservation. Journal of Northwest Atlantic Fishery Science, 25: 195-213.

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012) Spawning and nursery grounds of selected fish species in UK waters. Lowestoft: Centre for Environment, Fisheries and Aquaculture Science (CEFAS). Report No. 147.

EMODnet (European Marine Observation and Data Network) (2021) Mapping European Seabed Habitats (MESH) Project. Available from: https://www.emodnet-seabedhabitats.eu/ [Accessed August 2022].

Environment Resource Technology (Scotland) Limited [ERT]. (2003a). Sediment hydrocarbon analyses of seabed sediments acquired in the DTI strategic environmental assessment area 2 (SEA2), central and southern North Sea, May/June 2001 (Report No. ERTSL 637/R004). ERT Limited.

Environment Resource Technology (Scotland) Limited [ERT]. (2003b). Sediment trace and heavy metals analyses of seabed sediments acquired in the DTI strategic environmental assessment area 2 (SEA2), central and southern North Sea, May/June 2001 (Report No. ERTSL 637/R005). ERT Limited.

Erbe C, Marley SA, Schoeman RP, Smith JN, Trigg LE & Embling CB (2019). The effects of ship noise on marine mammals - A Review. Frontiers in Marine Science 6: 606.

European Environment Agency [EEA]. (2022). EUNIS habitat type hierarchical view (marine version 2022 & terrestrial version 2021). https://eunis.eea.europa.eu/habitats-code-browser-revised.jsp?expand=30000,31361#level_31361

Finneran, J.J., Schlundt, C.E., Carder, D.A., Clark, J.A., Young, J.A., Gaspin, J.B. & Ridgway, S.H. (2000) Auditory and behavioural response of bottlenose dolphins (Tursiops truncatus) and a beluga whale (Delphinapterus leucas) to impulsive sounds resembling distant signatures of underwater explosions. J. Acoust. Soc. Am. 108 (1): 417 - 431

Fliessbach, K., Borkenhagen, K., Guse, N., Markones, N., Schwemmer, P., & Garthe, S. (2019). A Ship Traffic Disturbance Vulnerability Index for Northwest European Seabirds as a Tool for Marine Spatial Planning. Frontiers in Marine Science. 6. 10.3389/fmars.2019.00192.

Folk, R. L. (1954). The distinction between grain size and mineral composition in sedimentary-rock nomenclature. The Journal of Geology, 62(4), 344-359. https://doi.org/10.1086/626171

Fugro (2022a) Garrow and Helvellyn Pre-decommissioning Environmental Baseline, Helvellyn UKCS Blocks 42/25a and 43/21a, Pre-decommissioning Environmental Baseline Survey Period: 21 to 22 August 2022.

Fugro (2022b) Pre-Decommissioning Environmental Baseline Survey, Helvellyn Field Southern North Sea, Block 47/10, Habitat Report, Survey Period: 21 to 22 August 2022.

Gardline (2001). *UKCS 47/10 (Helvellyn) Herring Spawning Ground Survey* (Gardline Project Reference 5743.3) Gardline Surveys.

GEBCO (2014) General Bathymetric Charts of the Oceans, GEBCO 2014 Grid. Available from: https://www.gebco.net/news_and_media/gebco_2014_grid.html [Accessed August 2022].

Genesis (2011) Review and assessment of underwater sound produced by oil and gas activities and potential reporting requirements under the Marine Strategy Framework Directive, Genesis Oil and Gas Consultants. Report to DECC: J71656-Final Report-G2.

Golding, N., Albrecht, J. & McBreen, F. (2020). Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef. (Joint Nature Conservation Committee [JNCC] Report No. 656). JNCC, Peterborough. ISSN 0963-8091

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J., Øien, N. (2021) Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys, May 2017. [Online] Available from: https://synergy.st-andrews.ac.uk/scans3/2017/05/01/first-results-are-in/ [Accessed January 2023].

Hermannsen, L., Beedholm, K., Tougaard, J. and Madsen, P. T. (2014). High frequency components of ship noise in shallow water with a discussion of implications for harbour porpoises (Phocoena phocoena). J. Acoust. Soc. Am. 138, 1640–1653.

Hill, J.M. (2008) Antedon spp., solitary ascidians and fine hydroids on sheltered circalittoral rock. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme. Plymouth: Marine Biological Association of the United Kingdom.

Hydrographer of the Navy (2011). International Chart Series No. 2182B. North Sea – Southern.

IAMMWG (2013) Management Units for Marine Mammals in UK Waters (June 2013). Peterborough: Inter-Agency Marine Mammal Working Group, Joint Nature Conservation Committee.

IAMMWG (2021) Updated abundance estimates for cetacean Management Units in UK waters (May 2021) Peterborough: Joint Nature Conservation Committee (JNCC), Report No. 680ISSN 0963-8091.

Irving, R. (2009). The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop (Joint Nature Conservation Committee [JNCC] Report No. 432). JNCC, Peterborough. ISSN 0963-8091

IUCN (2022) The IUCN Red List of Threatened Species. Available from: http://www.iucnredlist.org/ [Accessed August 2022].

JNCC (2004) Developing regional seas for UK water using biogeographic principles. Report by Joint Nature Conservation Committee to the Department for Environment, Food and Rural Affairs (DEFRA), 12pp.

JNCC (2007) UK BAP Species and Habitat Review 2007 – Report by the Biodiversity Reporting and Information Group (BRIG) to the UK Standing Committee. JNCC, Peterborough.

JNCC (2010) The Protection of Marine European Protected Species from Injury and Disturbance. Guidance for the Marine Area in England and Wales and the UK Offshore Marine Area. Peterborough: Joint Nature Conservation Committee (JNCC).

JNCC (2018) The Greater Wash SPA. [Online] Available from https://jncc.gov.uk/our-work/greater-wash-spa/ [Accessed August 2022].

JNCC (2019) Marine habitat data product: Habitats Directive Annex I marine habitats. [Shapefile]. Available at: https://jncc.gov.uk/our-work/marine-habitat-data-product-habitats-directive-annex-i-marine-habitats/ [Accessed August 2022].

JNCC (2022a) Holderness Offshore MPA. [Online] Available from: https://jncc.gov.uk/our-work/holderness-offshore-mpa/ [Accessed August 2022].

JNCC (2022b) MPA Mapper. Available from: https://jncc.gov.uk/mpa-mapper?zoom=10&center=0.164,53.833&layerIds=56,81,55,45,74,48&baseLayerId=-2&activeFilters=.

JNCC and NE (2019) Harbour Porpoise (Phocoena phocoena) Special Area of Conservation: Southern North Sea Conservation Objectives and Advice on Operations. March 2019.

Joint Nature Conservation Committee [JNCC] (2019c). UK BAP Priority Habitats. https://jncc.gov.uk/our-work/uk-bap-priority-habitats/

Joint Nature Conservation Committee [JNCC] (2019d). UK BAP Priority Species. https://jncc.gov.uk/our-work/uk-bap-priority-species/

Joint Nature Conservation Committee [JNCC]. (2014). Monitoring, assessment and reporting of UK benthic habitats: A rationalised list (Joint Nature Conservation Committee [JNCC] Report No. 499). JNCC, Peterborough. ISSN 0963 8901

Joint Nature Conservation Committee [JNCC]. (2015). The marine habitat classification for Britain and Ireland Version 15.03.: https://mhc.jncc.gov.uk/about/.

Joint Nature Conservation Committee [JNCC]. (2018). Marine habitat correlation tables version 201801 – spreadsheet version 2018. https://hub.jncc.gov.uk/assets/62a16757-e0d1-4a29-a98e-948745804aec

Joint Nature Conservation Committee [JNCC]. (2019a). About Marine Protected Areas. https://jncc.gov.uk/our-work/about-marine-protected-areas/

Joint Nature Conservation Committee [JNCC]. (2019b). Marine Conservation Zones. https://jncc.gov.uk/our-work/marine-conservation-zones/

Jones, E.L., Morris, C. D., Smout, S. and McConnell, B. J. (2016) Population scaling in 5 km x 5 km grey and harbour seal usage maps. St. Andrews: Sea Mammal Research Unit. Available from: http://www.smru.standrews.ac.uk/smrudownloader/uk_seal_usage_of_the_sea [Accessed August 2022].

KIS-ORCA (2022) Interactive Map. Available from: http://www.kis-orca.eu/map#.Wa7Q8LpFyP8 [Accessed August 2022].

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L.J. and Reid, J.B. (2010) An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. JNCC Report, No. 431. JNCC, Peterborough.

Lawson J., Kober, K., Win, I., Allcock, Z., Black, J., Reid, J.B., Way, L. & O'Brien, S.H. (2016) An assessment of the numbers and distributions of wintering red-throated diver, little gull and common scoter in the Greater Wash. JNCC Report, No. 574. JNCC, Peterborough.

Leterme, S.C., Seuront, L. and Edwards, M. (2006) Differential contribution of diatoms and dinoflagellates to phytoplankton biomass in the NE Atlantic and the North Sea. Marine Ecology – Progress Series, 312, 57-65.

Lonergan, M., Duck, C.D., Thompson, D., Moss, S. and McConnell, B. (2011) British grey seal (Halichoerus grypus) abundance in 2008: an assessment based on aerial counts and satellite telemetry. ICES Journal of Marine Science, 68 (10): 2201-2209.

Marine Scotland (2022) 2021 Provisional Scottish Sea Fisheries Statistics - Fishing Effort and Quantity and Value of Landings by ICES Rectangles. Available from: https://data.marine.gov.scot/dataset/2021-scottish-sea-fisheries-statistics-fishing-effort-and-quantity-and-value [Accessed January 2023].

NMPi (2022) National Marine Plan Interactive. Available from: https://marinescotland.atkinsgeospatial.com/nmpi/ [Accessed August 2022].

McConnell, B.J., Fedak, M.A., Lovell, P. and Hammond, P.S. (1999) Movements and foraging of grey seals in the North Sea. Journal of Applied Ecology, 36: 573-590.

MMO (2021b) Marine Planning Evidence ArcGIS Map. [Online]. Available at: https://defra.maps.arcgis.com/apps/webappviewer/index.html?id=8cb1883eda5547c6b91b5d5e6aeba90d [Accessed August 2022].

MMO (Marine Management Organisation) (2022) UK sea fisheries annual statistics report 2021. September 2022. Available at: https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2021 [Accessed August 2022].

Natural England (2018) Citation for Greater Wash SPA. Available at: http://publications.naturalengland.org.uk/publication/4597871528116224 [Accessed July 2022]

NMFS (2016). Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: underwater acoustic thresholds for onset of permanent and temporary threshold shifts. National Marine Fisheries Service, U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178pp.

NOAA (2018) 2018 Revisions to: Technical guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum,

NMFS-OPR-59. https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance

NOAA (National Oceanic and Atmospheric Administration) (2013) Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals – Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. US Office of Commerce, Maryland (2013).

NSTA (2023) Carbon Storage [Online] Available from: https://www.nstauthority.co.uk/data-centre/nsta-open-data/carbon-storage/ [Accessed January 2023].

OGA (2021) Licence data, Available from: https://www.ogauthority.co.uk/data-centre/data-downloads-and-publications/licence-data/ [Accessed August 2022].

OGUK (2013) The Management of Marine Growth During Decommissioning. Aberdeen: UK Oil and Gas Industry Associated Limited. Available from: https://oilandgasuk.co.uk/product/the-management-of-marine-growth-during-decommissioning/ [Accessed August 2022].

OGUK (2019) Environmental Report 2019. Aberdeen: UK Oil and Gas Industry Associated Limited. Available from: https://oilandgasuk.cld.bz/Environment-Report-2019/ [Accessed August 2022].

OGUK Energy Transition Outlook 2021. https://oeuk.org.uk/wp-content/uploads/2021/10/Energy-Transition-Outlook-2021.pdf

Oil & Gas UK [OGUK], (2021a). UK benthos: Database of offshore benthic environmental surveys in the North Sea. Version 5.14. Oil & Gas UK.

Oil & Gas UK [OGUK], (2021b). UK benthos: Database of offshore benthic environmental surveys in the North Sea. Version 5.14. Oil & Gas UK.

Oslo and Paris Commission [OSPAR]. (2008). OSPAR List of threatened and/or declining species and habitats. Reference Number: 2008-06. http://www.ospar.org/workareas/ bdc/species-habitats/list-of-threatened-declining-species-habitats.

Oslo and Paris Commission [OSPAR]. (2008). OSPAR List of threatened and/or declining species and habitats. Reference Number: 2008-06. http://www.ospar.org/workareas/ bdc/species-habitats/list-of-threatened-declining-species-habitats.

OSPAR (2009) Overview of Impact of anthropogenic underwater sound in the marine environment. Biodiversity Series, OSPAR Commission, 2009.

OSPAR Commission (2010) Quality Status Report 2010. OSPAR Commission, London, 176pp.

OSPAR Commission (2021) List of Threatened and/or Declining Species & Habitats. Available from: http://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats [Accessed August 2022].

Palka DL & Hammond PS (2001). Accounting for responsive movement in line transect estimates of abundance. Canadian Journal of Fisheries and Aquatic Sciences 58: 777-787.

Pangerc, T., Robinson, S., Theobald, P. and Galley, L. (2016). Underwater sound measurement data during diamond wire cutting: First description of radiated noise. In Proceedings of Meetings on Acoustics 4ENAL (Vol. 27, No. 1, p.040012). ASA.

Popper, A., Hawkins, A., Fay, R., Mann, A., Bartol, S., Carslon, T., coombs, Sheryl., Ellison, W., Gentry, R., Halvorsen M., Lokkeborg, S., Rogers, P., Southall, B., Zeddies, D. Tavolga, W., Sound Exposure Guidelines for Fishes and Sea urtles: A technical report prepared by ANSI-Accredited Standards Committee. 2014.

Reid, J. B., Evans, P. G. H. and Northridge, S. P. (2003) Atlas of Cetacean distribution in north-west European waters. Peterborough: Joint Nature Conservation Committee (JNCC).

Richardson, W.J., Greene, C.R. Jr., Malme, C.I. and Thomson, D.H. (1995) Marine Mammals and Noise. Academic Press, San Diego.

RSPB (2022) Common Scoter [Online] Available from: https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/common-scoter/ [Accessed August 2022].

Russell, D.J.F., Jones, E.L. and Morris, C.D. (2017) Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science, 8 (25). DOI: 10.7489/2027-1.

RWE (2021) Triton Knoll Offshore Wind Farm generates first power. Available at: https://www.group.rwe/en/press/rwe-renewables/2021-03-01-triton-knoll-offshore-wind-farm-generates-first-power [Accessed June 2022].

Schwemmer, P., Mendel, B., Sonntag, N., Dierschke, V., and Garthe, S. (2011) Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning, Ecological Applications, Vol. 21, No. 5 (July 2011), pp. 1851-1860.

SCOS (Special Committee on Seals) (2020) Scientific advice on matters related to the management of seal populations: 2020. Available from: http://www.smru.st-andrews.ac.uk/scos/scos-reports/ [Accessed August 2022].

Sharples, R.J., Moss, S.E., Patterson, T.A. and Hammond, P.S. (2012) Spatial variation in foraging behaviour of a marine top predator (Phoca vitulina) determined by a large-scale satellite tagging program. PLoS ONE 7: e37216.

Southall B L, Finneran J J, Reichmuth C, Nachtigall P E, Ketten D R, Bowles A E, Ellison W T, Nowacek D P, Tyack P L (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. & Tyack, P.L. (2007) Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals. 33: 411–521.

Tillin, H. and Tyler-Walters, H. (2014) Assessing the sensitivity of subtidal sedimentary habitats to pressures associated with marine activities. Phase I Report – Rationale and proposed ecological groupings for Level 5 biotopes against which sensitivity assessments would be best undertaken. JNCC Report No.512 A.

Tillin, H.M., Marshall, C., Gibb, N. & Garrard, S. L. (2022). *Sabellaria spinulosa* on stable circalittoral mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: https://www.marlin.ac.uk/habitat/detail/377

Turnpenny, W.H. and Nedwell, J.R. (1994). The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sound Generated by Seismic Surveys.UKHO (UK Hydrographic Office) (2013) North Sea (West) Pilot: East coasts of Scotland and England from Rattray Head to Southwold. 9th edition. The Hydrographer of the Navy, UK 232pp.

Tyler-Walters, H., Lear, D., and Allen, J. H. (2004). Identifying offshore biotope complexes and their sensitivities.
Tyler-Walters, H. (2008) *Pomatoceros triqueter*, *Balanus crenatus* and bryozoan crusts on mobile circalittoral cobbles and pebbles, Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme. Plymouth: Marine Biological Association of the United Kingdom.

UKHO (UK Hydrographic Office) (2013) North Sea (West) Pilot: East coasts of Scotland and England from Rattray Head to Southwold. 9th edition. The Hydrographer of the Navy, UK 232pp.

United Kingdom Offshore Operators Association (UKOOA). (2001). An analysis of UK offshore oil and gas environmental gas surveys 1975-95. The United Kingdom Offshore Operators Association.

Webb, A., Elgie, M., Irwin, C., Pollock, C. and Barton, C. (2016) Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK. Available from: http://jncc.defra.gov.uk/page-7373.

Appendix A: Marine Planning Objectives and Policies

Table A.1. Marine Planning Objectives and Policies Relevant to the Proposed Helvellyn Decommissioning Operations

Relevant Objectives	Associated Policies	Project Compliance
Economic Productivity - To promote the sustainable development of economically productive activities, taking account of spatial requirements of other activities of importance to the East marine plan areas.	EC1 - Proposals that provide economic productivity benefits which are additional to Gross Value Added currently generated by existing activities should be supported.	WPRL has submitted a CoP application to the NSTA and are now seeking approval to decommission the Helvellyn infrastructure. WPRL has explored alternative uses for the Helvellyn facilities, including the possibility for in situ re-use or redevelopment, however none were found viable.
Employment and Skill Levels - To support activities that create employment at all skill levels, taking account of the spatial and other requirements of activities in the East marine plan areas.	EC2 - Proposals that provide additional employment benefits should be supported, particularly where these benefits have the potential to meet employment needs in localities close to the marine plan areas.	Where possible and not economically detrimental the proposed decommissioning work will utilise local contractors.
Heritage Assets - To conserve heritage assets, nationally protected landscapes and ensure that decisions consider the seascape of the local area.	SOC2 - Proposals that may affect heritage assets should demonstrate, in order of preference: a) that they will not compromise or harm elements which contribute to the significance of the heritage asset; b) how, if there is compromise or harm to a heritage asset, this will be minimised; c) how, where compromise or harm to a heritage asset cannot be minimised it will be mitigated against, or; d) the public benefits for proceeding with the proposal if it is not possible to minimise or mitigate compromise or harm to the heritage asset. SOC3 - Proposals that may affect the terrestrial and marine character of an area should demonstrate, in order of preference: a) that they will not adversely impact the terrestrial and marine character of an area; b) how, if there are adverse impacts on the terrestrial and marine character of an area, they will minimise them;	The proposed decommissioning operations are not anticipated to have an impact on any heritage assets. As the Helvellyn infrastructure is subsea, any impact to the seascape of the local area will be temporarily as a result of vessels on location during the removal activities.

Relevant Objectives	Associated Policies	Project Compliance
	c) how, where these adverse impacts on the terrestrial and marine character of an area cannot be minimised they will be mitigated against; d) the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.	
Healthy Ecosystem - To have a healthy, resilient and adaptable marine ecosystem in the East marine plan areas.	ECO1 - Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be addressed in decision-making and plan implementation.	No significant cumulative impacts are predicted to occur. Refer to Section 6.4
	ECO2 - The risk of release of hazardous substances as a secondary effect due to any increased collision risk should be taken account of in proposals that require an authorisation.	In the unlikely event of an accidental release of hydrocarbons or chemicals the impact to the marine environment is not anticipated to be significant. Refer to Section 5.4.4.1.
Biodiversity - To protect, conserve and, where appropriate, recover biodiversity that is in or dependent upon the East marine plan areas.	BIO1 - Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence including on habitats and species that are protected or of conservation concern in the East marine plans and adjacent areas (marine, terrestrial).	The proposed decommissioning operations will not significantly impact biodiversity. Refer to Section 6.
Marine Protected Areas (MPAs) - To support the objectives of MPAs (and other designated sites around the coast that overlap, or are adjacent to the East marine plan areas), individually and as part of an ecologically coherent network.	MPA1 - Any impacts on the overall MPA network must be taken account of in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network	The proposed decommissioning operations will not pose a risk of adversely affecting (either directly or indirectly) the integrity of any MPA, either alone or in combination with other plans or projects. Refer to Section 7.
Governance - To ensure integration with other plans, and in the regulation and management of key activities and issues, in the East marine plans, and adjacent areas.	GOV2 - Opportunities for co-existence should be maximised wherever possible.	Residual effects on other sea users resulting from the physical presence of vessels on location at Helvellyn during the proposed decommissioning operations are predicted to be Negligible and not significant. In addition, removal of the WHPS and associated 500 m safety exclusion zone will result in positive effects as the area will become available to other sea users again. Refer to Section 6.1
	GOV3 - Proposals should demonstrate in order of preference: a) that they will avoid displacement of other existing or authorised (but yet to be implemented) activities; b) how, if there are adverse impacts resulting in displacement by the proposal, they will minimise them; c) how, if the adverse impacts resulting in displacement by the proposal, cannot be minimised, they will be mitigated against or; d) the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts of displacement.	