Wenlock Environmental Appraisal Report

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Abbreviations

AHV	Anchor Handling Vessel
AIS	Automatic Identification System
APRL	Alpha Petroleum Resources Limited
BEIS	Department of Business, Energy and Industrial Strategy
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CoP	Cessation of Production
DP	Decommissioning Programme
DSV	Diving Support Vessel
EA	Environmental Appraisal
EPS	European Protected Species
ERL	Effect Range Low
ERM	Effect Range Median
ERRV	Emergency Response and Rescue Vessel
ESAS	European Seabirds at Sea
EUNIS	European Nature Information Systems
FBE	Fusion Bonded Epoxy
FCS	Favourable Conservation Status
HCF	Hydrocarbon Free
HLV	Heavy Lift Vessel
ICES	International Council for the Exploration of the Sea
ICPOES	Inductively Coupled Plasma Optical Emission Spectrometry
JNCC	Joint Nature Conservation Committee
JUWB	Jack-up Work Barge
KP	Kilometre Point
MCV	Monohull Crane Vessel
MESH	Mapping European Seabed Habitats
MoD	Ministry of Defence
MSV	Multi-Purpose Support Vessel
MUs	Management Units
NNS&SR	North Norfolk Sandbanks and Saturn Reef
NORM	No Naturally Occurring Radioactive Material
NUI	Normally Unmanned Installation
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

PAH	Polycyclic Aromatic Hydrocarbons
P&A	Plug and Abandonment
PEXA	Practice and Exercise Area
PTS	Permanent Threshold Shift
PUK	Perenco UK Limited
ROV	Remotely Operated Vehicle
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
SLV	Shear Leg Vessel
SNCBs	Statutory Nature Conservation Bodies
SNS	Southern North Sea
SOPEPs	Shipboard Oil Pollution Emergency Plans
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area
SSCV	Semi-Submersible Crane Vessel
SSS	Side Scan Sonar
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
TTS	Temporary Threshold Shift
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association (now OGUK)
VTS	Viking Transportation System

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 Alpha Petroleum Resources Limited (APRL) for the decommissioning of the Wenlock installations and pipelines located in United Kingdom Continental Shelf (UKCS) Blocks 49/12, 49/18 and 49/23 in the Southern North Sea (see Figure 1.1).

The Wenlock gas field was first discovered in 1974. The Wenlock platform, a three slot Normally Unmanned Installation (NUI), was installed in 2006 with a design life of 15 years and the first well was drilled and started production in 2007. Two subsequent wells were drilled and started production in 2008 and 2009. Production has since declined making the installation uneconomic and a Cessation of Production (CoP) application has been approved by Oil and Gas Authority (OGA).

The Wenlock platform is located in UKCS Block 49/12 and is tied back to the Perenco UK Limited (PUK) operated Indefatigable 49/23AC (Inde 23A) platform via a 37 km, 8 inch pipeline (PL2355). APRL is the Well Operator for Wenlock and PUK is the appointed Installation Operator and Pipeline Operator. Chemicals for hydrate and corrosion inhibition are supplied from the Inde 23A platform via a dedicated 3-inch pipeline (PL2356), which is piggy-backed to the PL2355 pipeline. The pipelines are fully trenched and buried up to a short transition section coming back to the surface in the approaches to the Wenlock and Inde 23A platforms, including the tie-in spools, and at one mid-line crossing location. In addition, several locations along the route of the pipelines have been rock dumped, as well as being trenched, in order to provide down force on the pipelines to prevent any upheaval buckling.

Approximately mid-way along the pipeline route is a tee protection structure, not piled to the seabed, which is partially buried with the structure lid visible above the natural seabed.

A legacy subsea appraisal well (49/12a-8) is also located within the Wenlock 500 m safety zone, which has a 30 inch diameter conductor protruding approximately 3.2 m above the natural seabed.

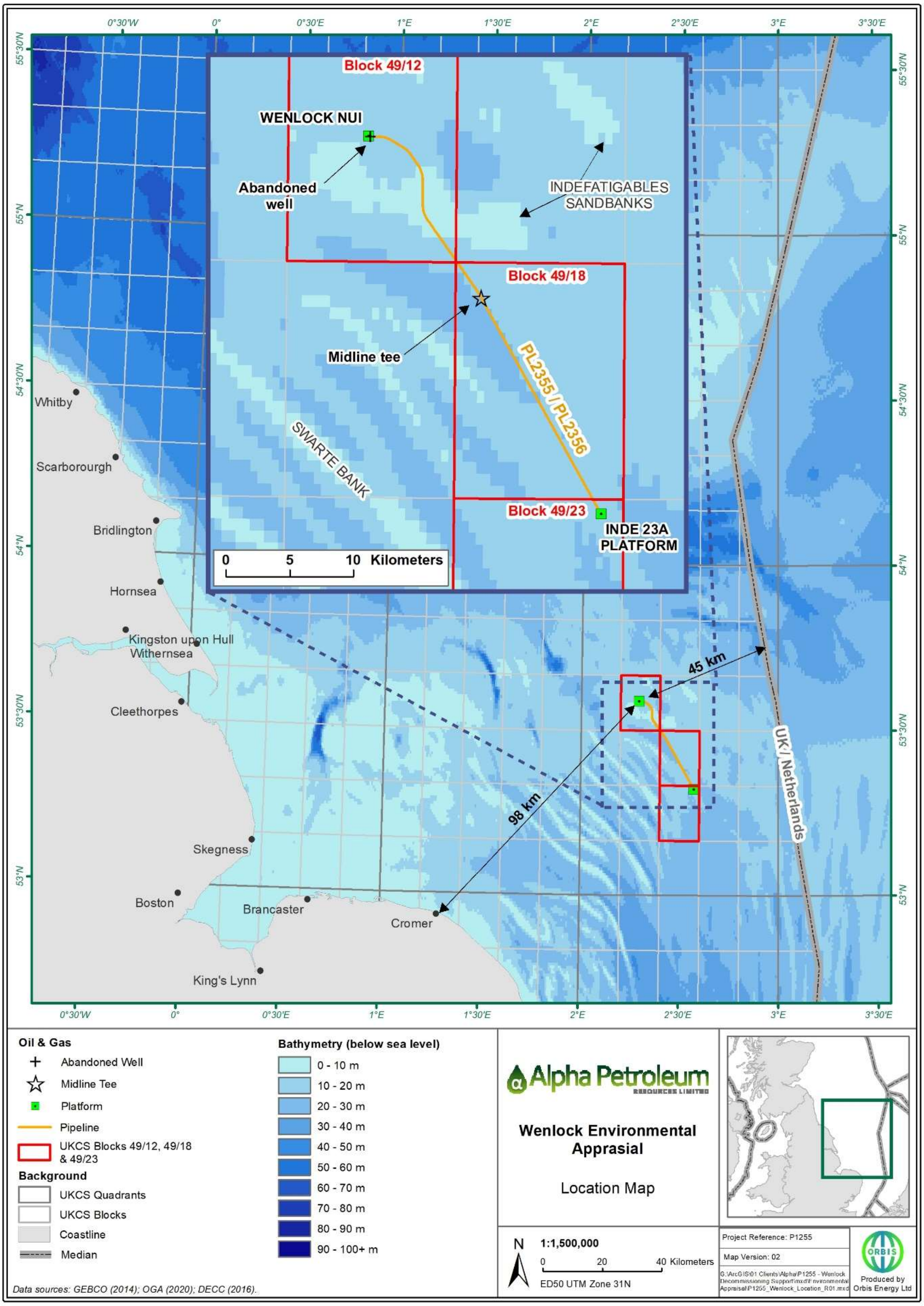
A summary of the Wenlock infrastructure being decommissioned and therefore within the scope of the Wenlock Decommissioning EA is provided in Table 1.1.

Table 1.1. Summary of Wenlock Infrastructure Being Decommissioned

Installation	Weight	UKCS Block	Co-ordinates (WGS84)
Wenlock platform (fixed steel jacket)	435 tonnes (topside weight) 645 tonnes (jacket weight)	49/12	53° 35.1983'N; 2° 34.2976' E
Legacy appraisal well (49/12a-8)	2.2 tonnes of conductor above seabed	49/12	53° 35’ 18.12”N; 2° 17’ 51.11”E
Mid-line tee structure	5.4 tonnes	49/18	53° 28’ 29.23”N; 2° 25’ 49.65”E

Pipeline	Length	From – To End Points	Burial Status
Gas Export Pipeline (PL2355)	37 km	Wenlock platform – Inde 23A platform riser flange where the pipeline and riser is connected	Fully trenched and buried up to tie-in spools
Chemical Injection Pipeline (PL2356)			

Figure 1.1. Wenlock 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 outlines in detail the infrastructure being decommissioned and the method by which the decommissioning will take place and is supported by the EA. For Wenlock, the EA supports the following two DPs: the Wenlock Field Installations DP and the Wenlock Pipelines 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 Wenlock Platform

OSPAR decision 98/3 specifically prohibits the dumping or leaving in place of installations in the marine environment and requires that the topsides of all installations must be returned to shore and all steel installations with a jacket weight less than 10,000 tonnes in air, which is the case for the Wenlock platform, must be completely removed for re-use, recycling or final disposal on land.

The removal methods which are currently being considered by APRL for the Wenlock platform are summarised in Table 1.2. A final decision on the removal method will be made following an engineering feasibility and commercial tendering process. As the preferred removal option has not yet been selected, the EA has assessed the option which results in a worst-case scenario in terms of environmental and societal effects.

Table 1.2. Decommissioning Strategy and Removal Options for Wenlock Platform

Installation	Decommissioning Strategy	Removal Options	Worst-case Scenario Assessed
Topside	The topside will be removed by a lift vessel and returned to shore. Re-use followed by recycle and then landfill will be the prioritised options for disposal.	1. Single lift removal along with jacket using a Semi-Submersible Crane Vessel (SSCV), Monohull Crane Vessel (MCV) or Shear Leg Vessel (SLV) 2. Single lift removal using a SSCV, MCV or SLV 3. Piece-small or piece large removal using a Jack-up Work Barge (JUWB)	The topside structure will be removed by an anchored HLV. The HLV will be towed to site using tugs and a separate anchor handling vessel (AHV) will be used to moor the HLV in place. To separate the topside from the jacket an oxygen acetylene torch will be used. The HLV will then lift the topside off and place it onto a barge for transport to shore.
Jacket	Once the topside has been removed the piles will be cut 3 m or greater below the seabed, slings attached and the jacket lifted and returned to shore to be dismantled at an onshore location. Re-use followed by recycle will be the prioritised options.	1. Single lift removal along with jacket using a SSCV, MCV or SLV 2. Single lift removal using a SSCV, MCV or SLV 3. Piece-small or piece large removal using JUWB	The piles will be cut internally using an abrasive cutting tool system. Prior to this the piles will be dredged to remove the soil inside the jacket skirts. The dredging tool will be deployed from a Diving Support Vessel (DSV). A remotely operated vehicle (ROV) will be used for assistance when running the dredging tool into the jacket sleeves. The jacket will then be removed by an anchored HLV, which will be towed to site using tugs. A separate AHV will be used to moor the HLV in place. The HLV will lift the jacket and place it onto a barge for transport to shore.

In preparation for removal of the Wenlock facilities a series of preparatory works will be undertaken, including well plug and abandonment and topside and pipelines hydrocarbon freeing activities. These activities are outside the scope of the EA and will be consented under appropriate environmental permits and consents.

1.3.2 Wenlock Pipelines and Associated Subsea Infrastructure

OSPAR decision 98/3 does not include the decommissioning of pipelines, and there are no international guidelines on the decommissioning of disused pipelines. APRL has therefore undertaken a Comparative Assessment (CA) in order to arrive at an optimal decommissioning solution for the Wenlock pipelines, mid-line tee structure and associated protective material (rock, mattresses and grout 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 Wenlock Pipelines and Associated Subsea Infrastructure

Infrastructure	Decommissioning Strategy	Main Reasons for Selection
Gas Export Pipeline (PL2355) and Chemical Injection Pipeline (PL2356)	Pipeline left cleaned and main trenched and buried sections, including those sections protected by rock dump to be left in situ.	The pipelines are already trenched and buried to > 0.6m, is in a stable state and no snagging events or damage has been reported during their operational life. In a flooded condition (as would be the decommissioned left in situ state) the pipelines are negatively buoyant and so no upward movement of the pipelines would be expected. No significant seabed (sandwave, megaripples) migration has been experienced during the life of the field.
Spoil sections, mattresses and grout bags at Wenlock and Indefatigable platform approaches	Riser to spool goose neck sections of pipeline, concrete protection mattresses and underlying pipeline sections and grout bags at the Wenlock and Indefatigable platform 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. 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.
Mid-line tee structure	The cover, protection frame and any valve stems that are not buried to 0.6m below natural seabed level to be removed and returned to shore for recycling or disposal. A combination of localised dredging, hydraulic cutter and lifting from a vessel crane will be required to remove the structure. The mattresses and gravel bags located around the outside of the protection structure will remain in situ. The tee manifold pipework will also remain in situ as it is not directly connected to the protection structure and is currently buried to a depth greater than 0.6m below natural seabed.	The recommendation from the CA was to remove the protection structure cover only and leave the remaining infrastructure in situ flush with the natural seabed level. However, subsequent consultation with OPRED has flagged that the mid-line tee protection structure is classed as an installation and is therefore subject to international obligations for decommissioning under the terms of OSPAR Decision 98/3. As such, full removal of the mid line tee protection structure is required. This was identified as an acceptable option in the CA and removes the legacy snagging risk associated with the mid-line tee structure.

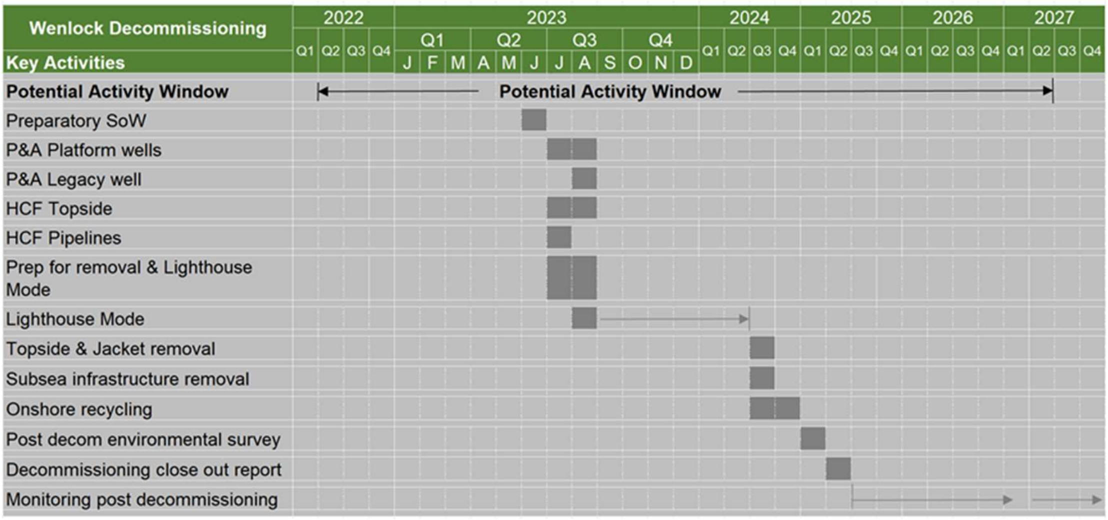
1.3.3 Legacy Appraisal Well

APRL proposes to fully abandon the legacy appraisal well by setting two further plugs in line with regulations. The P&A activity falls outside the scope of the EA and will be consented under appropriate environmental permits and consents. Once the well is fully abandoned, the conductor will be severed internally using an abrasive cutting tool system to at least 3 m below the natural seabed level and removed to prevent it becoming a potential seabed obstruction. No external excavation will be required. The jack-up vessel utilised to P&A the well will execute the cut and recover the conductor via crane. The conductor will then be returned to shore for reuse or recycling.

1.3.4 Project Schedule

The proposed Wenlock decommissioning work is scheduled to be undertaken sometime between 2022 and 2027. An indicative schedule for the work is shown in Figure 1.2.

Figure 1.2. Indicative Wenlock Decommissioning Schedule



1.4 The Baseline Environment

An overview of the key environmental and societal features in the vicinity of the Wenlock 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 Wenlock pre-decommissioning environmental baseline and habitat assessment survey conducted in March 2020.

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

Feature	Description
Physical Features	
Location	The proposed Wenlock decommissioning activities are located within UKCS Block 49/12 (Wenlock platform and legacy appraisal well), Block 49/18 (mid-line tee structure) and Block 49/23 (Inde 23A platform). The Wenlock platform is located approximately 97 km north east from the Norfolk coast and 45 km south west of the UK / Netherlands median line. The Inde 23A platform is located approximately 88 km north east from the Norfolk coast and 31 km south west of the UK / Netherlands median line.
Bathymetry	The seabed in the vicinity of the Wenlock infrastructure is flat lying and decreases in gradient from the northwest to southeast. The water depth at the Wenlock platform is 25.1 m LAT. Water depths along the route of the Wenlock pipelines range from 17.5 m to 31.2 m LAT, reaching a peak elevation as the pipelines cross one of the Indefatigable sandbanks at around kilometre point (KP) 5.5 – KP 9.5.
Seabed Sediments	Seabed sediments in the vicinity of the Wenlock platform are comprised of sandy gravel, with occasional patches of disturbed seabed observed in the western part of the area. Along the pipelines, the start of the route is composed of sandy gravel and gravelly sand. The section crossing the sandbank (KP 4.400 to 13.600) is mostly composed of sand at the exception of the summit where coarser material (gravelly sand to gravel) was reported. The section between KP 13.600 to 27.600 comprises sandy gravel / gravelly sand, while the last section of the route, towards the Inde 23A platform, was interpreted as a sandy seabed. Physio-chemical analysis of seabed sediment samples collected during the 2020 pre-decommissioning survey found that all stations sampled had low Total Organic Carbon (TOC) levels representative of an organically-deprived environment, which is typical for the Southern North Sea region due to the dominance of the sand/gravel fractions. No stations showed Total hydrocarbon content (THC) levels in excess of the OSPAR (2006) 50mg.kg^{-1} threshold for THC, used to delineate the chemical boundaries of cuttings piles and above which impacts on the biota may occur (BSL, 2020a). Polycyclic aromatic hydrocarbons (PAH) concentrations at all stations within 500m of the Wenlock platform exceeded the UKOOA 50th percentile for the Southern North Sea of 0.07 mg.kg^{-1}, although the results were attributed to diffuse impact from riverine plumes and shipping traffic rather than drilling related. Metal concentrations were elevated above background levels for all metals at almost every station. However, correlations between metals and sand and gravel, suggested variability in metals concentrations was natural and influenced by sediment characteristics across the survey area.
Oceanography	Tides in the southern North Sea are predominately semi-diurnal and tidal waters offshore in this area of the southern North Sea flood southwards and ebb northwards. Surface tidal streams in the vicinity of the Wenlock infrastructure are a maximum of 0.5 and 0.4 m/s respectively for spring and neap tides. The annual mean significant wave high in the vicinity the proposed decommissioning work ranges from 1.52 m to 1.60 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 Wenlock infrastructure lies within the boundary of two MPAs: North Norfolk Sandbanks and Saturn Reef SAC and Southern North Sea SAC. The Wenlock platform and approximately 28.6 km of the route of the Wenlock pipelines, including the mid-line tee structure, is located within the boundary of the North Norfolk Sandbanks and Saturn Reef SAC, designated for the protection of Annex I sandbanks and biogenic reef. In addition, the Wenlock platform and approximately 16.5 km of the route of the Wenlock pipelines, excluding the mid-line tee structure, is located within the boundary of the Southern North Sea SAC, designated for the protection of harbour porpoises

Feature	Description
Plankton	The phytoplankton community in this region of the southern North Sea is dominated by the dinoflagellate genus *Ceratium* (*C. fusus*, *C. furca*, *C. lineatum*), 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	Based on the ground-truthing data obtained during 2020 pre-decommissioning survey, two European Nature Information System (EUNIS) habitat classifications were assigned for the survey area, 'Circalittoral Coarse Sediment' (SS.SCS.CCS/A5.14) within the Wenlock 500 m zone and 'Circalittoral Fine Sand' (SS.SCS.CFiSa/A5.25) along the route of the pipelines. Observed fauna within areas of Circalittoral Coarse Sediment included Annelida (Serpulidae, *Lanice conchilega, Sabellaria spinulosa*), Cnidaria (*Alcyonium digitatum, Hydrallmania falcata*), Arthropoda (*Pagurus bernhardus, Cancer pagurus, Carcinus maenas,* Cirripedia), Echinodermata (*Asterias rubens, Ophiuroidea sp.*), Mollusca (observed as siphons protruding from the seabed) and Bryozoa (*Flustra foliacea*, Bryozoa turf). Observed fauna within areas of Circalittoral Fine Sand included Echinodermata (*Asterias rubens,* Ophiuroidea sp., Spatangoidea sp.) Cnidaria (possible *Cerianthus lloydii,*), Arthropoda (*Pagurus bernhardus, Corystes cassivelaunus*), and Mollusca (observed as siphons protruding from the seabed). Macrofanual analysis of seabed sediment samples collected during the 2020 pre-decommissioning survey found that species richness and faunal abundance varied within the survey area, reflecting the change in sediment type between the Wenlock platform and along the route of the pipelines. A total of 764 individuals (infauna and solitary epifauna) were identified from the 18 samples analysed. Of the 110 taxa recorded, five were solitary epifauna, and 96 were infaunal. Comparison with the 2005 pre-drill survey revealed a similar trend to that seen with the 2020 pre decommissioning survey, indicating that there has been little impact to the benthic communities at the comparable stations as a result of the construction and operation of the Wenlock field. The Annex I habitat *Sabellaria spinulosa* reef is a qualifying feature of the North Norfolk Sandbanks and Saturn Reef SAC, is a UK BAP priority marine habitat and is also listed on the OSPAR List of Threatened and/or Declining Species. During the 2020 pre-decommissioning survey, the presence of *S. spinulosa* was observed on the camera transects taken to the north west of the Wenlock platform. An assessment of 'reefiness' was subsequently performed which confirmed a variable level of reefiness, with one main reef area being identified, which consisted of approximately 55% 'Low Reef' structures, 34% 'Medium Reef' structures, and 11% 'Not a Reef' structures. The patches within this area were very variable and as such could not be broken down further, however with an area of approximately 7,000m^2, this reef would be considered an area of 'Low Reef' regardless of whether the reef was classified as low or medium structure. Further areas of disturbed sediment with the potential to contain *S. spinulosa* reef were delineated from the geophysical data within the vicinity of the Wenlock platform. These areas were assigned a 'worst case' level of potential reefiness, resulting in a total of six areas of potential 'Low Reef' and one area to the south east of the Wenlock platform that has delineated as 'Potential Low-Medium Reef'. *S. spinulosa* was not observed along the route of the pipelines.
Fish	Species likely to spawn within the vicinity of the Wenlock infrastructure include cod (*Gadus morhua*), herring (*Clupea harengus*), lemon sole (*Microstomus kitt*), mackerel (*Scomber scombrus*), the crustacean *Nephrops* also known as the Dublin Bay Prawn, plaice (*Pleuronectes platessa*) (at high intensity), sandeel (*Ammodytes* spp.), sole (*Solea solea*) and sprat (*Sprattus sprattus*). The proposed location is a likely nursery ground for anglerfish (*Lophius piscatorius*), cod, herring, horse mackerel (*Trachurus trachurus*), lemon sole, mackerel, *Nephrops*, sandeel, sprat, spiny dogfish (*Squalus acanthias*), tope shark (*Galeorhinus galeus*), and whiting (*Merlangius merlangus*) (at high intensity). Additionally, age 0 group fish are defined as fish in the first year of their lives and can also be classified as juvenile. The Wenlock infrastructure is located in an area of moderate probability of 0 group fish for herring, horse mackerel, mackerel and whiting, and low probability for anglerfish, blue whiting (*Micromesistius poutassou*), cod, haddock (*Melanogrammus aeglefinus*), hake (*Merluccius merluccius*), Norway pout (*Trisopterus esmarkii*), plaice, sole and sprat.

Feature	Description
Seabirds	The offshore waters of the southern North Sea 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 Wenlock infrastructure are guillemot (*Uria aalge*) in the breeding season, guillemot and razorbill (*Alca torda*) over winter, and guillemot during the post breeding dispersal period. In addition, during the summer of 2020, APRL recorded kittiwake nesting on the steel work below the helideck on the Wenlock platform. Approximately 45 to 50 nests were counted in July, with adults observed rearing their chicks. It is therefore acknowledged that nesting kittiwake could be present on the Wenlock topside in future years, potentially between the months of April and September. The Wenlock infrastructure also falls within the breeding season foraging ranges of several seabird species including, European storm petrel (*Hydrobates pelagicus*), Northern fulmar (*Fulmarus glacialis*), Manx shearwater (*Puffinus puffinus*), Northern gannet (*Morus bassanus*), black-legged kittiwake (*Rissa tridactyla*), lesser black-backed gull (*Larus fuscus*), great skua (*Stercorarius skua*) and Atlantic puffin (*Fratercula arctica*). An assessment of the medium seabird sensitivity to oil pollution scores for the blocks of interest within which the Wenlock infrastructure is located, indicates that sensitivity is generally low between August and October, and May and June, high to low between November and April, and extremely high to low in June.
Marine Mammals	Harbour porpoise (*Phocoena phocoena*) and white-beaked dolphin (*Lagenorhynchus albirostris*) are considered to be regularly occurring in the southern North Sea and both species have been observed in the vicinity of the Wenlock area. Minke whale (*Balaenoptera acutorostrata*) is also a frequent seasonal visitor. The Wenlock platform is located within the northern two thirds of the Southern North Sea SAC which is recognised as important for harbour porpoises during the summer season (April to September). The distribution of grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) in the vicinity of the Wenlock infrastructure is very low (< 1 individual per 25 km^2).
Societal Aspects	
Fisheries	The Wenlock infrastructure is located within International Council for the Exploration of the Sea (ICES) Statistical Rectangles 35F2 and 36F2. Fishing effort is relatively low in ICES Rectangle 36F2, with the mean annual fishing effort between 2011 and 2018 at only 114 days. Fishing effort is highest in May, August and September. The majority of fishing effort is from trawlers followed by traps. Landings data (by weight) indicates that catches are largely composed of demersal species (76%) followed by pelagic species (24%). The most commonly caught species are plaice, *Nephrops* and sole. In-depth fisheries statistics for ICES Rectangle 35F2 are only available for the years 2011 to 2013 for effort and 2011 to 2012 for landings. This suggests that fishing effort within ICES Rectangle 35F2 is very low, with an average of 46 days fished per year. Landings data demonstrate that catches (by weight) are largely composed of demersal species (57%), followed by pelagic species (40%) and shellfish (3%). The most commonly caught species are sprat, plaice and sole.
Shipping	Shipping activity is high in the vicinity of the Wenlock platform, predominantly comprised of cargo ships and offshore support vessels.
Oil and Gas Activity	The Wenlock field 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 installation are currently being decommissioned.
Offshore Renewables	The Hornsea Project Three (Status: Consented) and Hornsea Project One (Status: Operational) wind farm turbine areas (Operator: Ørsted) are located ca. 25 km north-east and 27 km north-west respectively of the Wenlock platform. The planned Hornsea Project Three export cable corridor is located 9 km north-west of the Wenlock infrastructure and the active Hornsea Project One export cables are located 25 km north-west. In addition, the Norfolk Boreas (Status: In-planning) and the Norfolk Vanguard West (Status: Consent granted but subject to re-determination) wind farm areas are being developed by Vattenfall Wind Power Ltd and are located ca. 26 km south east and 31 km south respectively of the Inde 23A platform.
Military activities	The Wenlock area overlaps with a Ministry of Defence Royal Airforce Practice and Exercise Area (PEXA).

Feature	Description
Wrecks	No historically significant wrecks are located in the vicinity of the Wenlock infrastructure and no wrecks were observed during the 2020 pre-decommissioning survey.
Cables	The active 'Norsea communications' telecom cable (Operator: Tampnet AS) crosses the Wenlock pipelines at KP14.45.
Aggregate and Dredging Activity	Humber 5 (Area no.: 483), Humber 4/7 (Area no.: 506) and Humber 3 (Area no.: 484) aggregate areas are located approximately 4 km north-east, 18 km north-west and 21 km south-west at nearest point respectively from the Wenlock infrastructure

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 Wenlock decommissioning activities (both from planned (routine) activities and unplanned (accidental) events), the APRL 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 Wenlock infrastructure is located within the boundary of the North Norfolk Sandbanks and Saturn Reef SAC and Southern North Sea SAC, an assessment was undertaken to determine whether there will be any likely significant effects on the conservation objectives of these MPAs as a result of the proposed Wenlock 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 1.4.2.

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 Wenlock 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 Wenlock 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. As the export pipeline and chemical injection pipeline will be flushed and depressurised as part of the preparatory works, any release 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. It is acknowledged that as the pipelines will be decommissioned in situ they will degrade overtime and contaminants contained within the pipeline material (e.g. coating) may be released into the marine environment. However, any releases are expected to occur in very small quantities, over a long period of time. Additionally, since the pipelines are fully trenched and buried, the pathway for contaminant releases will be limited.
Waste Management	The impacts of waste management are largely onshore and therefore outside the scope of the EA; however, APRL will ensure: • The principles of the Waste Management Hierarchy are followed, focusing on the reuse and recycling of wastes where possible; • Licensed waste contractors will be used; • A project Waste Management Plan will be in place to ensure compliance with relevant waste regulations; • 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; • If NORM is encountered, APRL will ensure appropriate Radioactive Substance Regulation permits are in place; • Marine growth will be removed by high pressure cleaning offshore, where necessary and practicable, with any remaining marine growth removed onshore at a dismantling yard, with appropriate odour control measures implemented.
Accidental Events (accidental releases & dropped objects)	Prior to the proposed decommissioning activities commencing, the Wenlock facilities will be 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. The risk of collision is considered 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 Wenlock platform. An approved OPEP will be in place prior to the proposed Wenlock decommissioning activities commencing and any spills from vessels in transit or working outside of existing 500m zones are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). The proposed Wenlock 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 Wenlock and Inde 23A platforms. These zones are clearly marked on navigation charts and have been in place for a number of years. If an anchored HLV is used to remove the platform, the anchor lines are likely to extend outside the exclusion zone, although this should not present a significant hazard to shipping or fishing vessels as they are unlikely to transit immediately adjacent to an existing exclusion zone. 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 Wenlock platform has been removed, the 500 m safety exclusion zone surrounding the platform 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, APRL is proposing to remove any exposed subsea infrastructure. The majority of the pipelines are currently buried to a depth well in excess of 0.6 m, with little change seen in their profile when comparing the 2020 pre-decommissioning survey and operational life interim general inspection surveys with the original as trenched surveys. 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 pipelines will be left in situ in a flooded condition no upward movement is expected. As such, the residual risk to commercial fishing from the legacy of infrastructure decommissioned in situ, namely the pipelines and associated stabilisation material is therefore predicted to be Low and not significant.

Prior to removal, the physical presence of the Wenlock platform has the potential to provide nesting habitat to breeding seabirds, which forage in the southern North Sea. Black-legged kittiwake (*Rissa tridactyla*) have previously nested on the platform and therefore the presence of this species during the breeding season (April to September) cannot be ruled out. It is an offence to deliberately disturb wild birds or take, damage or destroy the nest of any wild bird while that nest is being used or built or take or destroy an egg of any wild bird. Effects on nesting birds from the removal of the Wenlock topside during the breeding bird season are therefore predicted to be Moderate and significant without the application of mitigation measures. APRL therefore proposes to programme topside removal activities outside of the breeding bird season, if possible. By programing the Wenlock topside removal activities outside of the breeding bird season, residual effects on nesting birds from the removal of the Wenlock platform are therefore predicted to be Negligible and not significant. In the event an opportunity arises to use a lift vessel during the breeding season, the platform will be checked by a qualified ornithologist for the presence of nesting birds and the results shared with OPRED to ascertain if it is possible for a Wild Birds Licence to be granted to allow the works to go ahead.

1.5.2.2 Seabed Disturbance

It is estimated that the total area of seabed likely to be temporary disturbed by the proposed decommissioning activities is ca. 75,565 m^2 (0.08 km^2). The majority of this disturbance will be as a result of anchoring of the HLV during removal of the platform, footprint of the jack-up vessel used to P&A the wells and remove the legacy appraisal well conductor, removal of the mid-line tee protection structure and removal of the exposed pipeline sections / tie-in spools, including the mattresses and gravel bags at the approaches to the Wenlock and Inde 23A platforms. The jacket legs and legacy appraisal well conductor will be cut internally, to avoid any additional seabed disturbance from external excavation activities.

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 Wenlock infrastructure will also facilitate the restoration of the seabed back to its natural state. Of note is one aggregation of potential *S. spinulosa* biogenic reef, classified as having low reefiness, was identified approximately 446 m to the north west of the Wenlock platform from the camera transects obtained during the 2020 pre-decommissioning survey. In addition, a further six areas exhibiting potential low reefiness and one area exhibiting potential low to medium reefiness were identified from the geophysical data collected during the survey conducted around the Wenlock platform. *S. spinulosa* reefs are known to be susceptible to physical damage. APRL will therefore ensure that an anchor management plan is developed for the moored HLV and jack-up vessel, to ensure anchors and anchor chains/wires deployed avoid the identified potential *S. spinulosa* reef aggregations, where possible.

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 Wenlock 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. *S. spinulosa* is also considered to be tolerant to smothering.

In addition, there will be a legacy impact in an area of seabed totalling ca. 5,920 m^2 (0.006 km^2) as result of rock dump along the pipelines which will be decommissioned in situ, as well as any mattresses and/or gravel bags redeployed to cover the cut pipeline ends, if exposed at the seabed. The hard substrate will permanently change the habitat type and associated fauna present; however, the scale of the impact is Negligible considering the very large extent of sandy seabed available in the southern North Sea.

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 Wenlock infrastructure, the comparatively small area of seabed that will be impacted by the proposed decommissioning activities and the fact that, if possible, no identified areas of potential *S. spinulosa* reef will be subject to direct physical impact, 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 Wenlock decommissioning operations. The cutting tools used to sever the Wenlock 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 Wenlock 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 Wenlock 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 are predicted to Minor and not significant.

1.5.2.4 Transboundary Impacts

The Wenlock platform is located approximately 45 km south west of the UK / Netherlands median line and the Inde 23A platform is located approximately 31 km south west of the UK / Netherlands median line. However, any impacts arising from emissions, discharges and seabed disturbance generated as a result of the proposed decommissioning activities are predicted to be highly localised and are therefore not expected to result in any significant transboundary impacts. If it is decided to utilise disposal options outside of the UK, APRL 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 Wenlock decommissioning activities. APRL is aware that a number of nearby offshore oil and gas installations are currently in the process of being decommissioned, the closest of which is the Viking Alpha platform located approximately 7 km to the south-south west. The operational Hornsea Project One offshore wind farm is located approximately 27 km north west of the Wenlock platform and the proposed Hornsea Project Three wind farm turbine area is located approximately 25 km north west of the Wenlock platform, the export cable corridor for which runs 9 km to the north-west of the platform. In addition, the Humber 5 (Area no.: 483) aggregate area is located approximately 4 km to the north-east of the Wenlock platform. However, given the distances between the projects and the fact that any impacts arising from the proposed Wenlock decommissioning activities will be localised, no significant cumulative effects on marine receptors are predicted.

1.5.2.6 Marine Protected Areas

The Wenlock infrastructure is located within the boundary of two marine protected areas (MPAs); North Norfolk Sandbanks and Saturn Reef (NNS&SR) SAC designated for the protection of Annex I sandbank habitat and biogenic reef and Southern North Sea SAC designated for the protection of harbour porpoise.

The extent of seabed disturbance to occur within the NNS&SR SAC boundary as a result of proposed Wenlock decommissioning activities has been estimated at ca. 0.075 km^2, representing only 0.001% of the whole SAC area. Any physical impact to the sandbank habitat will, however, be temporary, with the habitat and benthic communities predicted to rapidly recover once the decommissioning activities have ceased. There will also be a legacy impact from the decommissioning in situ of the pipelines and associated stabilisation material. However, the pipelines are trenched and buried to a depth in excess of 0.6 m and no evidence of any trench can now be seen. Results from pipeline surveys undertaken between 2007 and 2020 indicate that the physical presence of the pipelines below the seabed does not visually appear to impact the sandbank features. The stabilisation material, primarily rock, which will remain on the seabed surface will continue to represent a change in habitat from a mobile sand feature to an immobile hard substrate, although over time some of the material may potentially bury or be partially buried by sand deposition. However, the area impacted is extremely small compared to the extent of sandbank habitat in the SAC, equivalent to ca. 0.001% of the NNS&SR SAC total area.

The 2020 pre-decommissioning survey identified one aggregation of potential *S. spinulosa* biogenic reef, classified as having low reefiness, approximately 446 m to the north west of the Wenlock platform, along with a further six areas exhibiting potential low reefiness and one area exhibiting potential low to medium reefiness within the vicinity of the Wenlock platform. *S. spinulosa* reefs are known to be susceptible to physical damage and therefore APRL will ensure that an anchor management plan is developed for the moored HLV and jack-up vessel, so the anchors and anchor chains/wires avoid the identified potential *S. spinulosa* reef aggregations, where possible.

The underwater noise emissions generated during the proposed Wenlock decommissioning activities will be temporary and localised, and while sound from the decommissioning vessels in particular may result in temporary behavioural impacts on a small number harbour porpoise, significant adverse effects at the population level are not anticipated.

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

1.6 Conclusions

The EA has confirmed that the Wenlock Field Installations DP and the Wenlock Pipelines 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 Wenlock 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 Wenlock infrastructure lies within the boundary of two marine protected areas: NNS&SR SAC and Southern North Sea SAC. 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 Wenlock decommissioning activities, either alone or in-combination with other plans or projects.

APRL 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 Wenlock decommissioning activities, APRL will produce a SEMS interface document for the project to help ensure the identified mitigation and control measures are successfully implemented.

2 Introduction

2.1 Background

Alpha Petroleum Resources Limited (APRL) is the Licence Operator of the Wenlock gas field, located in United Kingdom Continental Shelf (UKCS) Block 49/12a in the Southern North Sea, approximately 98 km offshore north east from the Bacton Gas Terminal on the North Norfolk coastline and 45 km south west of the UK / Netherlands median line. APRL has a 20% equity interest in Wenlock and Edison E&P (UK) Limited (Edison) has an 80% equity interest.

Production from Wenlock has been in decline for a number of years and the field is now uneconomic. A Cessation of Production (CoP) application has been approved by the Oil and Gas Authority (OGA). In accordance with the Petroleum Act 1998, APRL and Edison (the Section 29 notice holders) are now applying to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to obtain approval for decommissioning the Wenlock infrastructure.

2.2 Overview of the Wenlock Infrastructure

The Wenlock gas field was first discovered in 1974 and is located within production licences P33 and P1062. A three slot Normally Unmanned Installation (NUI) was installed on Wenlock in 2006 with a design life of 15 years (see Figure 2.1). The first well (W1) was drilled and started production in 2007 and two subsequent wells were drilled and started production in 2008 (W2) and 2009 (W3). APRL is the Well Operator and Perenco UK Limited (PUK) is the appointed Installation Operator and Pipeline Operator. Details of the Wenlock platform are provided in Table 2.1.

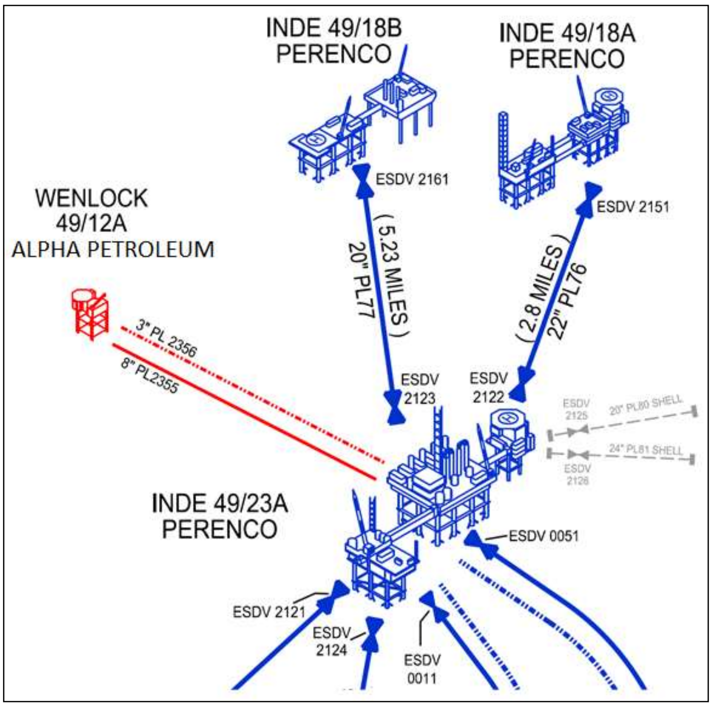
Table 2.1. Wenlock Platform Details

Platform Type	Water Depth (m)	Location (WGS84)	Topside		Jacket Weight			
			Weight (Te)	No. of modules	Weight (Te)	Number of legs	No. of piles	Weight of piles (Te)
Fixed steel jacket	25	53° 35.1983' N 2° 34.2976' E	435	1	645	4	4	351

Figure 2.1. The Wenlock Platform

The Wenlock platform is tied back to the PUK operated Indefatigable 49/23AC (Inde 23A) platform via a 37km, 8 inch pipeline (PL2355). After processing on the Inde 23A platform, the gas is exported to the Leman 49/27B Platform via the Inde export pipeline (PL22) and then to the onshore Bacton Gas Terminal via the PL24 pipeline. Chemicals for hydrate and corrosion inhibition are supplied from the Inde 23A platform via a dedicated 3-inch pipeline (PL2356), which is piggy-backed to the PL2355 pipeline (see Figure 2.2).

Figure 2.2. Wenlock Infrastructure



The pipelines are made of steel pipe with fusion bonded epoxy (FBE) coating and are fully trenched and buried up to a short transition section coming back to the surface and the tie-in spools, apart from at one mid-line crossing location. In addition, several locations along the route of the pipelines have been rock dumped, as well as being trenched, in order to provide down force on the pipelines to prevent any upheaval buckling.

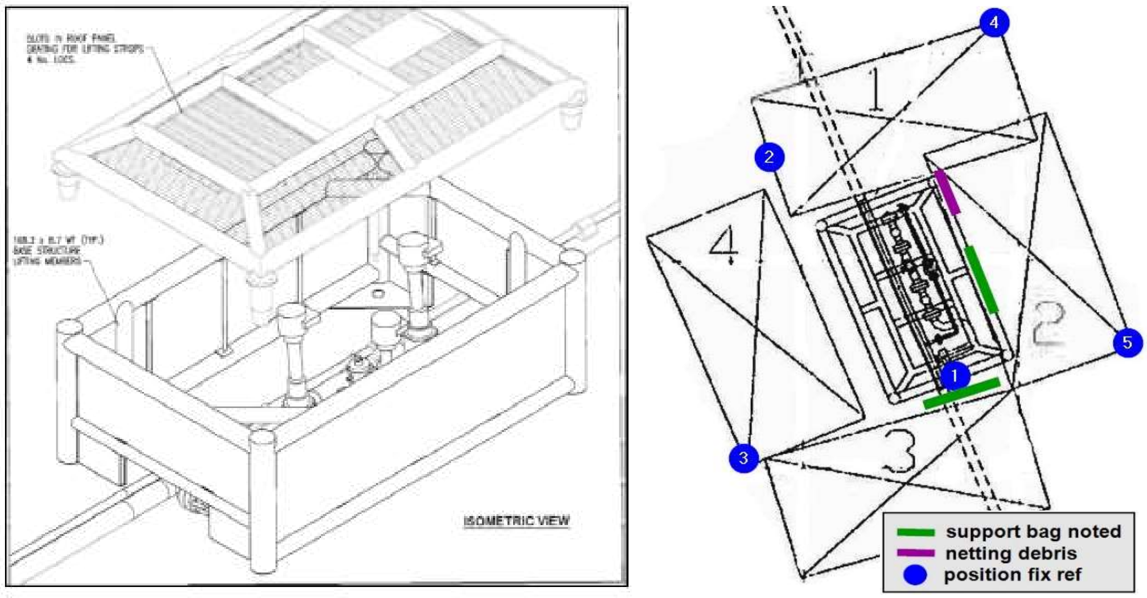
At the Wenlock platform approaches, the pipelines trenched burial depth gradually reduces from ca. 1.5 m burial to being on the seabed over a 460 m long section. This section of the pipelines has been rock dumped for protection and to prevent upheaval buckle. The remaining pipeline lengths and the pipeline spool sections are laid on the seabed surface and protected with concrete mattresses and grout bags for approximately 63m. At the riser to spool goose necks the pipelines are exposed.

At kilometre point (KP) 14.45[1], the pipelines cross the Norsea communications cable, which is located at a depth of approximately 0.5m below seabed. Concrete mattresses were laid below the Wenlock pipelines to provide separation between the cable and pipelines before the un-trenched section of the pipelines was rock dumped to provide protection.

On the pipeline routes, at approximately KP 16.690, is a tee protection structure of dimensions 4.5m x 2.8m x 2.2m, not piled to the seabed, which is located within a dredged area of the seabed and is partially buried with the structure lid visible above the natural seabed. Gravel bags and four concrete mattresses are placed around the edge of the structure within the dredged area (see Figure 2.3). The mid-line tee was originally installed as a tie-in point for a reservoir, discovered by well 49/18-5Z, located 170 from the export pipeline. This well is suspended; however, the area is not currently licenced or viewed as a current economic prospect.

[1] KP 0 is at Wenlock platform and KP 36.1 is at Inde 23A platform.

Figure 2.3. Mid-line Tee Protection Structure



At the Inde 23A platform approaches, the pipelines trenched burial depth gradually reduces from ca. 1.5 m burial to being on the seabed. The section of the pipelines which lies on the seabed is protected by concrete mattresses. The pipeline spool sections are also laid on the seabed and protected with concrete mattresses and gravel bags for a length of 105 m. Where the pipeline spools cross over the Inde pipelines (PL76 and PL77), concrete mats supports were built below the Wenlock spools to ensure the pipelines had separation between them. These sections of spool pipeline were then rock dumped to provide protection. At the riser to spool connection locations the pipelines are exposed.

In addition to the above infrastructure, there is a legacy subsea appraisal well (49/12a-8) within the Wenlock 500 m safety zone, located 239 m south east of the Wenlock platform. The well was first drilled in December 1988 and deemed non-viable and subsequently suspended with a single plug in February 1989. The 30 inch diameter conductor was left protruding approximately 3.2 m above the natural seabed.

Summary details of the Wenlock subsea installations are provided in Table 2.2 and a summary of the stabilisation material associated with the Wenlock infrastructure is provided in Table 2.3.

Table 2.2. Wenlock Subsea Installation Details

Installation	Water Depth (m)	Location (WGS84)	Weight (Te)
Mid-line tee	28.7 – 29.8	53° 28’ 29.23”N; 2° 25’ 49.65” E	5.4
Legacy appraisal well	27.8	53° 35’ 18.12”N; 2° 17’ 51.11” E	2.2 [1]

[1] This is the weight of the conductor above the seabed.

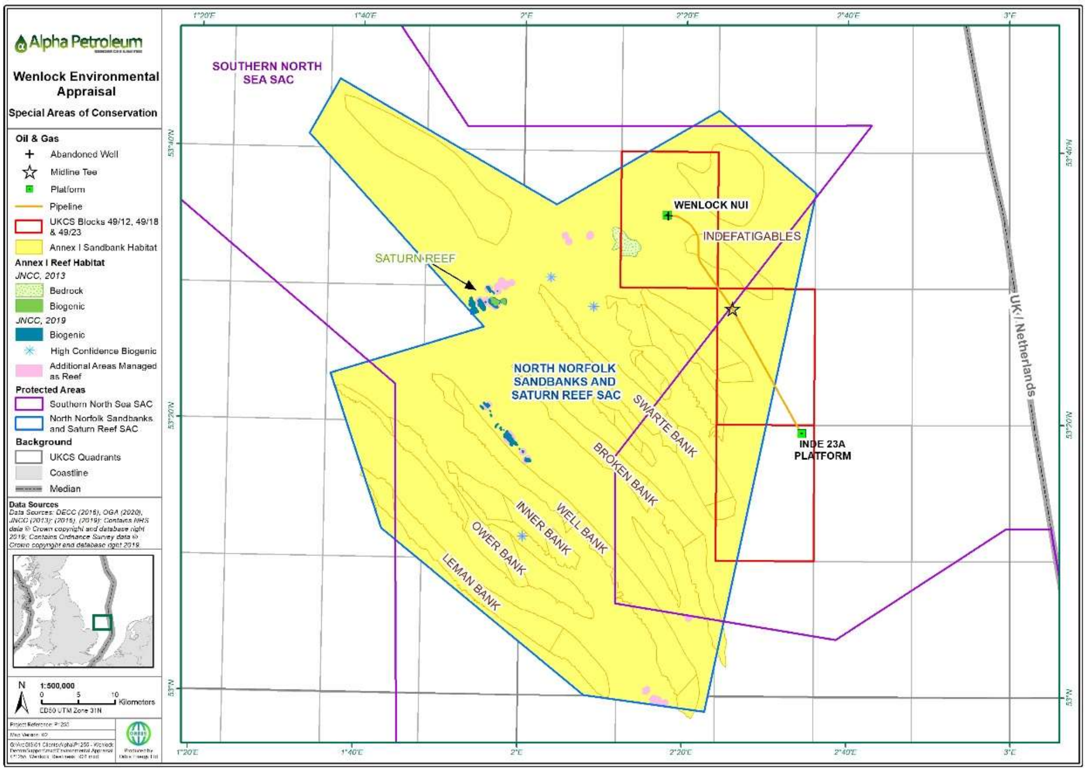
Table 2.3. Wenlock Stabilisation Material Details

Stabilisation Feature	No.	Weight (Te)	Location	Status
Concrete mattresses (6m x 4m x 0.15m and 6m x 3m x 0.3m)	61	420	PL2355 and PL2356	Exposed at the platform ends, partially buried at the mid-line tee location and buried at cable crossing
Gravel bags (25 kg bags)	ca. 100	2.5	Various around the concrete mattresses and riser spool goose necks	Exposed at the platform ends, buried at the mid-line tee location

Stabilisation Feature	No.	Weight (Te)	Location	Status
Rock dump	-	6,190	Across 26 locations (totalling 532 m in length) along PL2355 and PL2356 and at Wenlock platform approaches	Rock dump located on the seabed
	-	1,200	At Inde 23A platform approaches, totalling 60m in length	Rock dump located on the seabed

The Wenlock platform and approximately 28.6 km of the route of the Wenlock pipelines, including the mid-line tee structure, is located within the boundary of the North Norfolk Sandbanks and Saturn Reef Special Area of Conservation (SAC), designated for the protection of Annex I sandbanks and biogenic reef. In addition, the Wenlock platform and approximately 16.5 km of the route of the Wenlock pipelines, excluding the mid-line tee structure, is located within the boundary of the Southern North Sea SAC, designated for the protection of harbour porpoises (see Figure 2.4 and Section 4.2.6 for further details).

Figure 2.4. Location of Wenlock Infrastructure and SACs



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 the Department of Business, Energy and Industrial Strategy (BEIS).

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 the topsides of all installations must be returned to shore and all steel installations with a jacket weight less than 10,000 tonnes in air, which is the case for the Wenlock platform, 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 Wenlock installations and pipelines lie within the East Offshore Marine Plan area. APRL considers that the proposed Wenlock decommissioning activities are in broad alignment with the objectives and policies of the plan.

2.4 Scope and Purpose of this Environmental Appraisal Report

This EA report has been written by APRL to support the Wenlock Field Installations DP and the Wenlock Pipelines 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 Wenlock installations and pipelines and demonstrate the extent to which these impacts will be mitigated and controlled to an acceptable level.

Well plug and abandonment and the flushing and cleaning operations that will be undertaken on the topsides and pipelines as part of the preparatory work preceding the proposed decommissioning activities are outside the scope of this EA report and will be consented under appropriate environmental permits and consents.

3 Project Description

3.1 Proposed Decommissioning Solution

APRL is proposing to completely remove the Wenlock platform (topside and jacket) and recover to shore, as described in Table 3.1. A final decision on the removal method will be made following an engineering feasibility and commercial tendering process, but the options currently under consideration are discussed in Section 3.4.

Table 3.1. Summary of Decommissioning Solution for the Wenlock Platform

Installation	Proposed Decommissioning Solution	Reason for Selection
Topside	Complete removal followed by recovery to shore for re-use, recycling, and final disposal to landfill as appropriate. The topside will be made hydrocarbon free, removed by a lift vessel and returned to shore. Re-use followed by recycle and then landfill will be the prioritised options for the topside.	Complies with OSPAR requirements and OPRED guidelines and maximises recycling of materials.
Jacket	Complete removal and re-use or recycle. Jacket will be removed and dismantled at an onshore location. Re-use followed by recycle will be the prioritised options. Jacket skirt piles will be severed at least 3 m below the seabed.	Leaves clear seabed, removes a potential obstruction to fishing operations and maximizes recycling of materials, to comply with OSPAR requirements and OPRED guidance.
Platform Wells	Plug and Abandonment (P&A) platform wells prior to platform removal in accordance with HSE 'Offshore Installations and Wells Design and Construction Regulations 1996' and 'Oil & Gas UK Guidelines for the Suspension and Abandonment of wells Issue 6, June 2018'.	Meets HSE regulatory requirements and is in accordance with OGUK and OGA guidelines.

The legacy subsea appraisal well (49/12a-8), located within the Wenlock 500m safety zone, will be fully abandoned by setting two further plugs in line with regulations. The conductor will then be cut internally by high pressure water jet at least 3 m below the seabed, removed and returned to shore for reuse or recycling. This solution meets HSE regulatory requirements and is in accordance with OGUK and OGA guidelines.

For the remaining subsea infrastructure, namely the pipelines, mid-line tee structure and associated protective material, APRL has undertaken a Comparative Assessment in order to arrive at an optimal decommissioning solution. The Comparative Assessment is described fully in the Wenlock Pipelines (PL2355 and PL2356) Decommissioning Options Comparative Assessment (APRL, 2020). The selected decommissioning options derived from the Comparative Assessment, based on consideration of safety, environmental, technical, societal and economic factors, are summarised in Table 3.2. Further detail on the decommissioning activities associated with the subsea infrastructure is provided in Section 3.4.4.

Table 3.2. Summary of Decommissioning Solution for the Wenlock Subsea Infrastructure

Infrastructure	Proposed Decommissioning Solution	Main Reasons for Selection
Gas Export Pipeline (PL2355)	Pipeline left cleaned and 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 > 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 seabed (sandwave, megaripples) migration has been experienced during the life of the field.
Chemical Injection Pipeline (PL2356)	Pipeline left cleaned and 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 > 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 seabed (sandwave, megaripples) migration has been experienced during the life of the field.
Spoil sections, mattresses and grout bags at Wenlock and Indefatigable platform approaches	Riser to spool goose neck sections of pipeline, concrete protection mattresses and underlying pipeline sections and grout bags at the Wenlock and Indefatigable platform approaches to be removed and returned to shore for recycling or disposal.	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.
Mid-line tee structure	The cover, protection frame and any valve stems that are not buried to 0.6m below natural seabed level to be removed and returned to shore for recycling or disposal. Mattresses and gravel bags which are buried around the structure to remain in situ. The tee manifolded pipework will also remain in situ as it is currently buried to a depth greater than 0.6m below natural seabed and is not directly connected to the protection structure.	The recommendation from the CA was to remove the protection structure cover and leave the remaining infrastructure in situ flush with the natural seabed level. However, subsequent consultation with OPRED flagged that the mid-line tee protection structure is classed as an installation and is therefore subject to international obligations for decommissioning under the terms of OSPAR Decision 98/3. As such, full removal of the mid line tee protection structure is required. This was still identified as an acceptable option in the CA, particularly as it removes the legacy snagging risk associated with the mid-line tee structure.

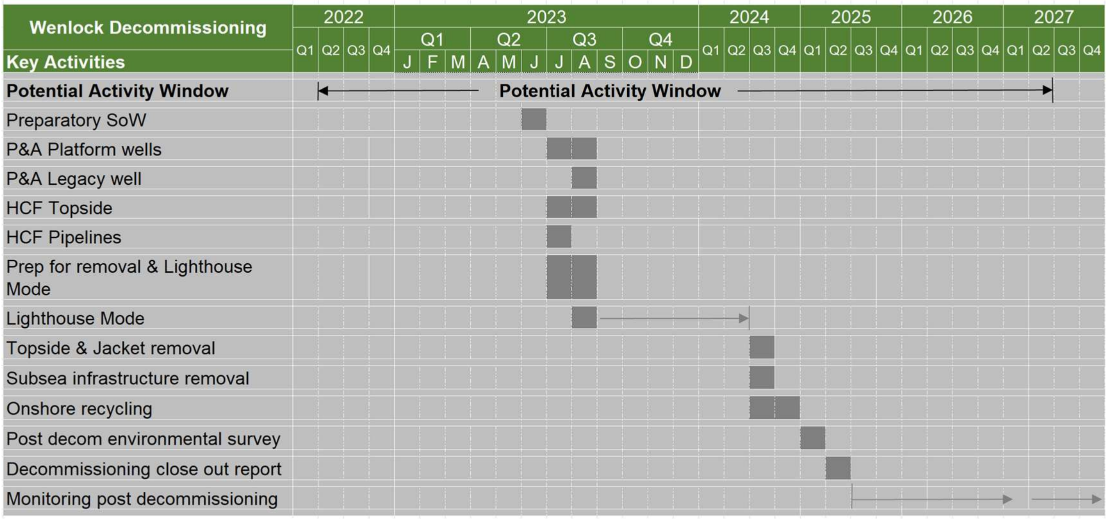
3.2 Potential for Alternative Uses

APRL has explored alternative uses for the Wenlock facilities, including the possibility for in situ re-use or redevelopment, however none were found viable. The platform equipment inventory will be assessed for use as spares for APRL asset portfolio.

3.3 Project Schedule

APRL anticipates executing the Wenlock decommissioning activities between 2022 and 2027. An indicative schedule for the work is shown in Figure 3.1, which is subject to approval of the DPs, changes in economics such as gas price which could extend the life of the field and unavoidable constraints such as contractor availability (e.g. vessel availability).

Figure 3.1. Indicative Decommissioning Schedule



A window has been programmed into the schedule in which a potential decommissioning contractor would be able to remove the platform and subsea infrastructure, following the initial preparation works to make the Wenlock infrastructure hydrocarbon free. The preferred options will be to prepare the Wenlock jacket for lift, then a) collaborate with other decommissioning or installation projects to share costs, and /or b) to engage in dialogue with lift vessel owners and closely monitor for opportunities where a lift vessel has unplanned availability in the vicinity and can at short notice remove the Wenlock jacket.

3.4 Decommissioning Activities

3.4.1 Preparatory Works

In preparation for removal of the Wenlock facilities, APRL will undertake a series of preparatory works. These activities fall outside of the scope of the DPs and this EA report and will be consented via appropriate environmental permits and consents under the OPRED PETS UK Energy Portal. These include the following hydrocarbon freeing activities:

- Topside will be cleaned, with the hydrocarbons (process fluids, fuels and lubricants) either injected into the platform wells or drained to tote tanks for transport and appropriate disposal onshore;
- Export pipeline and chemical injection pipeline will be cleaned and depressurised then disconnected from Wenlock and Inde 23A platforms;
- Platform wells and the legacy subsea appraisal well will be P&A'd in accordance with HSE regulatory requirements and OGUK guidelines.

Once hydrocarbon free the Wenlock platform will enter a Lighthouse Mode phase. During this time, the platform will be equipped with solar powered aids to navigation and an automatic identification system (AIS) to mark the structure until such time as it is fully removed.

3.4.2 Topside Removal

The Wenlock topside structure comprises three levels with an ESDV deck underneath, weighs 435 tonnes and the primary structure measures 12.75 m x 16 m x 9.25 m high.

A summary of the removal options under consideration by APRL for the Wenlock topside structure is provided in Table 3.3.

Table 3.3. Topside Removal Options

Option	Description
1. Single lift removal along with jacket using one of the following types of Heavy Lift Vessel (HLV): Semi-Submersible Crane Vessel (SSCV), Monohull Crane Vessel (MCV) or Shear Leg Vessel (SLV)	Removal of topside and jacket as a complete unit followed by recovery to shore for re-use, recycling, and disposal as appropriate.
2. Single lift removal using a SSCV, MCV or SLV	Removal of topside as a single unit followed by recovery to shore for re-use, recycling, disposal as appropriate.
3. Piece-small or piece large removal using a Jack-up Work Barge (JUWB)	Removal of topside in a series of smaller sub-units making use of the JUWB used for the well P&A activities, followed by recovery to shore for re-use, recycling or disposal as appropriate.

A final decision on the topside removal method will be made following a commercial tendering process. However, as a worst case scenario for assessment purposes, it is assumed the topside structure will be removed by an anchored HLV, with eight-point mooring system. The HLV will be towed to site using tugs and a separate anchor handling vessel (AHV) will be used to moor the HLV in place. An Emergency Response and Rescue Vessel (ERRV) will also be on location in the field. To separate the topside from the jacket an oxygen acetylene torch will be used. The HLV will then lift the topside off and place it onto a barge, for transport to shore. The supporting barge will not be anchored, but will either be tethered to the HLV or to its towing tugs. Alternatively the topside will be transported to shore on the HLV. A summary of the vessel requirements for topside removal and their typical fuel consumption is provided in Table 3.4.

Table 3.4. Vessel Requirements for Topside Removal

Vessel	Days on Location	Fuel Consumption Rate	Total Fuel Consumption
HLV	2	30 tonnes per day	60 tonnes
AHV	5	15 tonnes per day	75 tonnes
Tugs x 2	5	25 tonnes per day	250 tonnes
Barge	5	25 tonnes per day	125 tonnes
ERRV	2	8 tonnes per day	16 tonnes

3.4.3 Jacket Removal

The Wenlock jacket weighs approximately 645 tonnes excluding the piles and rigging. The weight of the four jacket skirt piles is approximately 351 tonnes. It is estimated that there is approximately 100 tonnes of marine growth on the jacket. APRL proposes to remove the marine growth offshore, where necessary and practicable, with any remaining marine growth brought back with the infrastructure and processed and disposed of onshore.

A summary of the removal options under consideration by APRL for the jacket is provided in Table 3.5.

Table 3.5. Jacket Removal Options

Option	Description
1. Single lift removal along with jacket using a SSCV, MCV or SLV	Removal of topside and jacket as a complete unit followed by recovery to shore for re-use, recycling, and disposal as appropriate.
2. Single lift removal using a SSCV, MCV or SLV	Removal of jacket as a single unit followed by recovery to shore for re-use, recycling, disposal as appropriate
3. Piece-small or piece large removal using JUWB	Removal of jacket in a series of smaller sub-units, followed by recovery to shore for re-use, recycling or disposal as appropriate.

A final decision on the jacket removal method will be made following a commercial tendering process; however, it is likely the jacket removal will be a reverse of its installation, a single lift. Once the topside has been removed the piles will be cut 3 m or greater below the seabed, slings attached and the jacket lifted and returned to shore.

APRL proposes to cut the piles internally using an abrasive cutting tool system. Before the cutting works can commence, the piles will be dredged to remove the soil inside the jacket skirts to a depth of ca. 4 m below the seabed to provide access for the abrasive cutting tool. The dredging tool will be deployed from a Diving Support Vessel (DSV) and a remotely operated vehicle (ROV) will be used for assistance when running the dredging tool into the jacket sleeves. No dredging will occur around the exterior of the jacket and no explosives will be used. It is estimated that the weight of the piles to be returned to shore is approximately 100 tonnes.

For the purpose of this assessment, it is assumed the jacket will be removed by an anchored HLV, with eight-point mooring system. The HLV will be towed to site using tugs and a separate AHV will be used to moor the HLV in place. The DSV, which will be on location to cut the piles, will be used as an ERRV once the HLV has arrived on location. The HLV will lift the jacket and place it onto a barge, for transport to shore. The supporting barge will not be anchored, but will either be tethered to the HLV or to its towing tugs. Alternatively the jacket will be transported to shore on the HLV. A summary of the vessel requirements for jacket removal and their typical fuel consumption is provided in Table 3.6.

Table 3.6. Vessel Requirements for Jacket Removal

Vessel	Days on Location	Fuel Consumption Rate	Total Fuel Consumption
DSV	6	20 tonnes per day	120 tonnes
HLV	2	30 tonnes per day	60 tonnes
AHV	5	15 tonnes per day	75 tonnes
Tugs x 2	5	25 tonnes per day	250 tonnes
Barge	5	25 tonnes per day	125 tonnes

3.4.4 Subsea Infrastructure

3.4.4.1 Pipelines and Stabilisation Material

The recommendation from the CA (APRL, 2020) is that a partial removal option be adopted for both the gas export pipeline and chemical injection pipeline, with the majority of the pipelines left in situ, including where the pipelines cross the NorSea cable, as well as those sections protected by rock dump.

At the Wenlock and Indefatigable platform approaches, APRL proposes to cut and remove the riser to spool goose neck sections of pipeline and remove the concrete protection mattresses and grout 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. The tie-in spools and pipeline stabilisation features (mattresses and gravel bags) which are located under the rock dump will remain in situ. At the Inde 23A platform, the Wenlock pipelines will be decommissioned up to the first riser elbow flanges at the seabed. The risers are owned by PUK who will decommission these at a later date, as part of the Inde 23A DP. Within the Inde 23A 500m safety zone, the Wenlock pipelines cross the Inde pipelines PL76 and PL77. These crossings will be left 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. In order to recover the mattresses and cut sections of pipework a Multi-Purpose Support Vessel (MSV) or DSV will be required. It is anticipated that the mattresses 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 grout bags will be returned to shore for recycling or disposal. However, in the event of practical difficulties during the removal operations, APRL 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 or at the start of the Inde crossing rock dump, then a mattress or gravel bags will be deposited over the ends to prevent a possible snagging point.

Table 3.7 summarises the types of vessels required to decommission the pipelines and stabilisation material, their anticipated duration on location and typical fuel consumption rates.

Table 3.7. Vessel Requirements to Decommission Pipelines and Stabilisation Material

Vessel	Days on Location	Fuel Consumption Rate	Total Fuel Consumption
DSV / MSV	21	20 tonnes per day	420 tonnes
Survey vessel	7	12 tonnes per day	84 tonnes

3.4.3.2 Mid-Line Tee Structure

The mid-line tee protection structure is classed as an installation and is subject to international obligations for decommissioning under the terms of OSPAR Decision 98/3. Full removal of the structure is therefore required, which was identified as an acceptable option in the CA (APRL, 2000).

In order to access the protection structure, the seabed will first need to be cleared. This may be done by water jetting using an ROV deployed from a MSV or DSV. This is a method of jetting which uses high pressured water to clear sediment within a targeted area. APRL then proposes to cut the structure using mechanical cutting tools such as hydraulic shears or diamond wire cutters. The vessel would then lift the structure directly to its deck using its crane.

Table 3.8 summarises the types of vessels required to decommission the mid-line tee structure, their anticipated duration on location and typical fuel consumption rates.

Table 3.8. Vessel Requirements to Decommission Mid-Line Tee Structure

Vessel	Days on Location	Fuel Consumption Rate	Total Fuel Consumption
DSV / MSV	4.5	20 tonnes per day	90 tonnes
Survey vessel	0.5	12 tonnes per day	6 tonnes

3.4.3.3 Legacy Appraisal Well Conductor

Once the legacy appraisal well has been abandoned downhole, the conductor will be severed and removed to prevent it becoming a potential seabed obstruction. APRL proposes to cut the conductor internally using an abrasive cutting tool system to at least 3 m below the natural seabed level. No external excavation will be required. The vessel utilised to P&A the well will execute the cut and recover the conductor via crane. The conductor will then be returned to shore for reuse or recycling.

For the purposes of this assessment it is assumed that the same vessel will be utilised to P&A the platform wells and legacy appraisal well and cut and recover the legacy appraisal well conductor. Although the P&A activities fall outside of the scope of this EA report and will be consented via appropriate environmental permits and consents under the OPRED PETS UK Energy Portal, for completeness, Table 3.9 summaries the types of vessels required to undertake the work, their anticipated duration on location and typical fuel consumption rates.

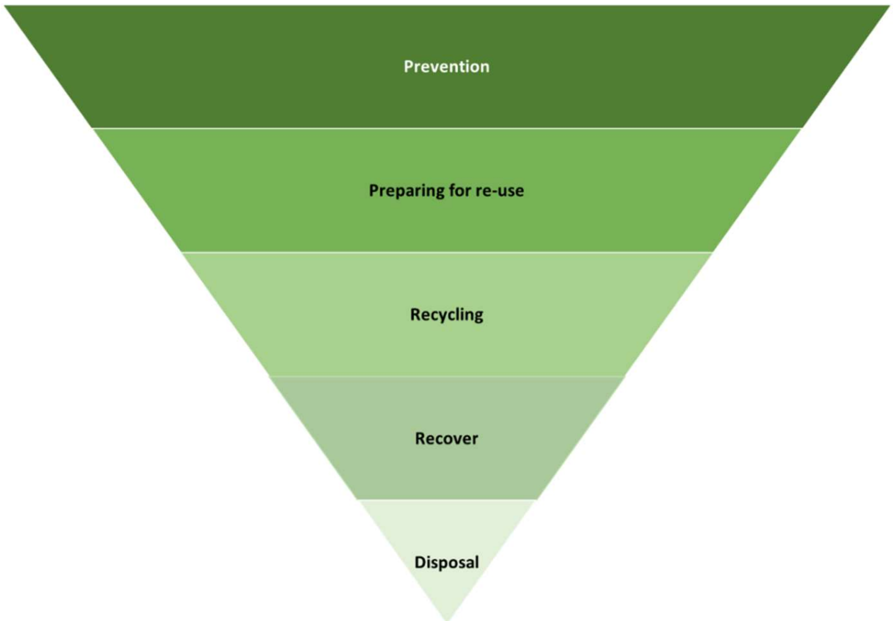
Table 3.9. Vessel Requirements for P&A Operations and Conductor Removal

Vessel	Days on Location	Fuel Consumption Rate	Total Fuel Consumption
Jack-up Vessel	63	10 tonnes per day	630 tonnes
AHV	4	15 tonnes per day	60 tonnes
ERRV	63	8 tonnes per day	504 tonnes

3.5 Waste Management

The Wenlock 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)

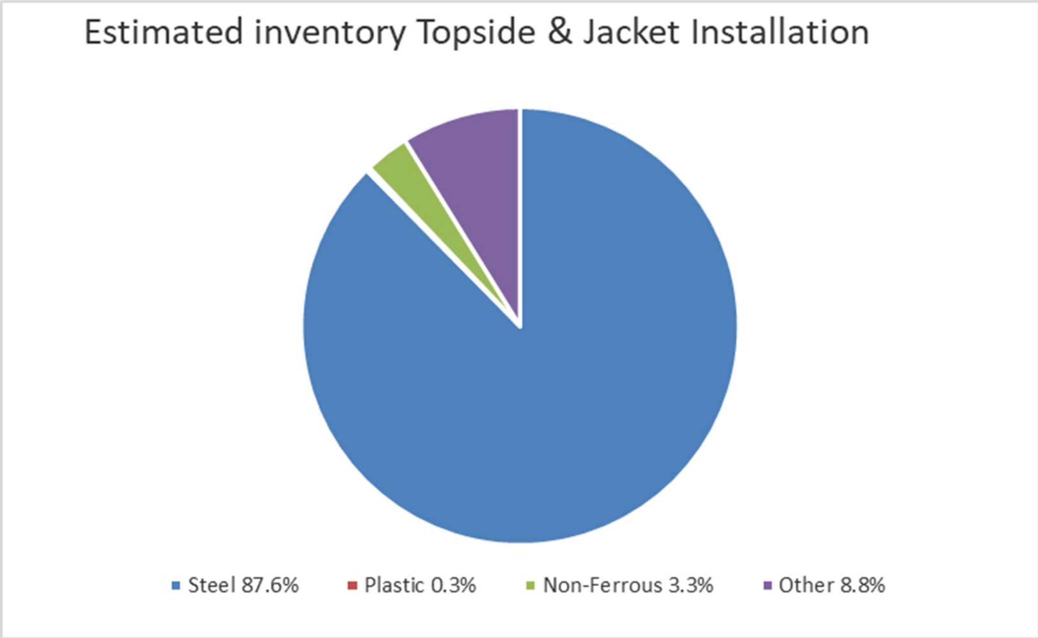


Steel and other recyclable materials are estimated to account for the greatest proportion of the Wenlock materials inventory. The topside and jacket structures will be transported to an onshore decommissioning facility for segregation, re-use and recycling. The potential for transboundary shipment of waste is still under review. All other wastes generated offshore during decommissioning will be segregated by type, before being transported to onshore waste facilities.

APRL 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.

Figure 3.2 summarises the estimated breakdown of materials relating to the topside and jacket to be removed, which equates to 1,080 tonnes. These quantities exclude well materials, and are limited to everything above the seabed cutline. Jacket piling below this level (comprises of 251 tonnes of steel) are not included and will be left in place.

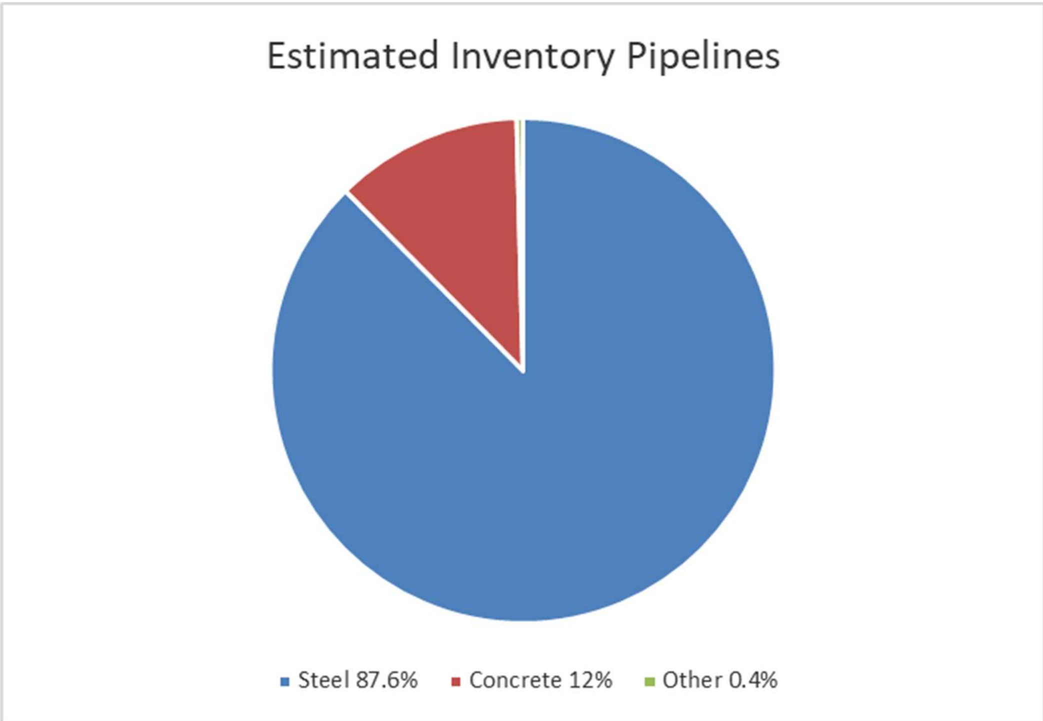
Figure 3.2. Pie Chart of Estimated Waste Inventories (Topside and Jacket Installation) [1]



[1] Total Topside & Jacket weight 1,080 Te

Figure 3.3 summarises the estimated breakdown of materials relating to the Wenlock subsea infrastructure, which equates to 3,800 tonnes. It is proposed that approximately 265 tonnes of this material will be removed, with the remainder of material left *in situ*, as discussed in Section 3.1.

Figure 3.3. Pie Chart of Estimated Inventories (Pipelines) [1]



[1] Total pipelines weight 3,800 Te. This includes the pipelines, tie-in spools, anodes, mattresses, gravel bags, mid-line tee protection frame and manifold.

No naturally occurring radioactive material (NORM) has been encountered on Wenlock 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. APRL will ensure tests for NORM are undertaken offshore by a Radiation Protection Supervisor. If NORM is encountered, APRL 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

Post decommissioning, a site survey will be carried out around the Wenlock platform 500m radius and a (minimum) 100m corridor (50m either side) along the route of the Wenlock pipelines where decommissioning activities have taken place to identify any oil and gas debris and confirm the seabed has no trawling obstructions. Any seabed debris related to offshore oil and gas activities will be recovered for onshore disposal or recycling in line with existing disposal methods.

APRL will provide a verification of seabed clearance to OPRED following completion of the Wenlock decommissioning activities. 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.

If necessary, 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 Wenlock 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 Wenlock 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 seabed survey carried out by N Sea on behalf of APRL in March 2020 has been referenced, where relevant (N Sea, 2020a; 2020b; Marine Space, 2020; BSL, 2020a; 2020b). The survey consisted of geophysical, habitat investigation and environmental work scopes.

The geophysical survey collected multibeam echosounder (MBES), side scan sonar (SSS) and magnetometry data within a 1 km x 1 km area centred on the platform and legacy appraisal well location and along a 100 m survey corridor centred on the Wenlock pipelines. A general visual inspection was also conducted at the Wenlock platform, abandoned wellhead 49/12a-8, mid-line tee and at the approach to the Inde 23AC platform.

Environmental seabed sampling was carried out at a total of six stations in the vicinity of the Wenlock platform with a further three stations sampled along the pipelines; at the mid-line tee, the Norsea cable crossing and at the Inde 23A platform spool mattress. A reference station, located approximately 5 km from all assets, was also sampled to provide a regional understanding of the different habitats encountered. All stations underwent the following sampling/sub-sampling:

- 2 x 0.1 m^2 macro-invertebrate replicate samples processed over a 1000µm aperture sieve;
- 1 x 0.1 m^2 physico-chemical replicate, subsampled for particle size distribution, total organic carbon, total organic matter, moisture, heavy and trace metals, and hydrocarbons, at a single surface depth of 0 – 2 cm.

To inform the habitat assessment, camera transects of at least 50m length were conducted at each sampling station for the acquisition of video and stills data. *Sabellaria spinulosa* was observed in high density during transect WEN_NW500 in an area of increased SSS reflectivity, and, as such, four additional transects (WEN_NW_500_SAB_01,02,03 and WEN_NW500_02) were conducted. Similar areas of high SSS reflectivity were observed along the Wenlock pipeline which were investigated with two further transects (PL2355_SAB_01 and PL2355_SAB_S_02), however, no *S. spinulosa* were observed at these locations.

Where applicable, the results of the pre-decommissioning survey were compared to the pre-drill environmental baseline survey undertake at the Wenlock location in 2005 (DDH Consulting, 2005). As the majority of 2005 sampling stations are outside of the geophysical area of the 2020 survey, only two stations are comparable with the 2020 stations; one at the Wenlock platform location (Station 1) and one at the Norsea cable crossing location (Station 7).

A variety of reference values relating to regional background levels and threshold effect levels have also been utilised to aid in the interpretation of the results, including UKOOA (2001); CCME (2001); OSPAR (2008) and Long *et al*. 1995.

The location of the stations (from both the 2020 and 2005 surveys) and transects in relation to the Wenlock infrastructure is illustrated in Figures 4.1 and 4.2.

Figure 4.1. MBES Bathymetry Data and Environmental Sampling Strategy for Wenlock Platform and Pipelines (Chart 1 of 2) (BSL, 2020a)

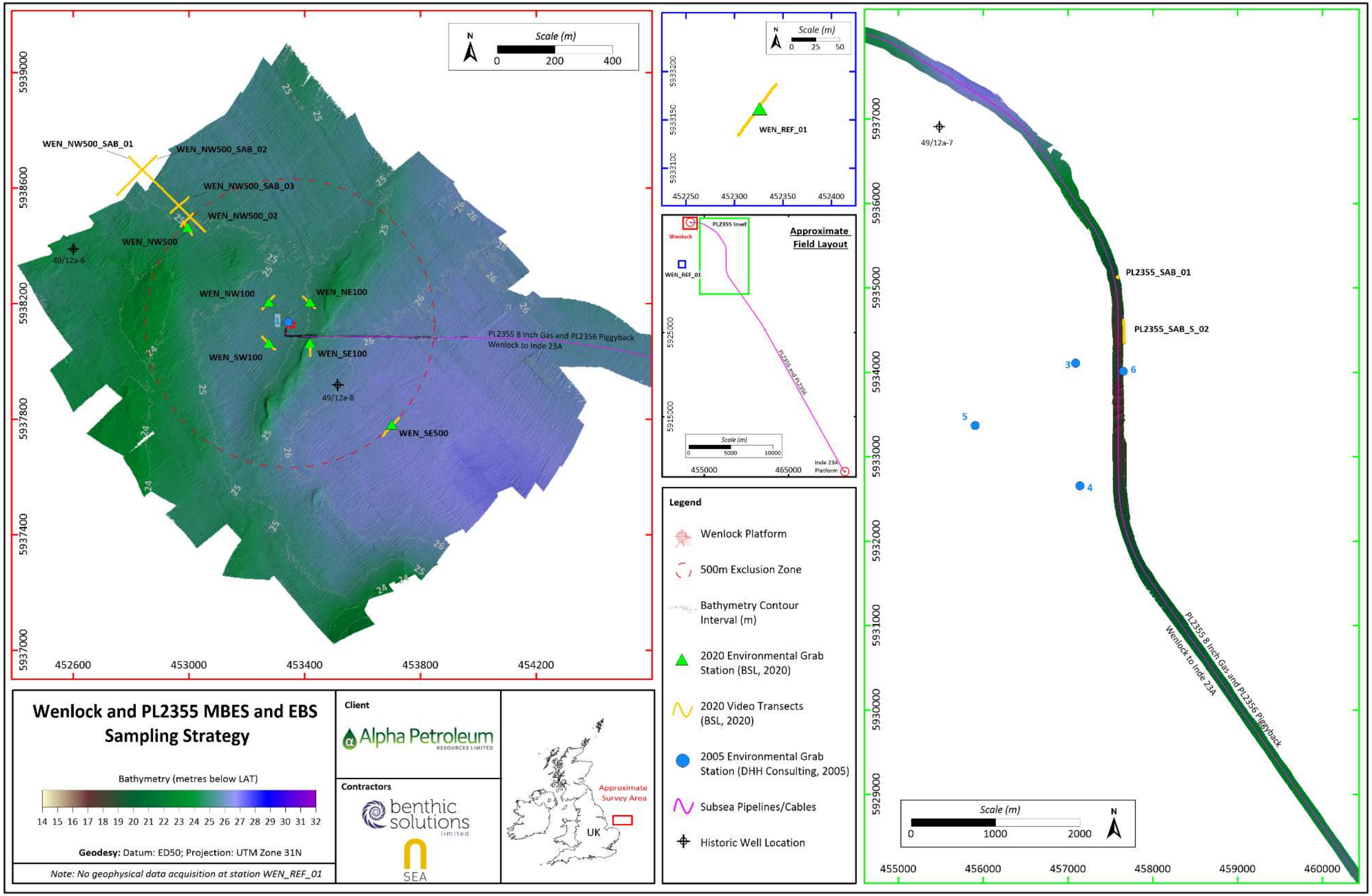
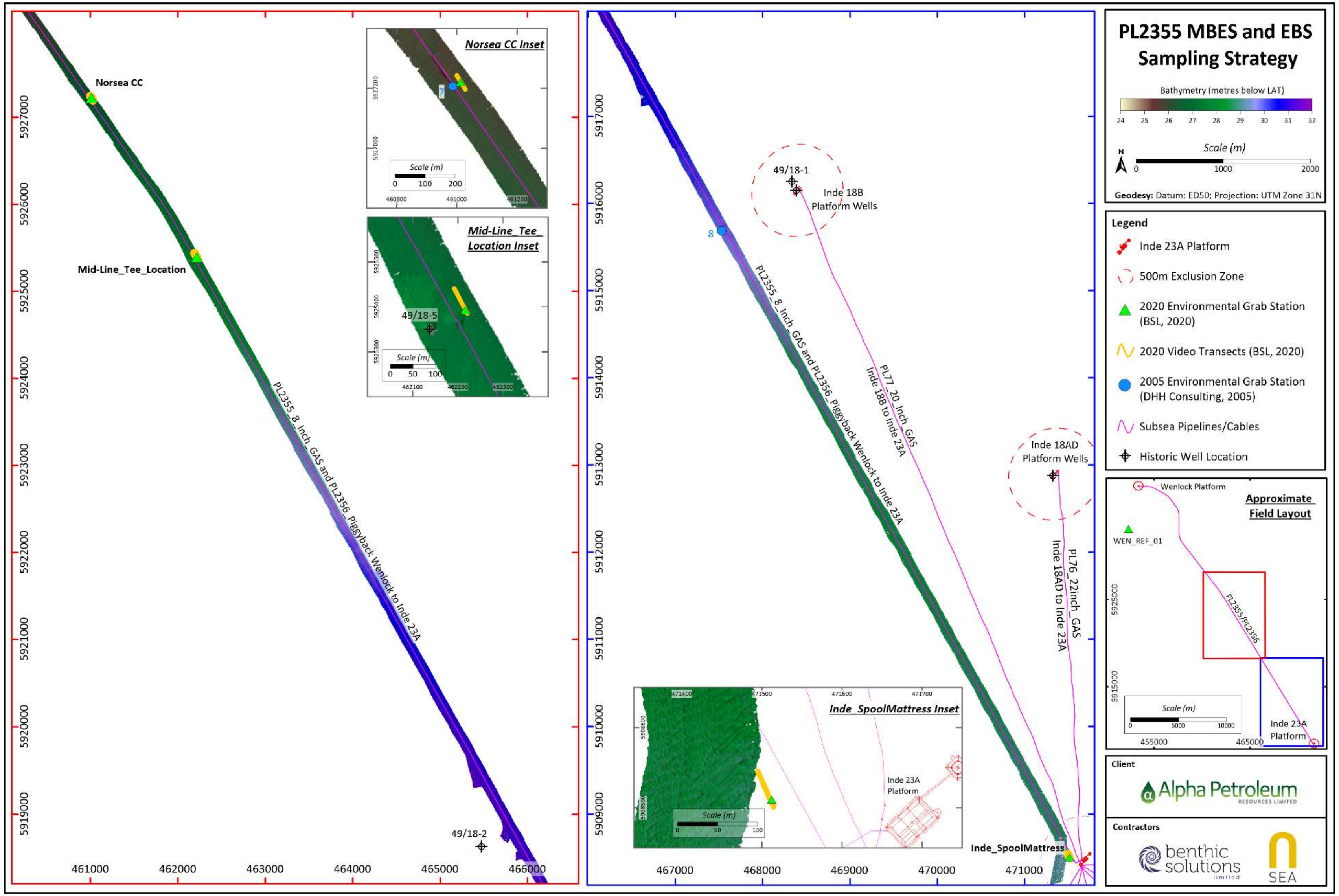


Figure 4.2. MBES Bathymetry Data and Environmental Sampling Strategy for Wenlock Platform and Pipelines (Chart 2 of 2) (BSL, 2020a)



4.4 Physical Environment

4.4.1 Geography

The Wenlock NUI is located in UKCS Block 49/12, approximately 97 km north east from the Norfolk coast and 45 km south west of the UK / Netherlands median line. The Inde 23A platform is located in UKCS Block 49/23, approximately 88 km north east from the Norfolk coast and 31 km south west of the UK / Netherlands median line (Figure 1.1, Section 1.1). The Wenlock pipelines also cross UKCS Block 49/18; the Norsea cable crossing and the mid-line tee are located within this block at KP 14.45 and KP 16.690 respectively.

4.4.2 Bathymetry

The seabed in the vicinity of the Wenlock infrastructure is relatively flat lying and generally decreases in gradient from northwest to southeast (Figures 4.1 and 4.2) (N Sea, 2020a; 2020b). Water depths along the route of the Wenlock pipelines range from 17.5 m to 31.2 m LAT, reaching a peak elevation as the pipelines cross one of the Indefatigable sandbanks at around KP 5.5 – KP 9.5 (N Sea, 2020b). Water depths at the Wenlock infrastructure where the proposed decommissioning activities will take place are summarised in Table 4.1.

Table 4.1. Water Depth at Locations of Proposed Wenlock Decommissioning Work

Infrastructure	Water Depth at Location (m)
Wenlock platform [1]	25.1
Inde 23A platform [2]	29.0
Mid-line tee [3]	28.7 – 29.8
Norsea cable crossing [3]	29.0
Abandoned well [1]	27.8

[1] Source: N Sea, 2020a; [2] Source: GEBCO, 2014; [3] Source: N Sea, 2020b.

4.4.3 Seabed Sediments

Seabed sediments within the southern North Sea generally comprise coarse sands with gravels in some areas. Sediments are highly mobile largely due to the increased near seabed currents (DECC, 2016). The SSS data collected during the 2020 pre-decommissioning survey indicates that seabed sediments in the vicinity of the Wenlock platform are comprised of sandy gravel, with occasional patches of disturbed seabed observed in the western part of the area (N Sea, 2020a). Along the pipelines, the start of the route is composed of sandy gravel (up to KP 2.900) and gravelly sand (up to KP 4.400). The section crossing the sand bank (KP 4.400 to 13.600) is mostly composed of sand at the exception of the summit where coarser material (gravelly sand to gravel) was reported. The section between KP 13.600 to 27.600 comprises sandy gravel / gravelly sand while the last section of the route, towards Inde 23A, was interpreted as a sandy seabed (N Sea, 2020b).

Analysis of the sediment samples taken during the 2020 survey found that all stations within the Wenlock 500 m zone conformed to Folk classifications of 'Sandy gravel and 'Gravelly sand'. All stations along the route of the pipelines and the reference station were composed of over 90% sand, with two pipeline stations identified as 'Slightly gravelly sand' and the reference station and one pipeline station identified as 'Sand'. The mean particle size ranged from 0.20 mm at stations Mid-Line_Tee and Norsea_CC (located along the route of the pipelines) to 2.08 mm at WEN_NW500 (located 500 m upstream of the Wenlock platform), with an average of 0.74 mm (±0.61SD) across the survey area (BSL, 2020a).

All stations sampled had low Total Organic Carbon (TOC) levels (mean 0.14% ±0.05SD) representative of an organically-deprived environment, which is typical for the Southern North Sea region due to the dominance of the sand/gravel fractions. In contrast, levels of total organic matter

(TOM) could be considered slightly elevated at stations within 500 m of the platform (ranging from 1.2% to 1.5%), with all platform stations exceeding the UKOOA (2001) 50th percentile for the Southern North Sea of 1.12%; however, the levels are similar to those recorded during the 2005 survey (1.1% at Station 1) (BSL, 2020a).

Total hydrocarbon content (THC) ranged from 2.7 $mg.kg^{-1}$ at the reference station to 42.5 $mg.kg^{-1}$ at WEN_NW500 (located 500 m upstream of the Wenlock platform), with a mean of 9.08 $mg.kg^{-1}$ (±12.8SD) across the survey area. Six stations within the survey area exceeded the UKOOA 50th percentile for the Southern North Sea of 4.34 $mg.kg^{-1}$, with one of these, WEN_NW500, in excess of the UKOOA 95th percentile level of 11.4 $mg.kg^{-1}$. WEN_NW500 is located near an area of *Sabellaria spinulosa* reef (see Section 4.2.2), which could be the reason for the higher THC at this station. As *S. spinulosa* acts to stabilise the sediment, its presence could increase deposition and retention of ambient natural and anthropogenic derived particulate material in an otherwise mobile sediment environment. No stations showed levels in excess of the OSPAR (2006) 50$mg.kg^{-1}$ threshold for THC, used to delineate the chemical boundaries of cuttings piles and above which impacts on the biota may occur (BSL, 2020a). The THC results from the 2005 survey recorded less than 5.0$mg.kg^{-1}$ at both comparable stations, which is similar to some of the stations sampled in the current survey.

Total n-alkane concentrations followed a similar pattern to THC, ranging from 0.03$mg.kg^{-1}$ at the reference station to 2.34$mg.kg^{-1}$ at WEN_NW500, with a mean of 0.42$mg.kg^{-1}$ (±0.73SD) across the survey area. No relationship between increased n-alkanes and proximity to the Wenlock platform was noted. Only station WEN_NW500 showed total n-alkanes surpassing the UKOOA 95th percentile of 0.78$mg.kg^{-1}$, with the gas chromatogram revealing a heavily weathered signature spanning the majority of alkanes consistent with petrogenic residues from diesel/fuel oil sources. This is likely to reflect broad-spectrum hydrocarbon input from coastal runoff, discharge from the riverine systems and contaminants introduced by shipping traffic (BSL, 2020a).

Total polycyclic aromatic hydrocarbons (PAH) concentrations were variable across the survey area and were again highest at WEN_NW500 and lowest at the reference station (4.79 $mg.kg^{-1}$ and 0.00 $mg.kg^{-1}$, respectively), with a mean of 0.59 $mg.kg^{-1}$ (±1.58SD) across the survey area. Significant correlations were observed between PAH and sediment characteristics, showing a strong positive correlation with gravel and a negative correlation with sand. PAH concentrations at all stations within 500m of the Wenlock platform exceeded the UKOOA 50th percentile for the SNS of 0.07 $mg.kg^{-1}$, while WEN_NW500 also surpassed the 95th percentile of 0.37$mg.kg^{-1}$. No significant correlation between distance from the Wenlock platform and PAH concentration was found, therefore the results were attributed to diffuse impact from riverine plumes and shipping traffic rather than drilling related (BSL, 2020a). Furthermore, the stations sit at the low end of the Cefas PAH concentrations for sediments surrounding North Sea oil and gas installations which range from 0.02$mg.kg^{-1}$ to 74.7$mg.kg^{-1}$ (Sheahan *et al.*, 2001).

Results for heavy and trace metal analysis are provided in Table 4.2. Metal concentrations showed no particular spatial pattern, but were elevated above background levels for all metals at almost every station. All metals exceeded, where available, their respective UKOOA 50th percentiles, with chromium, copper, vanadium, zinc and iron also elevated above the UKOOA 95th percentiles (BSL, 2020a).

Natural barium was highest 500 m south of the Wenlock platform and barium by fusion was highest 100 m south of the platform. Both stations showed relatively low THC, but with barium by fusion over five times higher than the second highest station it is possible that the levels at this station reflect low-level historic contamination from drilling activities associated with the nearby legacy appraisal well, located approximately 130 m south east, which was drilled in 1988. However, barium levels at these stations are still well below contaminated stations found within 500 m of active UK platforms, which often show concentrations in the thousands of $mg.kg^{-1}$ (e.g. 33,562$mg.kg^{-1}$; Cefas, 2001).

Table 4.2. Sediment Metals Analysis

Station	Depth (m)	Distance from Platform (m)**	Arsenic (AR-MS)	Cadmium (AR-MS)	Chromium (AR-MS)	Copper (AR-MS)	Lead (AR-MS)	Mercury (AR-MS)	Nickel (AR-MS)	Vanadium (AR-MS)	Zinc (AR-MS)	Aluminium (AR-MS)	Iron (AR-MS)	Barium (AR-MS)	Barium by Fusion (ICPOES)
WEN_NE100	25	100 (W)	16.2	0.14	65.6	9.2	7.2	0.03	16.3	46.7	35.9	5,750	26,100	60.6	291
WEN_SE100	25	100 (W)	8.0	0.06	86.5	6.7	5.0	0.02	8.4	25.5	20.3	2,670	10,500	25.2	2,500
WEN_NW100	25	100 (W)	10.6	0.08	76.1	5.6	5.4	0.02	9.9	27.0	22.8	2,820	12,500	44.2	149
WEN_SW100	25	100 (W)	16.4	0.13	77.4	11.1	7.5	0.02	16.5	43.1	41.8	5,360	23,100	51.5	294
WEN_NW500	25	500 (W)	13.6	0.30	65.5	8.3	7.0	0.02	18.1	38.0	43.1	2,640	12,400	51.2	409
WEN_SE500	26	500 (W)	11.5	0.06	72.7	8.4	5.8	0.02	10.8	29.7	24.3	5,040	20,900	106	279
Inde_SpoolMattress	29*	160 (I23A)	11.0	0.07	78.9	16.0	8.7	<0.015	5.7	21.6	39.0	1,830	8,220	17.6	109
Mid-Line_Tee	28	11,100 (I18B)	9.0	0.05	66.6	3.2	5.1	<0.015	4.9	22.8	13.5	1,660	6,460	19.7	212
Norsea_CC	27	13,300 (W)	8.0	0.05	74.7	9.0	4.5	0.02	4.8	21.1	16.2	1,890	6,770	18.4	265
WEN_REF_01	30*	5,100 (W)	8.7	<0.04	91.2	4.4	4.3	0.03	5.5	21.7	12.4	1,530	8,020	18.7	153
Mean			**10.8**	**0.10**	**76.6**	**8.08**	**5.92**	**0.02**	**9.40**	**27.8**	**25.9**	**2,827**	**12,097**	**39.2**	**486**
SD			**2.81**	**0.08**	**8.36**	**3.84**	**1.49**	**0.00**	**5.00**	**7.85**	**12.2**	**1,427**	**6,054**	**28.9**	**761**
CV (%)			**26.1**	**84.9**	**10.9**	**47.6**	**25.2**	**17.6**	**53.1**	**28.2**	**47.1**	**50.5**	**50.0**	**73.8**	**156.7**
Historical Comparison															
Wenlock (DDH Consulting, 2005)	**Station 1 (Platform)**		**12.9**	**0.0173**	**6.48**	**2.47**	**6.1**	**<0.04**	**7.31**	**25.4**	**22.1**	**-**	**-**	**9.39**	**-**
	Station 7 (~Norsea_CC)		**5.72**	**<0.01**	**6.25**	**0.773**	**5.25**	**<0.04**	**3.47**	**17.3**	**11.4**	**-**	**-**	**10.2**	**-**
Reference Levels															
UKOOA 50th Percentile (UKOOA, 2001)				0.03	6.51	2.04	6.00	0.02	3.97	14.7	12.2	-	5,183	26	-
UKOOA 95th Percentile (UKOOA, 2001)			-	0.72	44.8	13.9	21.0	0.05	21.5	35.8	35.8	-	18,555	272.4	-
OSPAR ERL (OSPAR, 2009b)			8.20	1.20	81	34	46.7	0.15	20.9	-	150		-	-	-
OSPAR ERM (OSPAR, 2009b)			70	9.60	370	270	218	0.71	51.6	-	410		-	-	-

Light Yellow cell = above UKOOA 50th %ile *Orange cell = above UKOOA 95th %ile* *Pink cell = above ERL* *Red cell = above ERM*

**Outside of MBES area, depth based on closest geophysical data or non-tidally corrected single beam echo sounder depth from deck logs*

*** W = Wenlock Platform, I23A = Inde 23A Platform, I18B = Inde 18B Platform*

Effect range low (ERL) values are defined by Long, *et al*. (1995) as the lowest concentration of a metal that produced adverse effects in 10% of the data reviewed, whilst effect range median (ERM) values designate the level at which half of the studies reported harmful effects. Consequently, metal concentrations recorded below the ERL value are not expected to elicit adverse effects, while levels above the ERM value are likely to be toxic to some marine life. It can be seen from Table 4.2 that arsenic was elevated above its ERL value at all but two stations while chromium was above its ERL value at two stations. None of the metals were found to be elevated above their ERM values.

Correlations between metals and sand and gravel, suggested variability in metals concentrations was natural and influenced by sediment characteristics across the survey area (BSL, 2020a).

4.4.4 Seabed Features

The Wenlock platform and approximately 28.6 km of the route of the Wenlock pipelines, including the mid-line tee structure, is located within the boundary of the North Norfolk Sandbanks and Saturn Reef SAC, which contains the most extensive example of offshore linear ridge-type sandbanks in UK waters (refer to Section 4.2.6 for further details). Sediment movement occurs at high levels around and across each sandbank system; however large-scale bank migration in the SAC is believed to be very slow, with the sandbanks thought to be gradually elongating towards the north east (JNCC, 2010a). Within the SAC, the Wenlock pipelines cross one of the Indefatigable sandbanks between KP 5.5 and KP 9.5 (see Figure 2.4, Section 2.2). Historic general inspection survey data for the Wenlock pipelines indicates that the 2007 seabed profile closely matches that seen in 2015 and 2020 (pre-decommissioning survey), both at the peak of the sandbank and on its slope. The outer banks in the SAC (Swarte and Indefatigable) may be moribund, as their crests now lie in comparatively deep water where currents are likely to be insufficient for sand transportation (Cooper *et al.*, 2008; Kenyon *et al.,* 1981).

Sandbanks are also characterised by relatively strong currents which produce characteristic features such as mega ripples. During the 2020 pre-decommissioning survey, megaripples were observed along the majority of the route of the Wenlock pipelines and were particularly marked between KP 6.6 and KP 13.6, where they are sinuous with 10-15 m wavelength, and from KP 27.6 to the Inde 23A end of the pipeline with 15-20 m wavelength. The height of the megaripples is approximately 0.2 m (N Sea, 2020b). No sand ripples were detected in the vicinity of the Wenlock platform (N Sea, 2020a).

Sixty-four boulders were identified during the pre-decommissioning seabed survey (fifty-eight in the vicinity of the Wenlock platform and six along the PL2355 pipeline), along with thirteen items of potential debris (N Sea, 2020a; 2020b). One of the platform pile sleeves displayed indications of scour (approximately 0.10 m to 0.15 m). No signs of scour were observed at the abandoned well conductor protruding from the seabed (N Sea, 2020a) and no signs of scour were observed at the mid-line tee structure, although rope remains of possible fishing gear were seen snagged behind the rigging of the support bag of the east face mattress (N Sea, 2020b). No evidence of drill cuttings was found in the vicinity of the Wenlock platform or at the abandoned appraisal well location.

Patches of disturbed sediment were identified from the SSS data to the west of the Wenlock platform, which were subsequently investigated for their potential to be Annex I listed habitat *Sabellaria spinulosa* (see Section 4.2.2 for further details).

4.4.5 Oceanography

Tides in the southern North Sea are predominately semi-diurnal and tidal waters offshore in this area of the southern North Sea 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 Wenlock infrastructure are a maximum of 0.5 and 0.4 metres per second 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 10ºC and 11ºC (Marine Scotland, 2020).

The annual mean significant wave height in the vicinity of the Wenlock infrastructure ranges from 1.52 m to 1.60 m (Marine Scotland, 2020).

4.4.6 Meteorology

Winds in this region of the Southern North Sea 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).

4.5 Biological Environment

4.5.1 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 southern North Sea a phytoplankton bloom occurs every spring, generally followed by a smaller peak in the autumn (DECC, 2016).

The southern North Sea 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 *Ceratium* (*C. fusus*, *C. furca*, *C. lineatum*), 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 southern North Sea, which has been linked to changes in global weather phenomena (DECC, 2016). However, the planktonic assemblage in the vicinity of the Wenlock infrastructure is not considered unusual.

4.5.2 Seabed Communities

4.5.2.1 Habitat Classification

Data from the Mapping European Seabed Habitats (MESH) Project (EMODnet, 2018) mapped and classified seabed sediment types in the Celtic and Greater North Sea according to the European Nature Information Systems (EUNIS) classification. This system also identifies keystone species that are associated with certain environmental conditions (e.g. water depth, temperature, sediment type etc.) and can therefore be indicators of specific habitat or environmental condition. This allow for the inference of community composition based on seabed type mapping and the identification of benthic biotopes. The following EUNIS seabed classifications have been identified in the vicinity of the Wenlock infrastructure (Connor *et al.*, 2004):

- **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.

As previously noted the Wenlock infrastructure is located within the boundary of the North Norfolk Sandbanks and Saturn Reef SAC (refer to Section 4.2.6 for further details). Numerous surveys have been undertaken within this SAC as part of the site assessment process. Analysis of grab and video samples collected during a collaborative survey conducted by CEFAS and JNCC in 2013 indicated that the predominant EUNIS habitats within the SAC were sublittoral coarse sediment, sand, mud, and mixed sediments (Vanstaen and Whomersley, 2015). Characterising species generally included the polychaetes *Ophelia borealis*, *Polycirrus*, *Lagis koreni*, *Scoloplos armiger* and *Nephtys cirrosa*, and the amphipod *Bathyporeia guilliamsoniana*. The whole site was faunally heterogeneous on a small spatial scale, and infaunal communities were similar between nearshore and offshore sandbanks, and between crest, flanks, and troughs. Biotopes present on the sandbanks generally matched either 'A5.233: *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand' or 'A5.231: Infralittoral mobile clean sand with sparse fauna'. However, the only EUNIS biotope that could confidently be assigned to grab and video samples was 'A5.611: *S. spinulosa* on stable circalittoral mixed sediment' (Jenkins *et al.,* 2015). The habitat type has also been identified in the region in a number of past surveys (BMT Cordah, 2003; Jenkins *et al.*, 2015; JNCC, 2017a; 2019).

Based on the ground-truthing data obtained during 2020 survey, two JNCC/EUNIS habitat classifications were assigned for the survey area, 'Circalittoral Coarse Sediment' (SS.SCS.CCS/A5.14) within the Wenlock 500 m zone and 'Circalittoral Fine Sand' (SS.SCS.CFiSa/A5.25) along the route of the pipelines (BSL, 2020b).

<u>Circalittoral Coarse Sediment (A5.14) Habitat</u>

Observed fauna within areas of Circalittoral Coarse Sediment included Annelida (Serpulidae, *Lanice conchilega, Sabellaria spinulosa*), Cnidaria (*Alcyonium digitatum, Hydrallmania falcata*), Arthropoda (*Pagurus bernhardus, Cancer pagurus, Carcinus maenas,* Cirripedia), Echinodermata (*Asterias rubens, Ophiuroidea sp.*), Mollusca (observed as siphons protruding from the seabed) and Bryozoa (*Flustra foliacea*, Bryozoa turf). Chordata were almost completely absent from the visual survey of the 'Circalittoral Coarse Sediment', with sightings of just three individuals across all stations (*Pleuronectiformes spp.*) (BSL, 2020b).

The presence of a relatively rich community of polychaetes including *Mediomastus fragilis,* and some venerid bivalves within the coarse sediment stations indicated conformance to the level five biotope '*Mediomastus fragilis, Lumbrineris spp.* and Venerid Bivalves in Circalittoral Coarse Sand or Gravel' (SS.SCS.CCS.MedLumVen/A5.142). Other species characteristic of the A5.142 habitat and recorded within the Wenlock survey area included the pea urchin *Echinocyamus pusillus*. However, while much of the evidence suggests that this biotope is dominant within the survey area, the low abundance of the key taxa, *Lumbrineris spp.* (only one individual of one species found) has prevented confident assignment to this biotope (BSL. 2020b).

Example seabed images for this habitat are provided in Figure 4.3. The extent of this habitat within the survey area is mapped in Figures 4.5 and 4.6.

Circalittoral Fine Sand (A5.25) Habitat

Observed fauna within areas of Circalittoral Fine Sand included Echinodermata (*Asterias rubens,* Ophiuroidea sp., Spatangoidea sp.) Cnidaria (possible *Cerianthus lloydii,*), Arthropoda (*Pagurus bernhardus, Corystes cassivelaunus*), and Mollusca (observed as siphons protruding from the seabed). Chordata were completely absent from the visual survey of the 'Circalittoral Fine Sand' (BSL, 2020b).

Two level five biotopes exist within the Circalittoral Fine Sand habitat; '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in Circalittoral Fine Sand' and '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand'. However, due to the generally impoverished fauna observed at these stations further classification to either of the two level five biotopes for fine sand was not possible, but the presence of both *Echinocyamus pusillus* and *Bathyporeia elegans* at all four stations suggests some conformance to both biotopes (BSL, 2020b).

Example seabed images for this habitat are provided in Figure 4.4. The extent of this habitat within the survey area is mapped in Figures 4.5 and 4.6.

Figure 4.3. Example Images of Circalittoral Coarse Sediment (A5.14) Habitat (BSL, 2020b)

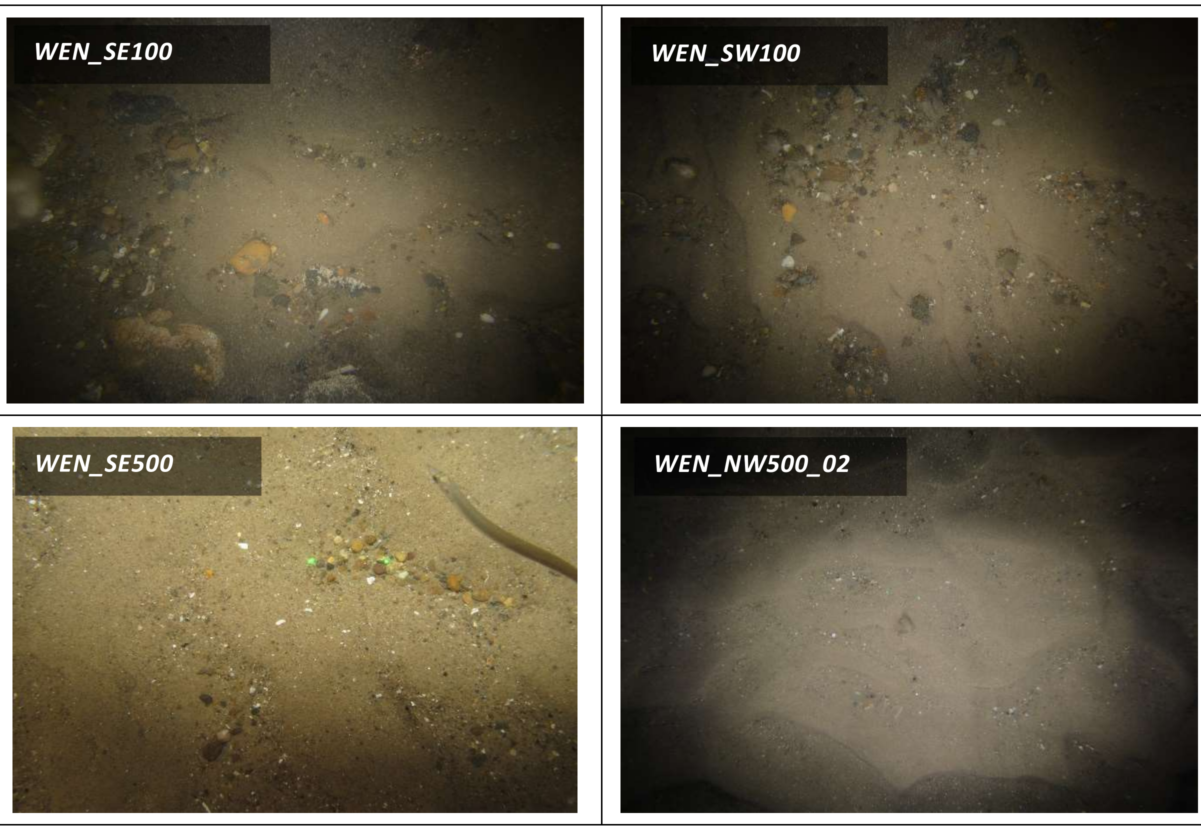


Figure 4.4. Example Images of Circalittoral Fine Sand (A5.25) Habitat (BSL, 2020b)

Figure 4.5. Habitat Distribution Over Sidescan Sonar Data for Wenlock and PL2355/PL2356 (Chart 1 of 2) (BSL, 2020b)

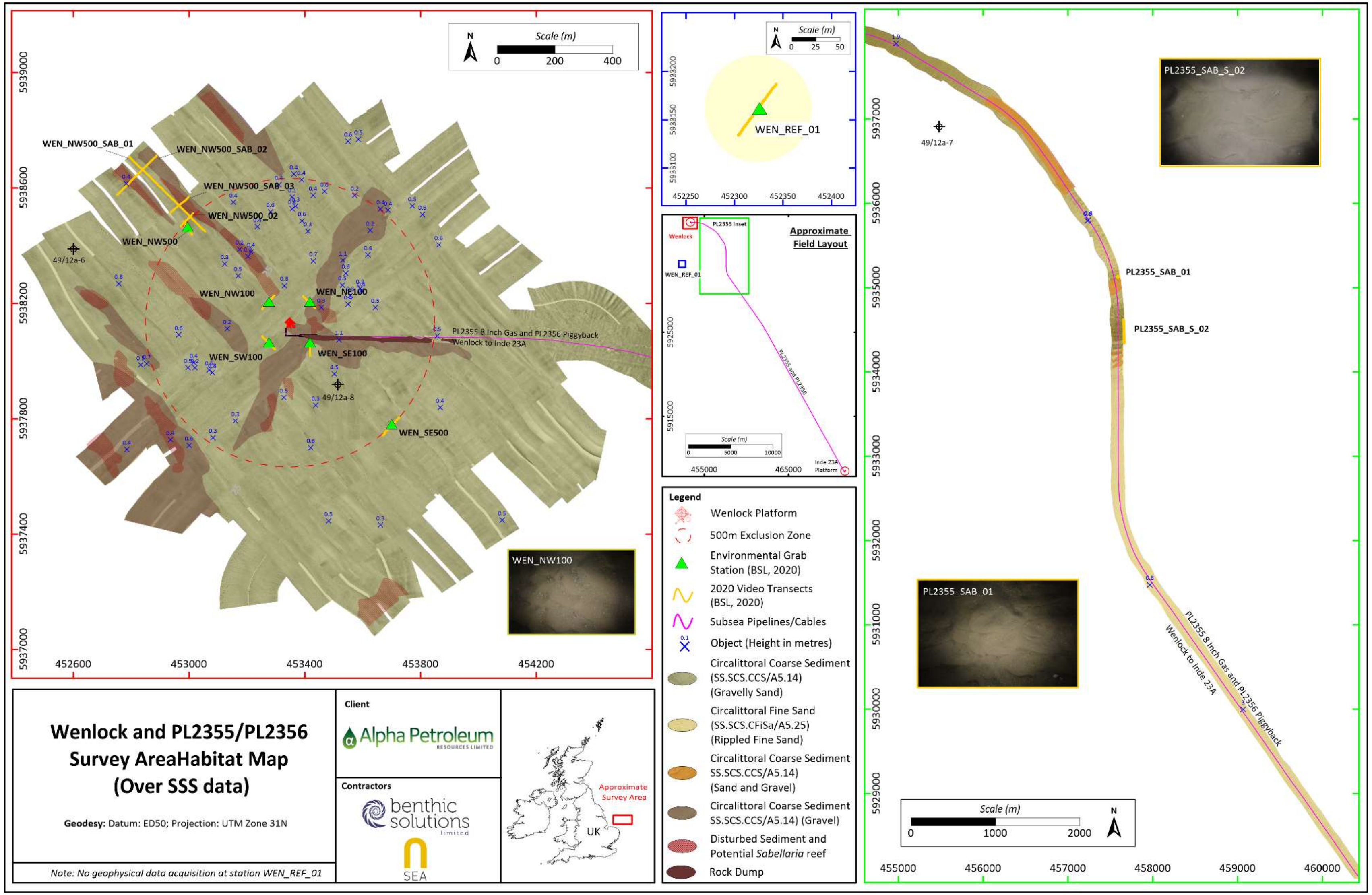
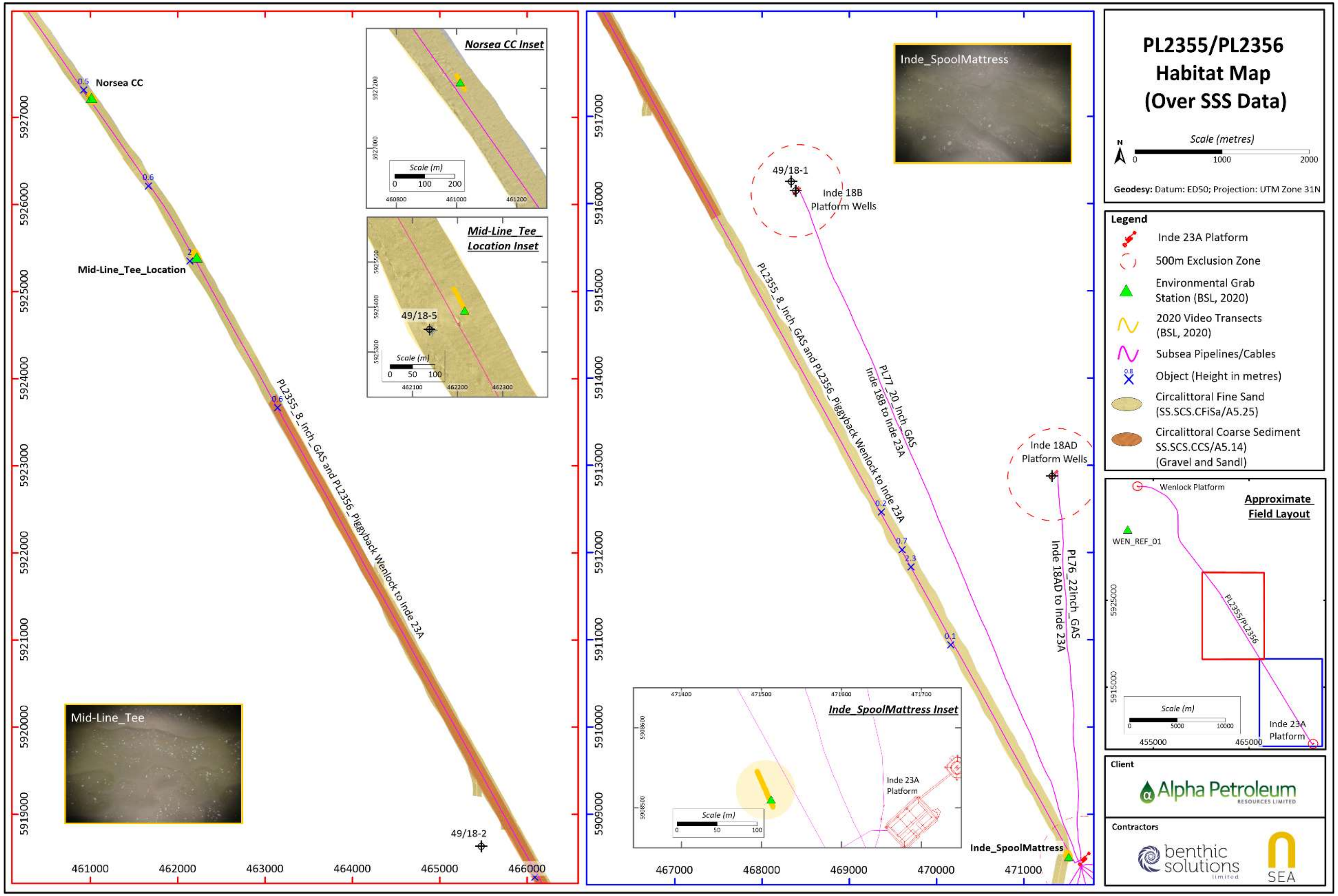


Figure 4.6. Habitat Distribution Over Sidescan Sonar Data for Wenlock and PL2355/PL2356 (Chart 2 of 2) (BSL, 2020b)



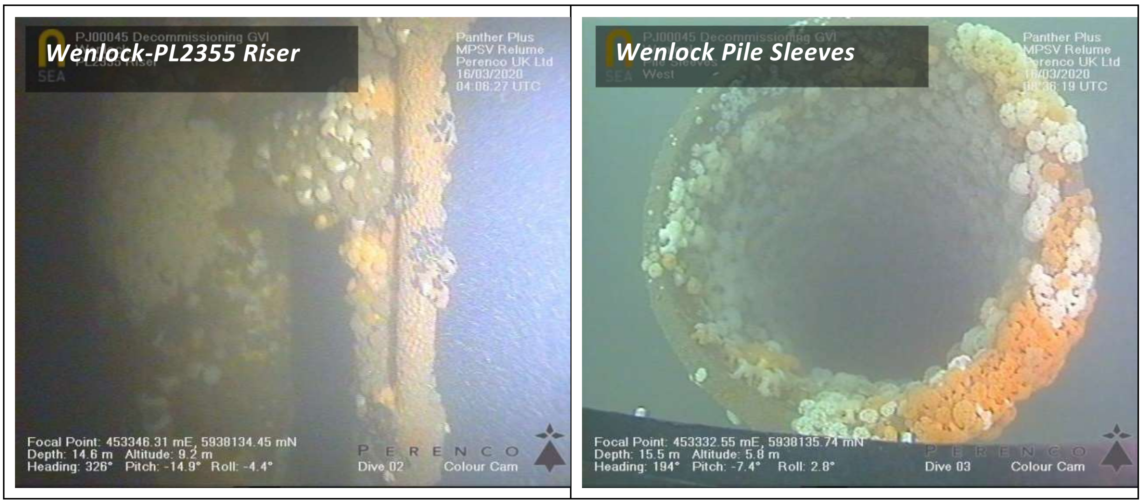
Anthropogenic Habitat

The introduction of additional hard substrate into the marine environment can increase epifaunal biodiversity by providing hard attachment in an otherwise homogeneous soft sediment environment.

During the 2020 survey, an average of 90-100% soft marine growth was observed on the Wenlock platform, with additional hard marine growth observed in the splash zone (N Sea 2020a). An average of 90% soft marine growth was also noted on the abandoned wellhead (N Sea, 2020b).

Inspection of the platform structure with ROV revealed that the structure was colonised by species such as barnacles (Cirripedia spp.), anemones (Actiniaria spp.) and Hydroids, while hermit crabs (Paguridae spp.) and flatfish (Pleuronectiformes) were observed living under and near to infrastructure (BSL, 2020b) (see Figure 4.7).

Figure 4.7. Example Images of Anthropogenic Habitat (BSL, 2020b)



4.5.2.2 Macrofaunal Analysis

Analysis of sediment macrofauna from the 2020 pre-decommissioning survey found that species richness and faunal abundance varied within the survey area, reflecting the change in sediment type between the Wenlock platform and PL2355/PL2356 pipeline stations.

A total of 764 individuals (infauna and solitary epifauna) were identified from the 18 samples analysed. Of the 110 taxa recorded, five were solitary epifauna, and 96 were infaunal, consisting of 48 annelid species accounting for 56.7% of the total individuals. The crustaceans were represented by 19 species (11.0% of the total individuals), the molluscs by 15 species (13.0% of the total individuals) and the echinoderms by three species (3.8% of the total individuals). Solitary epifauna was represented by two Cnidaria (Actiniaria and Edwardsiidae) and three Chordata (*Ascidiella scabra, Branchiostoma lanceolatum* and *Ammodytes marinus*). All other groups (Phoronida, Platyhelminthes, Nemertea, Nematoda and Sipuncula) were represented by six species, accounting for 13.4% of the total individuals. A total of four juvenile species were also recorded within the survey area, of which Echinodermata (9 individuals) were the most abundant (BSL, 2020a).

Epifaunal richness was greater at stations within 500 m of the Wenlock platform, where gravel was recorded as a more significant component of the sediment. This is expected for coarse sediment habitats where epifaunal species utilise the hard substrata for attachment and colonisation. Conversely, at the pipeline stations which were influenced by fine to medium sands, very few epifaunal species were recorded (BSL, 2020a).

Numbers of individuals were variable within the Wenlock platform and PL2355/PL2356 pipeline route survey area and ranged between 6 per $0.1m^2$ for sample replicates WEN_SE100_F1 and WEN_REF_1_F2 to 131 per $0.1m^2$ for sample replicate WEN_NE100_F1. By station, faunal abundance followed a similar pattern with a minimum of 15 per 0.2m^2 at station WEN_REF_01 and maximum abundance of 213 per 0.2m^2 at WEN_NE100. Overall numbers with consistent with an impoverished macrofauna found within mobile sand environments (BSL, 2020a).

Analysis using multivariate statistics identified five significantly different macrofaunal groupings within the survey area, the first comprising the two stations within the highest species richness and faunal abundance of the survey area located within the Wenlock platform 500m zone (WEN_NE100 and WEN_SE500). The second, third and fourth clusters comprised all other stations near to the Wenlock platform and the reference station WEN_REF_01, where univariate parameters varied from the first cluster. The last cluster contained all stations sampled along the PL2355/PL2356 pipeline, where the dominance of sand resulted in a macrofaunal community unique from the Wenlock platform stations. As expected, variation in macrofauna community composition were significantly correlated with particle size distribution, but also weakly significantly correlated with TOC and metals. The latter correlations were deemed to be due to natural variations rather than any drilling impact (BSL, 2020a).

Comparison with the 2005 pre-drill survey revealed a similar trend to that seen with the 2020 pre-decommissioning survey, with Station 7 (Norse_CC) impoverished compared to Station 1 (Wenlock platform). The high sand content and its mobility at Station 7 and Norsea_CC is thought to have prevented settlement and colonisation by many species resulting in the denuded community found between years at stations along the pipeline. At a species level, over ten species found at Station 1 were also found within 100 m of the Wenlock platform in the 2020 survey, including *Notomastus*, the ross worm *Sabellaria spinulosa*, the arthropod *Leptocheirus hirsutimanus* and the pea urchin *Echinocyamus pusillus*. Station 7 also shared some species with the current comparable station Norsea_CC, including the sea potato *Echinocardium cordatum*, a sand hopper *Bathyporeia elegans* and the polychaete *Goniada maculata*. The results indicate that there has been little impact to the benthic communities at the two comparable stations as a result of the construction and operation of the Wenlock field (BSL, 2020a).

4.5.2.3 Annex I Biogenic Reef

Sabellaria spinulosa is one of the two designated features of the North Norfolk Sandbanks and Saturn Reef SAC (refer to Figure 2.2 (Section 2.2) for areas of reef that have been previously identified within the SAC). The ross worm *S. spinulosa* is a polychaete, which forms sand-tubes. Consolidation of large agglomerations of these tubes forms reef habitat which allows settlement, and provides habitat for other species. These biogenic reefs support epifauna such as bryozans, hydroids, sponges and anemones. Additional mobile organisms include squat lobsters, crabs, the common lobster (*Homarus gammarus*) and pink shrimp (*Panalus montagui*) (JNCC, 2010a). *S. spinulosa* reef is listed as an Annex I habit under the Habitats Directive (Council Directive 92/43/EEC), as a UK BAP priority marine habitat (JNCC, 2007) and is listed on the OSPAR List of Threatened and/or Declining Species (OSPAR, 2014).

During the 2020 pre-decommissioning survey, the presence of *S. spinulosa* was noted on camera transect WEN_NW500 to the north west of the Wenlock platform, and a series of three additional transects was conducted in this area to delineate the boundaries of this (WEN_NW500_SAB_01, WEN_NW500_SAB_02, and WEN_NW500_SAB_03). An assessment of 'reefiness' was performed to describe the habitat using a combination of the JNCC guidelines for assessment of 'reefiness' of *S. spinulosa* aggregations (Gubbay, 2007) and JNCC / Centre for Environment, Fisheries and Aquaculture Science (Cefas) recommended methodologies (Jenkins *et al.,* 2015). The results are documented in Table 4.3.

The results of the reefiness assessment confirmed a variable level of reefiness, with one main reef area being identified, which consisted of approximately 55% 'Low Reef' structures, 34% 'Medium Reef' structures, and 11% 'Not a Reef' structures. The patches within this area were very variable and as such could not be broken down further, however with an area of approximately 7,000m^2, this reef would be considered an area of 'Low Reef' regardless of whether the reef was classified as low or medium structure (BSL, 2020b).

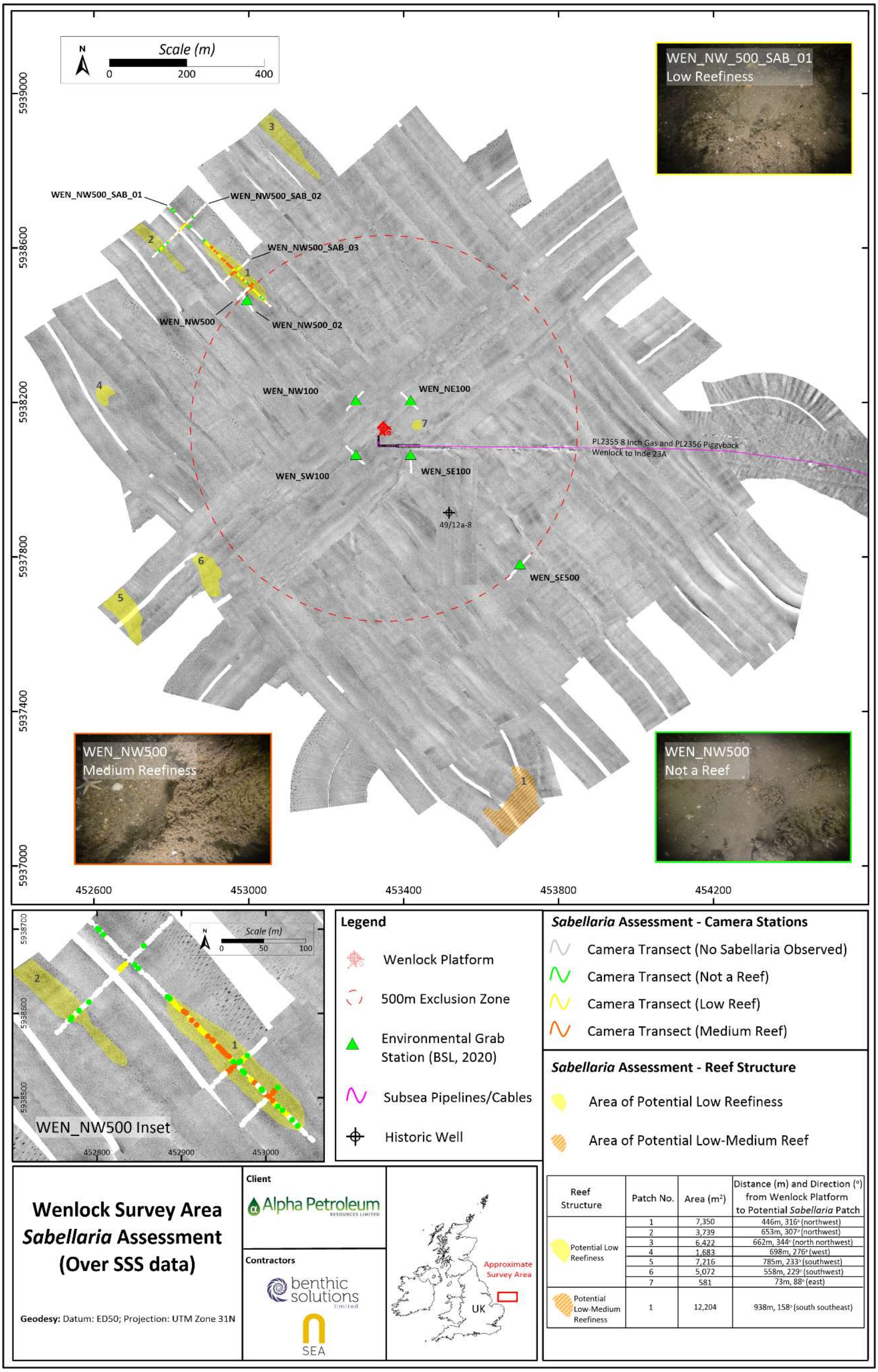
Further areas of disturbed sediment with the potential to contain *S. spinulosa* reef were delineated from the geophysical data and were assessed by comparing the geophysical signatures to those observed in the ground-truthed area around station WEN_NW500. A combination of this comparison and the area of the potential feature were used to assign a 'worst case' level of potential reefiness, resulting in a total of six areas of potential 'Low Reef' and one area to the south east of the Wenlock platform that has the potential to be classed as 'Medium Reef', but as the limits extend beyond the boundaries of the geophysical data this cannot be quantified. As such this area is delineated as 'Potential Low-Medium Reef'. All identified and potential areas of *S. spinulosa* reef are mapped in Figure 4.8.

Two further camera transects (PL2355_SAB_01 and PL2355_SAB_S02) were conducted along the route of the Wenlock pipelines to investigate sediment changes in the geophysical data, however no *S. spinulosa* was observed. It is likely that the fine mobile sands found along the pipeline and associated sediment turnover prevent the settlement of *S. spinulosa* in this fine sand habitat. This is backed up by the presence of *S. spinulosa* to the north of the Wenlock platform where sediment was more coarse with the highest gravel contents being recorded at station WEN_NW500 (56.5%), and its absence along the pipeline route where sediment was more sand dominated (BSL, 2020b).

Table 4.3. Sabellaria Reefiness Assessed from Video Data (BSL, 2020b)

Station	Easting (m)	Northing (m)	Sediment Type	*Sabellaria* Reefiness (After Gubbay 2007)		
				Patchiness (% cover)	Elevation (Average tube height in cm)	Reef Structure
WEN_NW 500_SAB_01	453054 453039	5938450 5938465	Rippled Slightly Gravelly Sand	N/A	N/A	N/A
	453039 453017	5938465 5938487	Gravelly Sand with *Sabellaria* tubes	<5%	<5cm	Not a Reef
	453017 453011	5938487 5938493	Gravelly Sand with *Sabellaria* tubes	10-20%	5-8cm	Low
	453011 452978	5938493 5938527	Gravelly Sand with *Sabellaria* tubes	20-30%	5-10cm	Medium
	452978 452964	5938527 5938539	Gravelly Sand with *Sabellaria* tubes	5-10%	3-5cm	Not a Reef
	452961 452957	5938543 5938548	Gravelly Sand with *Sabellaria* tubes	5-10%	3-5cm	Not a Reef
	452957 452936	5938548 5938569	Gravelly Sand with *Sabellaria* tubes	20-30%	5-10cm	Medium
	452936 452891	5938569 5938613	Gravelly Sand with *Sabellaria* tubes	40-50%	10cm	Medium
	452891 452880	5938613 5938624	Gravelly Sand with *Sabellaria* tubes	10-20%	5cm	Low
	452880 452840	5938624 5938662	Slightly Gravelly Sand	1%	<3cm	Not a Reef
WEN_NW 500_SAB_02	452847 452865	5938662 5938680	Gravelly Sand	N/A	N/A	N/A
	452865 452882	5938680 5938696	Gravelly Sand with *Sabellaria* tubes	15%	5cm	Low
	452882 452923	5938696 5938738	Rippled Gravelly Sand	N/A	N/A	N/A
	452923 452936	5938738 5938751	Gravelly Sand with *Sabellaria* tubes	10%	<5cm	Low
	452936 452982	5938751 5938797	Rippled Gravelly Sand	N/A	N/A	N/A
WEN_NW 500_SAB_03	453031 453050	5938599 5938616	Rippled Gravelly Sand	N/A	N/A	N/A
	453050 453071	5938616 5938633	Gravelly Sand with *Sabellaria* tubes	40%	8cm	Medium
	453071 453078	5938633 5938638	Gravelly Sand with *Sabellaria* tubes	10%	<5cm	Low
	453078 453094	5938638 5938654	Rippled Gravelly Sand	N/A	N/A	N/A
WEN_NW 500	453110 453095	5938596 5938583	Gravelly Sand with *Sabellaria* tubes	5-10%	4-5cm	Not a Reef
	453095	5938583	Slightly Gravelly Sand	N/A	N/A	N/A

Figure 4.8. S. spinulosa Potential and Ground-truthed Coverage Around the Wenlock Platform (BSL, 2020b)



Reef Structure	Patch No.	Area (m^2)	Distance (m) and Direction (°) from Wenlock Platform to Potential *Sabellaria* Patch
Potential Low Reefiness	1	7,350	446m, 316° (northwest)
	2	3,739	653m, 307° (northwest)
	3	6,422	662m, 344° (north northwest)
	4	1,683	698m, 276° (west)
	5	7,216	785m, 233° (southwest)
	6	5,072	558m, 229° (southwest)
	7	581	73m, 88° (east)
Potential Low-Medium Reefiness	1	12,204	938m, 158° (south southeast)

4.5.3 Fish

4.5.3.1 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 Wenlock infrastructure is located within ICES Statistical Rectangles 35F2 and 36F2. Species that spawn within this ICES Rectangles 35F2 and 36F2 include cod (*Gadus morhua*), herring (*Clupea harengus*), lemon sole (*Microstomus kitt*), mackerel (*Scomber scombrus*), the crustacean *Nephrops* also known as the Dublin Bay Prawn, plaice (*Pleuronectes platessa*) (at high intensity), sandeel (*Ammodytes* spp.), sole (*Solea solea*) and sprat (*Sprattus sprattus*). ICES Rectangles 35F2 and 36F2 are also nursery grounds for anglerfish (*Lophius piscatorius*), cod, herring, horse mackerel (*Trachurus trachurus*), lemon sole, mackerel, *Nephrops*, sandeel, sprat, spiny dogfish (*Squalus acanthias*), tope shark (*Galeorhinus galeus*), whiting (at high intensity) (*Merlangius merlangus*) (Table 4.4; Coull *et al.*, 1998; Ellis *et al.*, 2012).

Table 4.4. Fish Spawning and Nursery Species within ICES Rectangles 35F2 and 36F2 (Coull et al., 1998; Ellis et al., 2012)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish [1]	N	N	N	N	N	N	N	N	N	N	N	N
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 [2]	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
Nephrops	N	N	N	N	N	N	N	N	N	N	N	N
Plaice												
Sandeels [3]	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
Spiny Dogfish [2]	N	N	N	N	N	N	N	N	N	N	N	N
Tope Shark	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

[1] Insufficient data available on spawning grounds.
[2] Viviparous species (gravid females can be found all year) (*Ellis et al., 2012*).
[3] Six sandeels were observed at four stations within the Wenlock survey area (WEN_NW100, WEN_REF_01, WEN_SE500, and WEN_SW100) during the 2020 pre-decommissioning survey (BSL, 2020b).

In addition, data outputs from Aires *et al.* (2014) provide a guide to the most likely locations for aggregations of fish during their first year. Age 0 group fish are defined as fish in the first year of their lives and can also be classified as juvenile. The Wenlock infrastructure is located in an area of moderate probability of 0 group fish for herring, horse mackerel, mackerel and whiting, and low probability for anglerfish, blue whiting (*Micromesistius poutassou*), cod, haddock (*Melanogrammus* *aeglefinus*), hake (*Merluccius merluccius*), Norway pout (*Trisopterus esmarkii*), plaice, sole and sprat (Aires *et al.*, 2014).

All the species mentioned above, with the exception of haddock, lemon sole, *Nephrops*, sprat are listed as UK BAP priority marine species (JNCC, 2007). Cod is on the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR, 2014). In addition, cod, haddock spiny dogfish and tope shark are listed as 'Vulnerable' globally on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species – with spiny dogfish also listed as 'Endangered' in Europe - and should therefore be considered as priorities for protection. All other species are listed as 'Least Concern', aside from sole which is listed as 'Data Deficient' (IUCN, 2020).

4.5.3.2 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 southern North Sea at various times throughout the year, and may therefore be present in the vicinity of the proposed Wenlock infrastructure, are listed in Table 4.5 (Ellis *et al.*, 2004; IUCN, 2020).

Table 4.5. Elasmobranch Species Likely to be found in the Vicinity of the Proposed Decommissioning Work (Ellis et al., 2004; IUCN, 2020)

Common name	Latin name	Depth range (in metres)	Global IUCN Status [1]	European IUCN Status [1]
Blonde skate	*Raja brachyuran*	10 – 900	Near Threatened	Near Threatened
Common smooth-hound	*Mustelus mustelus*	5 – 350	Vulnerable	Vulnerable
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	Least Concern	Near Threatened
Thornback skate	*Raja clavata*	10 – 300	Near Threatened	Near Threatened
Tope shark	*Galeorhinus galeus*	0 – 2000	Vulnerable	Vulnerable
Undulate skate	*Raja undulata*	50 – 200	Endangered	Near Threatened

[1] Status as of April 2020

Of these species listed in the table above, blonde skate, common smooth-hound, spiny dogfish, starry smooth-hound, thornback skate and tope shark are of most concern due to their unfavourable conservation status (IUCN, 2020). In addition, spotted skate, thornback skate, and spiny dogfish are listed on the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR, 2014).

4.5.4 Seabirds

4.5.4.1 At-Sea Distribution

The offshore waters of the southern North Sea are visited by seabirds, mainly for feeding purposes in and around the shallow sandbanks, although the number of seabirds in this region are generally lower compared to further north (DECC, 2016). The Wenlock infrastructure lies within the breeding season foraging ranges of several seabird species including, European storm petrel (*Hydrobates pelagicus*), Northern fulmar (*Fulmarus glacialis*), Manx shearwater (*Puffinus puffinus*), Northern gannet (*Morus bassanus*), black-legged kittiwake (*Rissa tridactyla*), herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*), great skua (*Stercorarius skua*), common guillemot (*Uria aalge*) and Atlantic puffin (*Fratercula arctica*) (Woodward *et al.*, 2020). These species may therefore be present in the vicinity of the proposed decommissioning activity during the breeding season, which in Regional Sea 2 begins at the end of April for some seabirds, although most seabirds begin breeding in May, with moulting commencing in July. Peak numbers of seabirds, however, tend to be found offshore following the breeding season and throughout winter, between July and March (DECC, 2016).

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 Wenlock 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 Blocks 49/12, 49/18 and 49/23 is shown in Table 4.6, with the data indicating a density of less than 4 seabirds per km^2 during the breeding season (March – September) and less than 5 seabirds per km^2 in winter (November – March). The most abundant species present are guillemot (*Uria aalge*) in the breeding season, guillemot and razorbill (*Alca torda*) over winter, and guillemot during the post breeding dispersal period (JNCC, 2020a; Kober *et al.*, 2010).

Table 4.6. Predicted At-Sea Seabird Density in the Blocks 49/12, 49/18 and 49/23 (number of individuals per km^2) (JNCC, 2020a; Kober et al., 2010)

<table>
<tr><th rowspan="2">Species</th><th rowspan="2">Season</th><th colspan="12">Predicted Density in the Blocks of Interest [1]</th><th rowspan="2">Predicted Density Range Across UK Waters [1]</th></tr>
<tr><th>J</th><th>F</th><th>M</th><th>A</th><th>M</th><th>J</th><th>J</th><th>A</th><th>S</th><th>O</th><th>N</th><th>D</th></tr>
<tr><td rowspan="2">Fulmar</td><td>Breeding</td><td></td><td></td><td colspan="5">0.2</td><td></td><td></td><td></td><td></td><td></td><td>0 – 582.6</td></tr>
<tr><td>Winter</td><td colspan="2">0.2</td><td></td><td></td><td></td><td></td><td></td><td colspan="5">0.2</td><td>0 – 239.2</td></tr>
<tr><td>Sooty shearwater</td><td>Winter</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="5">< 0.1</td><td></td><td>0 - 16.3</td></tr>
<tr><td>Manx shearwater</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="5">< 0.1</td><td></td><td></td><td></td><td>0 - 190.2</td></tr>
<tr><td>Storm petrel</td><td>Breeding</td><td></td><td></td><td></td><td></td><td></td><td colspan="5">< 0.1</td><td></td><td></td><td>0 - 24.9</td></tr>
<tr><td rowspan="2">Gannet</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="5">0.2</td><td></td><td></td><td></td><td>0 - 110.5</td></tr>
<tr><td>Winter</td><td colspan="4">0.1</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">0.1</td><td>0 - 24.9</td></tr>
<tr><td rowspan="2">Pomarine skua</td><td>Other – spring</td><td></td><td></td><td colspan="4">< 0.1</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0 - 2.2</td></tr>
<tr><td>Other –autumn</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">< 0.1</td><td></td><td></td><td>0 - 2.2</td></tr>
<tr><td rowspan="2">Arctic skua</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="4">< 0.1</td><td></td><td></td><td></td><td></td><td>0 - 2.4</td></tr>
<tr><td>Other</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">< 0.1</td><td></td><td>0 - 1.1</td></tr>
<tr><td rowspan="2">Great skua</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="4">< 0.1</td><td></td><td></td><td></td><td></td><td>0 - 1.6</td></tr>
<tr><td>Winter</td><td colspan="4">< 0.1</td><td></td><td></td><td></td><td></td><td colspan="4">< 0.1</td><td>0 - 4.3</td></tr>
<tr><td rowspan="2">Kittiwake</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="5">0.9</td><td></td><td></td><td></td><td>0 - 185.0</td></tr>
<tr><td>Winter</td><td colspan="4">0.8</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">0.8</td><td>0 - 306.8</td></tr>
<tr><td rowspan="2">Great black-backed gull</td><td>Breeding</td><td></td><td></td><td></td><td colspan="5"><0.1</td><td></td><td></td><td></td><td></td><td>0 - 4.8</td></tr>
<tr><td>Winter</td><td colspan="3">0.2</td><td></td><td></td><td></td><td></td><td></td><td colspan="4">0.2</td><td>0 - 19.5</td></tr>
<tr><td rowspan="2">Common gull</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="4"><0.1</td><td></td><td></td><td></td><td></td><td>0 - 2.6</td></tr>
<tr><td>Winter</td><td colspan="4">0.1</td><td></td><td></td><td></td><td></td><td colspan="4">0.1</td><td>0 - 39.9</td></tr>
<tr><td rowspan="2">Lesser black-backed gull</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="4">0.2</td><td></td><td></td><td></td><td></td><td>0 - 351.7</td></tr>
<tr><td>Winter</td><td colspan="4">0.2</td><td></td><td></td><td></td><td></td><td colspan="4">0.2</td><td>0 - 368.8</td></tr>
<tr><td>Herring gull</td><td>Winter</td><td colspan="3">0.4</td><td></td><td></td><td></td><td></td><td></td><td colspan="4">0.4</td><td>0 - 101.9</td></tr>
<tr><td>Common tern</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="5"><0.1</td><td></td><td></td><td></td><td>0 - 6.5</td></tr>
<tr><td rowspan="3">Guillemot</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="2">3.1</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0 - 713.4</td></tr>
<tr><td>Winter</td><td colspan="4">2.1</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">2.1</td><td>0 - 62.7</td></tr>
<tr><td>Other</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">1.3</td><td></td><td></td><td></td><td>0 - 254.8</td></tr>
<tr><td rowspan="3">Razorbill</td><td>Breeding</td><td></td><td></td><td></td><td></td><td colspan="2">0.2</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0 - 22.0</td></tr>
<tr><td>Winter</td><td colspan="4">2.5</td><td></td><td></td><td></td><td></td><td></td><td colspan="3">2.5</td><td>0 - 15.8</td></tr>
<tr><td>Other</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">0.1</td><td></td><td></td><td></td><td>0 - 64.6</td></tr>
<tr><td>Little auk</td><td>Winter</td><td colspan="3">0.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">0.5</td><td>0 - 13.4</td></tr>
<tr><td rowspan="2">Atlantic Puffin</td><td>Breeding</td><td></td><td></td><td></td><td colspan="4">0.1</td><td></td><td></td><td></td><td></td><td></td><td>0 - 162.4</td></tr>
<tr><td>Winter</td><td colspan="3">0.5</td><td></td><td></td><td></td><td></td><td colspan="5">0.5</td><td>0 - 0.14</td></tr>
<tr><td colspan="15">Key (Number of individuals per km^2)</td></tr>
<tr><td colspan="15">2.5 - ≤ 4.0 | 1.0 - < 2.5 | 0.1 - < 1.0 | < 0.1 | No Occurrence</td></tr>
</table>

[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).

Of the species listed in Table 4.6, the global and European populations of kittiwake are listed as Vulnerable on the IUCN Red List, and the global and European populations of razorbill and sooty shearwater (*Ardenna grisea*) are listed as Near Threatened. Atlantic puffin is listed as Vulnerable globally and fulmar is listed as Least Concern globally, although both species are Endangered in Europe. Globally, herring gull (*Larus argentatus*), and guillemot are of Least Concern, however their European populations are Near Threatened. The global and European populations of Manx shearwater, gannet, storm petrel, pomarine skua (*Stercorarius pomarinus*), arctic skua (*Stercorarius parasiticus*), great skua, great black-backed gull (*Larus marinus*), common gull (*Larus canus*), lesser black-backed gull, common tern (*Sterna hirundo*) and little auk (*Alle alle*) are of Least Concern (IUCN, 2020).

4.5.4.2 Nesting Seabirds

APRL has previously recorded kittiwake nesting on the steel work below the helideck on the Wenlock platform. During 2020, approximately 45 to 50 nests were observed in July, with adults observed rearing their chicks (see Figure 4.9). Although most kittiwake colonies are located on sheer cliffs, the species is known to nest on man-made structures such as buildings, bridges, seawalls and offshore oil and gas installations (JNCC, 2020b). Colony size can vary from less than ten pairs to tens of thousands, with individuals returning to the same colony over multiple years. The nearest major colony to the Wenlock platform, supporting 44,520 pairs (count period 2008 – 2011; NE, 2018) is located at the Flamborough and Filey Coast Special Protection Area (SPA), approximately 164 km to the north west.

The phenology of nesting kittiwakes has been summarised in Table 4.7, although timings can vary from year to year due to factors such as lack of food. During the breeding season, kittiwakes feed mainly on small pelagic shoaling fish, particularly sandeels, but also scavenge for offal and discards around fishing boats (JNCC, 2020b). The first breeding does not usually occur until the age of 4 to 5 years, with birds laying 1 to 3 eggs per season (Del Hoyo *et al*., 1996; Cramp and Simmons, 1983). It is therefore acknowledged that nesting kittiwake could be present on the Wenlock topside, potentially between the months of April and September.

Table 4.7. Phenology of Kittiwakes (Coulson et al., 2011; Hatch et al., 2020; JNCC, 2020b; Keogan et al., 2018)

Behaviour	Approx. Date Range	Observations
First Arrival	February to April	-
Nest Building	End of April – Mid May	Nests are normally built 1-3 weeks before appearance of first eggs.
Egg Laying	May	At Flamborough & Filey Coast SPA egg laying normally occurs in early to mid May. Incubation is normally around one month.
Hatching	Mid to late June	-
Fledging	Late July - September	Peak in mid-August, with chicks leaving colony ca. 10 days after first flight.

As noted above, the global and European populations of kittiwake are listed as Vulnerable on the IUCN Red List. Kittiwake is also on the OSPAR List of Threatened and/or Declining Species and Habitats and Red listed in Birds of Conservation Concern 4.

Figure 4.9. Photographs Showing Nesting Kittiwake underneath the Wenlock Helideck

4.5.4.3 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 Blocks 49/12, 49/18 and 49/23, within which the proposed Wenlock decommissioning activity is taking place, indicate that sensitivity is generally low between August and October, and May and June, high to low between November and April, and extremely high to low in June (Table 4.8; Webb *et al*., 2016).

Table 4.8. Assessment of Seabird Oil Sensitivity Index (SOSI) Scores for UKCS Blocks 49/12, 49/18, 49/23 and the Surrounding Area (Webb et al., 2016)

Block	J	F	M	A	M	J	J	A	S	O	N	D
49/6	1	N	N	N	N	1	1	5	5	N	1	1
49/7	1	N	N	N	5	5	1	5	5	5	1	1
49/8	2	N	N	N	5	5	2	5	5	5	2	2
49/11	1	1	1	N	N	1	1	5	5	N	N	N
49/12	**N**	**N**	**N**	**N**	**5**	**5**	**1**	**5**	**5**	**5**	**N**	**N**
49/13	5	N	N	N	5	5	2	5	5	5	5	5
49/14	5	N	N	N	5	5	5	5	5	5	5	5
49/16	2	2	2	N	N	N	5	5	5	N	N	N
49/17	N	N	N	N	N	2	2	5	5	5	N	N
49/18	**5**	**N**	**N**	**N**	**5**	**5**	**2**	**5**	**5**	**5**	**5**	**5**
49/19	5	N	N	N	5	5	5	5	5	5	5	5
49/22	1	3	3	3	N	N	5	5	3	3	1	1
49/23	**3**	**4**	**4**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**3**	**3**
49/24	5	5	5	5	5	5	5	5	5	5	5	5
49/27	1	4	4	4	N	N	5	5	5	N	1	1
49/28	1	4	4	4	N	N	5	5	5	N	1	1
49/29	3	4	4	4	5	5	5	5	5	N	3	3

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.

4.5.5 Marine Mammals

4.5.5.1 Cetaceans

Cetacean abundance in the southern North Sea 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 southern North Sea, 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 Southern North Sea SAC has been designated to protect these areas and the Wenlock infrastructure lies within this SAC (refer to Section 4.5.6 for further details).

The relative abundance of the most common species of cetaceans in this area of the southern North Sea 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 Wenlock infrastructure is located within SCANS-III Block O (Table 4.9) in which harbour porpoise, minke whale and white-beaked dolphin have been recorded (Hammond *et al.,* 2017). It should be noted that although density estimates are shown in Table 4.9, 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 4.9. Cetacean Abundance and Density Recorded in SCANS-III Aerial Survey Area Block O (Hammond et al., 2017)

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 six cetacean species (harbour porpoise, common dolphin, bottlenose dolphin, white-beaked dolphin, white-sided 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 Wenlock infrastructure is located, along with the corresponding abundance of animals within these units, are listed Table 4.10 below (IAMMWG, 2015).

Table 4.10. Estimates of Cetacean Abundance in the Relevant MMMUs (IAMMWG, 2015)

Species	Management Unit	Abundance of Animals	95% Confidence Interval	Density [1]
Bottlenose dolphin	Greater North Sea (639,886 km^2)	0	-	-
Harbour porpoise	North Sea (678,206 km^2)	227,298	176,360 – 292,948	0.335
Risso's dolphin [2]	Marine Atlantic [3]	-	-	-
Common dolphin	Celtic and Greater North Seas (1,560,875 km^2)	56,556	33,014 – 96,920	0.036
Minke whale		23,163	13,772 – 38,958	0.015
White-beaked dolphin		15,895	9,107 – 27,743	0.010
White-sided dolphin		69,293	34,339 – 139,828	0.044

[1] Density (individuals per km) was calculated using the total area of the MU and the abundance of animals within that MU.
[2] There is no current abundance estimate available for Risso's dolphin.
[3] 'Marine Atlantic' Management Unit comprises all UK waters and extends to the seaward boundary used by the EC for Habitats Directive reporting.

It is evident that harbour porpoise is the most abundant species in the North Sea compared to other species identified in Table 4.10, despite its MU being smaller in area. White-sided 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 4.9 and Table 4.11).

To provide a more localised indication of the seasonal distribution of cetaceans in the area of the Wenlock infrastructure, data from the JNCC Atlas of Cetacean Distribution in north-west European Waters is shown in Table 4.11. This indicates that both harbour porpoise and white-beaked dolphin have been observed, predominately in the spring and / or summer months (Reid *et al.*, 2003).

Table 4.11. Cetacean Sightings in ICES Rectangles 35F2 and 36F2 (Reid et al., 2003)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise		Low	Low	Low	Low	High	Low	Low				
White-beaked dolphin				Low	Low							

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, 2014) 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, 2020).

4.5.5.2 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

Grey seals are incredibly rare globally, and the UK hosts around 40% of the world population 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 6,085 grey seals were counted between Donna Nook and Dover in August 2016 (DECC, 2016; SCOS, 2018).

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 Wenlock infrastructure is very low (< 1 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, 2018).

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 5,199 in 2016. The largest colony in the UK is The Wash, with an estimated 3,377 individuals counted in 2016 (SCOS, 2018).

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 Wenlock infrastructure is very low (< 1 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, 2018).

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 4.12 lists the seal count for the South East England MU, along with the corresponding abundance of animals within this unit.

Table 4.12. 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.*, 2010). This estimate was not available for harbour seals.

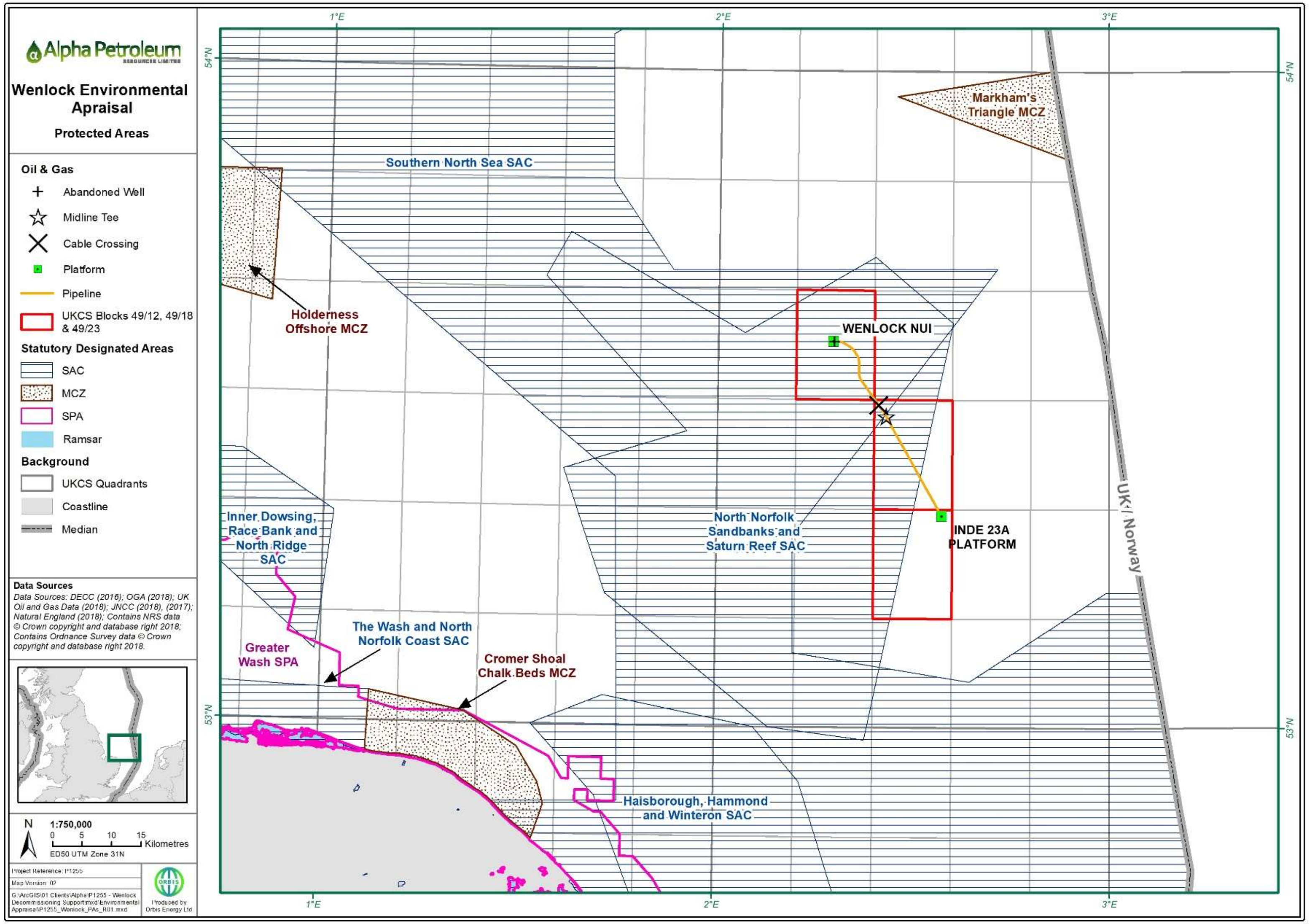
4.5.6 Marine Protected Areas

The Wenlock infrastructure lies within the boundary of two marine protected areas (MPAs): North Norfolk Sandbanks and Saturn Reef (NNS&SR) SAC and Southern North Sea (SNS) SAC. There are no other MPAs located within 40 km of the proposed decommissioning work. Figure 4.10 shows the location of these MPAs in relation to the location of the proposed operations and the qualifying features and site description are detailed in Table 4.13.

Table 4.13. Marine Protected Areas within 40 km of the Proposed Decommissioning Work

<table>
<tr><th rowspan="2">Site Name</th><th colspan="5">Distance & Direction</th><th rowspan="2">Qualifying Features and Site Description</th></tr>
<tr><th>Wenlock platform</th><th>Legacy well</th><th>Cable crossing</th><th>Mid-line Tee</th><th>Inde 23A platform</th></tr>
<tr><td>North Norfolk Sandbanks and Saturn Reef SAC</td><td colspan="4">Located within SAC boundary</td><td>5 km E</td><td>Features: Annex I habitats; Sandbanks which are slightly covered by sea water all the time (1110) and Reefs (1170).
Description: Located in the southern North Sea, the North Norfolk Sandbanks are the most extensive example of the offshore linear ridge sandbank type in UK waters. The site covers an area of 3,603 km^2. The site encloses a series of 10 main sand banks, and associated smaller banks. Invertebrate communities are typical of sandy sediments in the southern North Sea such as polychaete worms, isopods, crabs and starfish. Areas of Sabellaria spinulosa biogenic reef are present within the site, consisting of thousands of fragile sand-tubes made by ross worms (polychaetes) which have consolidated together to create solid structures rising above the seabed. Figure 2.4 (Section 2.2) shows the location of the proposed decommissioning work in relation to the Annex I habitat within the SAC.
Conservation Objectives: For the features to be in favourable condition thus ensuring site integrity in the long term and contribution to Favourable Conservation Status of the features. This contribution would be achieved by maintaining or restoring, subject to natural change:
• The extent and distribution of the qualifying habitats in the site;
• The structure and function of the qualifying habitats in the site;
• The supporting processes on which the qualifying habitats rely.</td></tr>
<tr><td>Southern North Sea SAC</td><td colspan="3">Located within SAC boundary</td><td>0.25 km SE</td><td>18 km SE</td><td>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 Wenlock platform and abandoned well 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).
Conservation Objectives: To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status 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;
• The condition of supporting habitats and processes, availability of prey is maintained.</td></tr>
</table>

Figure 4.10. Marine Protected Areas in the Vicinity of the Wenlock Infrastructure



4.6 Human Environment

4.6.1 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 southern North Sea, 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 35F2 and 36F2. Fishing effort is relatively low in ICES Rectangle 36F2, within which the Wenlock platform is located, with the mean annual fishing effort between 2011 and 2018 at only 114 days (Figure 4.11). Fishing effort is highest in May, August and September. The majority of fishing effort is from trawlers however, the data does not specify the gear type (i.e. demersal or pelagic), followed by traps. In ICES Rectangle 36F2, the mean annual fish landings (by weight) between 2011 and 2018 was 487 tonnes, with a mean value of £691,764 (Figures 4.12 and 4.13). Landings by weight and value peak in August. Landings data demonstrate that catches (by weight) are largely composed of demersal species (76%), followed by pelagic species (24%), and the most commonly caught species are plaice, *Nephrops* and sole (Marine Scotland, 2019).

In depth fisheries statistics for ICES Rectangle 35F2 (within which the mid-line tee and Inde 23A platform are located) are only available for the years 2011 – 2013 for effort and 2011 – 2012 for landings. Fishing effort within ICES Rectangle 35F2 is very low, with an average of 46 days fished per year (Figure 4.11). The mean annual fish landings (by weight) between 2011 and 2012 was 85 tonnes, with a mean value of £117,367 (Figures 4.12 and 4.13). Landings data demonstrate that catches (by weight) are largely composed of demersal species (57%), followed by pelagic species (40%) and shellfish (3%), and the most commonly caught species are sprats, plaice and sole. Demersal species comprise a moderate proportion of the catches by weight (57%), but a large proportion of the catches by value (86%) (Marine Scotland, 2019).

Data from analysis of the intensity of mobile fishing associated with oil and gas pipelines (2007-2015) show that the number of fishing tracks for all gears is low at the Wenlock platform and along the length of pipelines, rising to moderate at Inde 23A (Rouse *et al.*, 2017). Table 4.14 provides a summary of UK Fleet landings over a five year period (2013-2017). There has been a general declining trend from 2013 to 2017 in both ICES rectangle 35F2 and 36F2 (MMO, 2018).

Figure 4.11. Total Fishing Effort (Days Fished) between 2011 and 2018 within ICES Rectangles 35F2 and 36F2 (Marine Scotland, 2019)

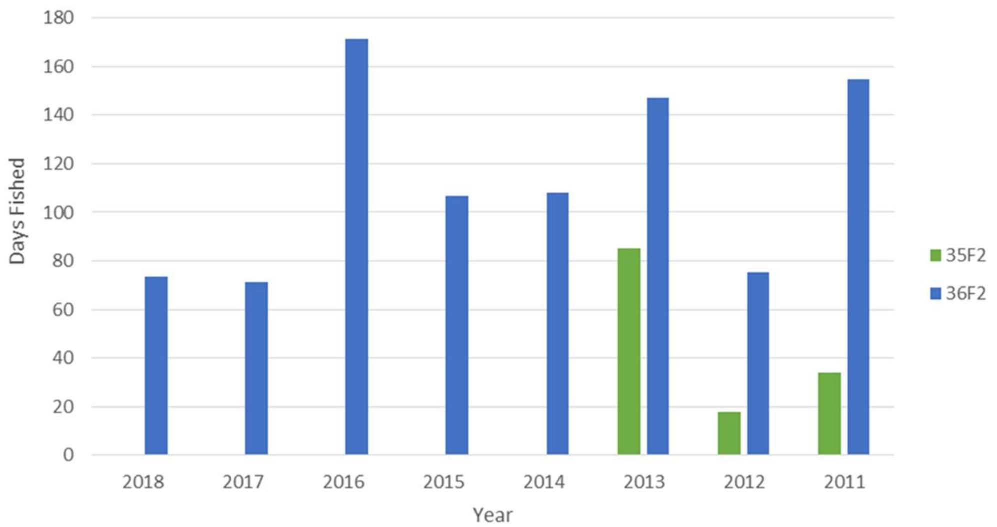


Figure 4.12. Total Annual Fishing Landings (tonnes) between 2011 and 2018 within ICES Rectangles 35F2 and 36F2 (Marine Scotland, 2019)

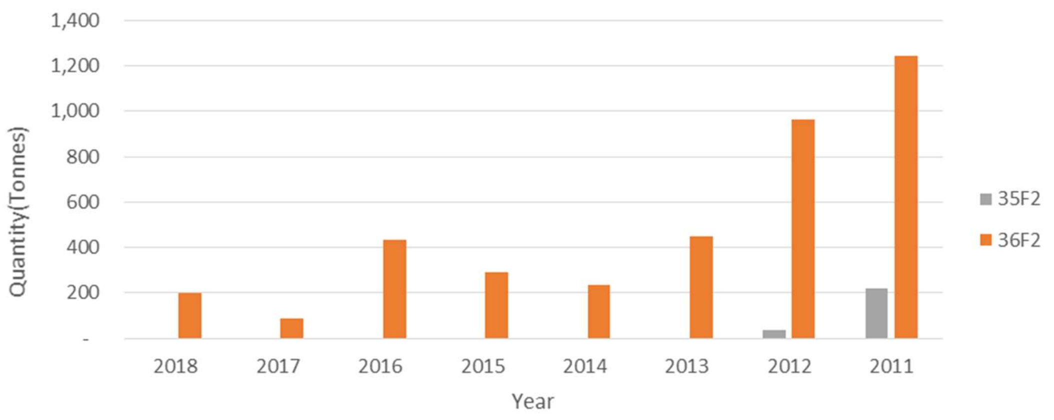


Figure 4.13. Total Annual Catch by Value (£) between 2011 and 2018 within ICES Rectangles 35F2 and 36F2 (Marine Scotland, 2019)

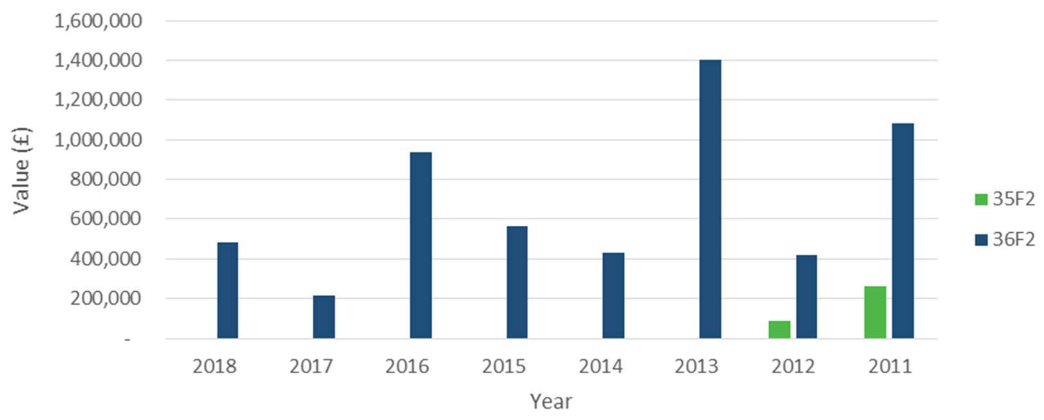


Table 4.14. UK Fleet Landings within ICES Rectangles 35F2 and 36F2 (MMO, 2018)

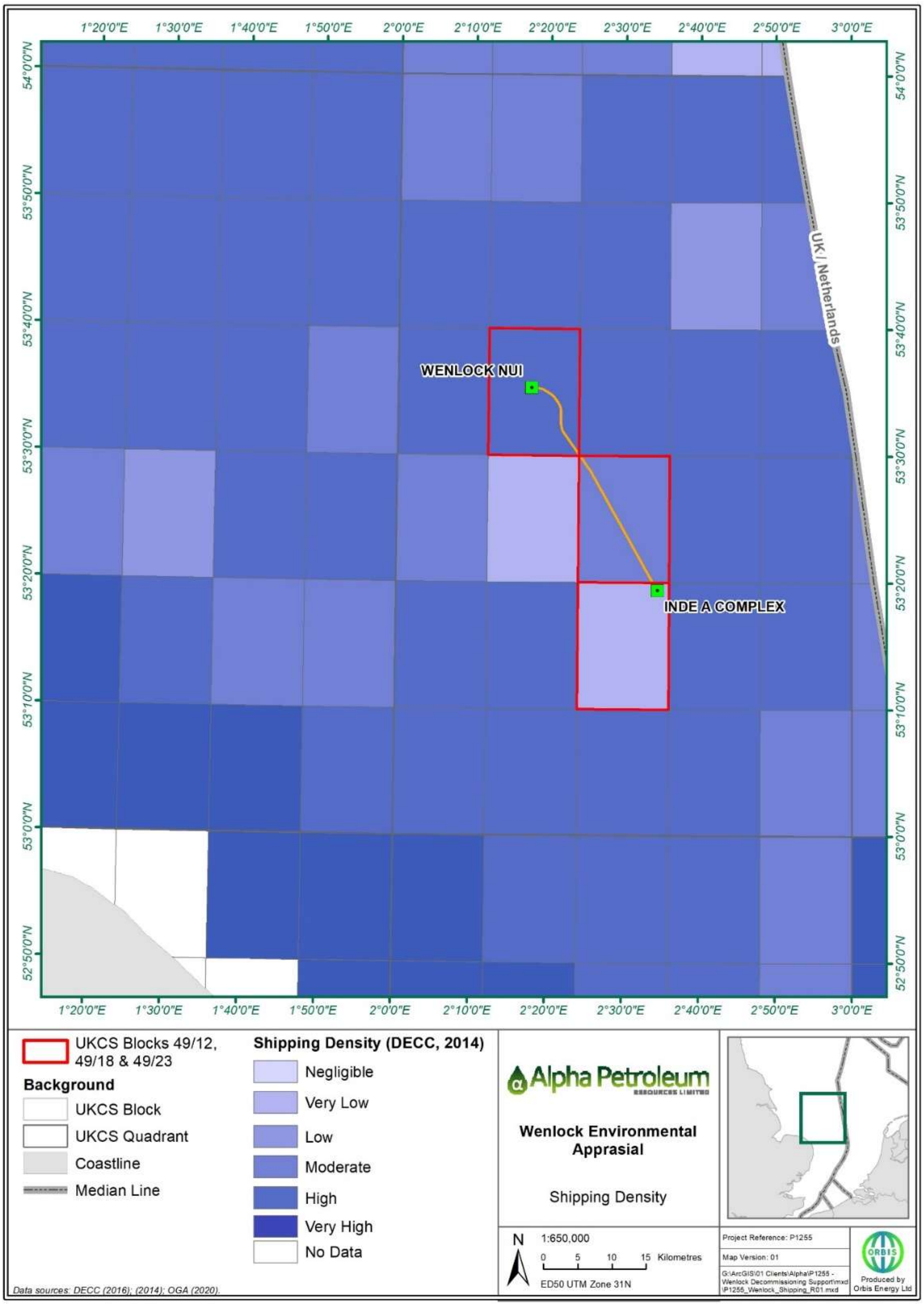
ICES Rectangle	Year	Landed Weight (tonnes)	Value (£)
35F2	2013	144.0702	483110.59
	2014	119.4166	379,666.78
	2015	78.3692	283,799.79
	2016	80.3616	366,345.26
	2017	60.243	235,987.64
36F2	2013	411.4019	870,670.4
	2014	212.8861	432,236.77
	2015	263.4652	562,101.4
	2016	389.4362	935,891.2
	2017	65.1688	209,080.62

4.6.2 Shipping

The density of shipping traffic in the southern North Sea 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 high within Block 49/12, moderate within Block 49/18 and very low within Block 49/23 (DECC, 2014) (refer to Figure 4.14).

A shipping survey previously undertaken at the Wenlock platform location recorded 31 ships per day on average passing within 15 nautical miles (28 km) of the location, with the majority being cargo ships and offshore support vessels (Anatec, 2008).

Figure 4.14. Shipping density in the vicinity of the Proposed Wenlock Infrastructure (DECC, 2014).



4.6.3 Oil and Gas Activities

There is a high level of existing oil and gas activity in this region of the southern North Sea, as illustrated in Figure 4.15. Facilities adjacent to the Wenlock platform are listed in Table 4.15.

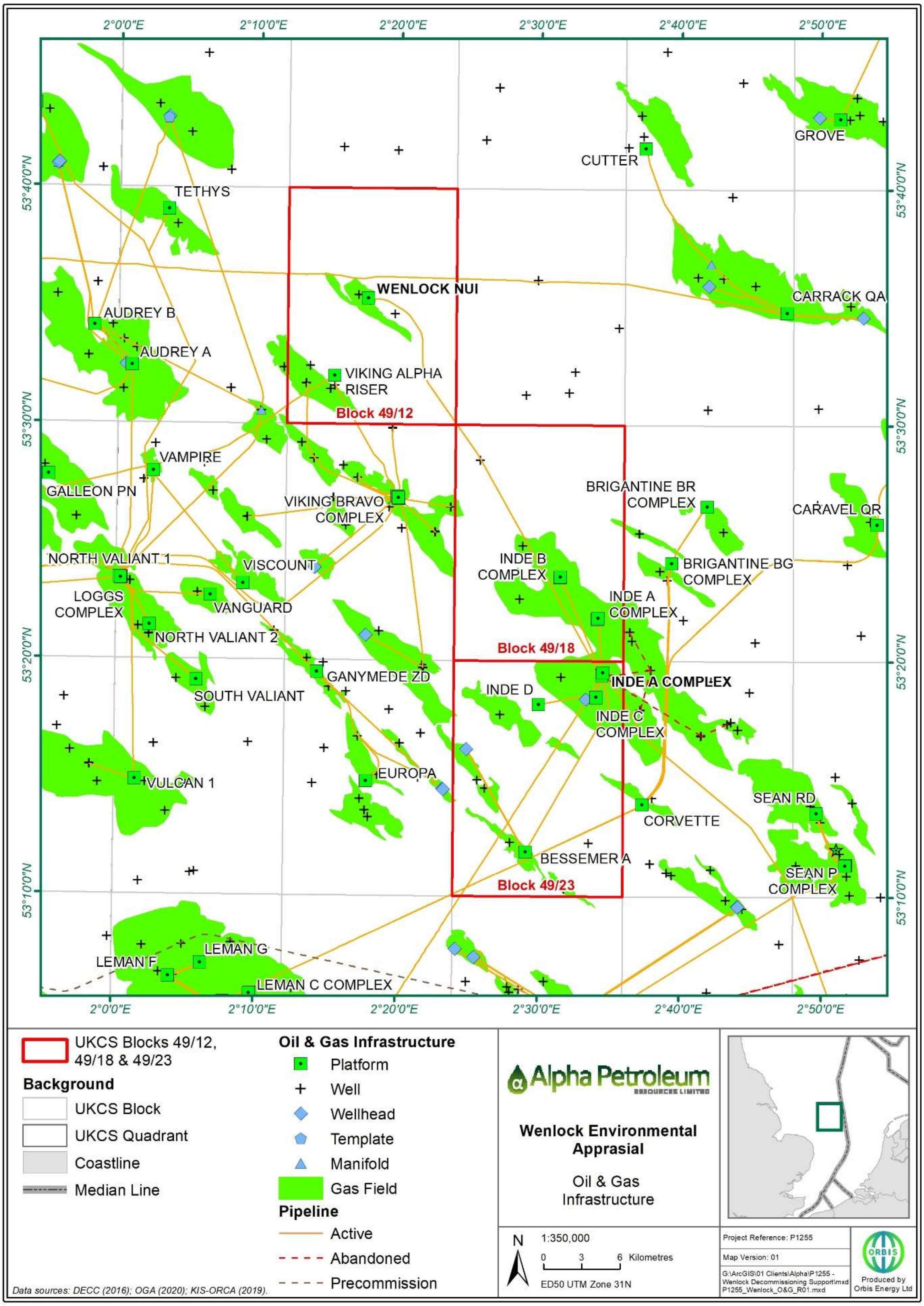
A total of 103 wells have previously been drilled within Blocks 49/12, 49/18 and 49/23, of which 34 are operational, four have been shut-in, 24 have been abandoned, six have been plugged, and 46 have been plugged and abandoned (UK Oil and Gas Data, 2020). The closest wells to the Wenlock field development infrastructure are the legacy subsea appraisal well (49/12a-8) well within the Wenlock 500 m safety zone, located 239 m south east of the Wenlock platform and the suspended 49/18-5Z well, which is located 170 m from the mid-line tee structure.

Table 4.15. Oil and Gas Infrastructure Adjacent to the Wenlock Platform (UK Oil and Gas Data, 2020)

Name	Distance/ Direction[1]	Operator	Status
Viking Alpha Platform	7 km SSW	Chrysaor Production (U.K.) Limited	Decommissioning Underway
Viking Hotel Platform	10.5 km S	Chrysaor Production (U.K.) Limited	Decommissioned
Viking Echo Platform	13 km SSW	Chrysaor Production (U.K.) Limited	Decommissioning Underway
Viking Bravo Platform	16 km S	Chrysaor Production (U.K.) Limited	Decommissioning Underway
Tethys Platform	17 km NW	Chrysaor Production (U.K.) Limited	Operational
Viking Delta Platform	17.5 km SSE	Chrysaor Production (U.K.) Limited	Decommissioned
Vixen VM Subsea Well	22 km SSW	Chrysaor Production (U.K.) Limited	Decommissioning Underway
Ann Subsea Well	22 km NNW	Spirit Energy North Sea Limited	Decommissioning Underway
Cutter Platform	25 km NNE	Shell U.K. Limited	Operational
Victor JD Platform	30 km S	Chrysaor Production (U.K.) Limited	Decommissioned
Brigantine BG Platform	30 km SSE	Shell U.K. Limited	Operational
Brigantine BR Platform	31 km SSE	Shell U.K. Limited	Operational
Carrack QA Platform	32km E	Shell U.K. Limited	Operational
Inde 23A Platforms (23AC, 23AT, 23AQ)	35 km SSE	Perenco (UK) Limited	Operational
Inde 18A Platform	35 km SSE	Perenco (UK) Limited	Operational
Inde 18B Platform	35 km SSE	Perenco (UK) Limited	Operational

[1] Measured from the Wenlock platform

Figure 4.15. Oil and Gas Infrastructure in the Vicinity of the Proposed Wenlock Decommissioning Work



4.6.4 Telecommunication Subsea Cables

The active 'NORSEA COMS' telecom cable (Operator: TAMPNET) crosses the PL2355 / PL2356 pipelines at KP14.45 (Figure 4.16) (KIS-ORCA, 2020).

4.6.5 Offshore Renewable Activities

The Hornsea Project Three (Status: Consented) and Hornsea Project One (Status: Operational) wind farm turbine areas (Operator: Ørsted) are located ca. 25 km north-east and 27 km north-west respectively of the Wenlock infrastructure (see Figure 4.16). The planned Hornsea Project Three export cable corridor is located 9 km north-west of the Wenlock infrastructure and the active Hornsea Project One export cables are located 25 km north-west.

The Norfolk Boreas (Status: In-planning) and the Norfolk Vanguard West (Status: Consent granted but subject to re-determination) wind farm areas are being progressed by Vattenfall Wind Power Ltd and are located ca. 26 km south east and 31 km south respectively of the Inde 23A platform (Crown Estate, 2020) (see Figure 4.16).

Construction activities at Hornsea Project Three could be taking place in the period 2022-2025, potentially overlapping with the proposed Wenlock decommissioning activities. There could also be potential overlap with the construction of Norfolk Boreas and Norfolk Vanguard West, both of which are provisionally scheduled for the period 2024-late 2020s.

4.6.6 Offshore Aggregate and Dredging Areas

Humber 5 (Area no.: 483), Humber 4/7 (Area no.: 506) and Humber 3 (Area no.: 484) aggregate areas are located approximately 4 km north-east, 18 km north-west and 21 km south-west at nearest point respectively from the Wenlock infrastructure (MMO, 2020) (see Figure 4.16). The proposed decommissioning work is also located within an area of potential aggregate opportunities as defined by the Crown Estate (MMO, 2020). There are no dredging areas within 40 km of the proposed Wenlock decommissioning work (MMO, 2020).

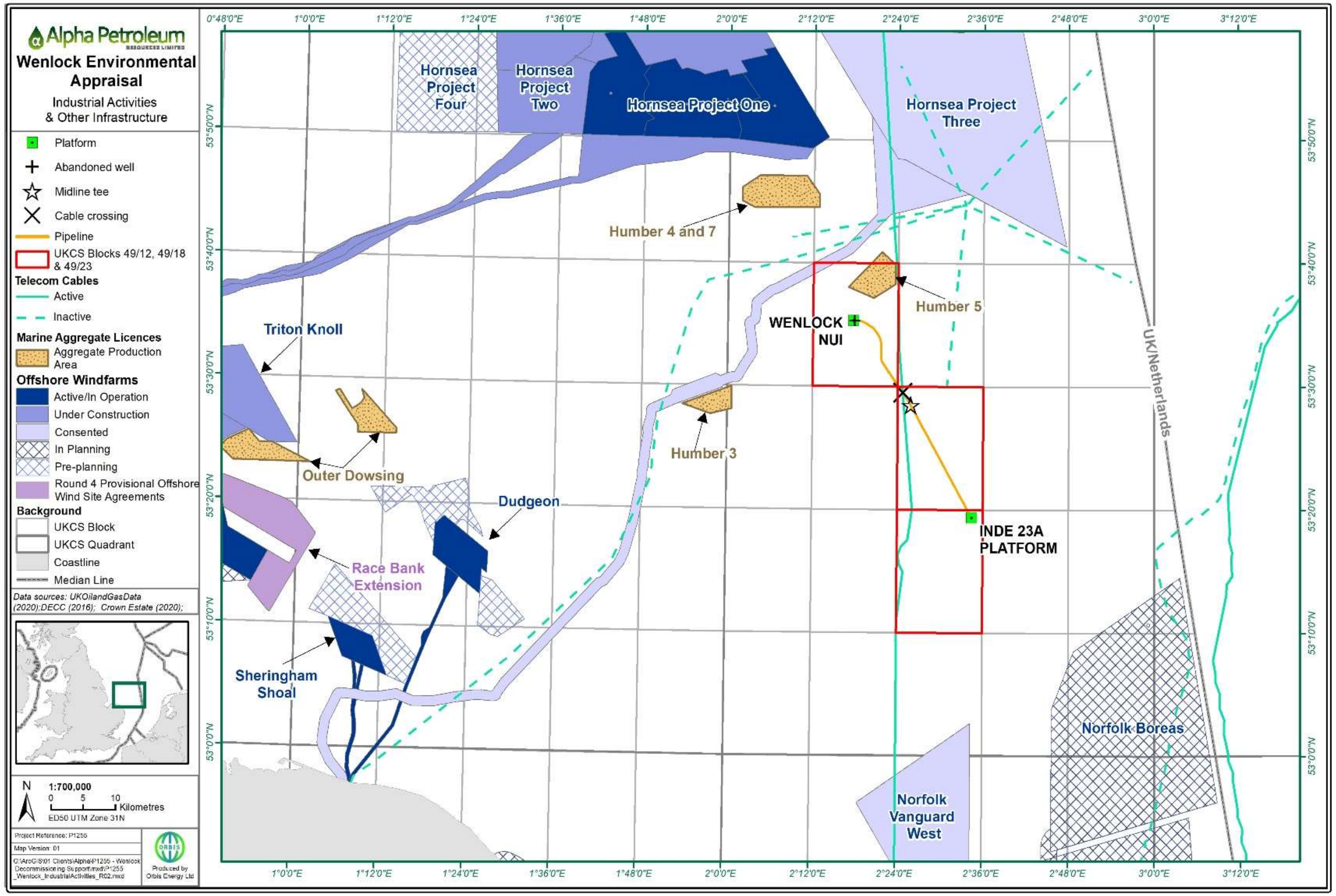
4.6.7 Military Activities

Blocks 49/12 and 49/18 lie within a Ministry of Defence (MoD) Royal Airforce Practice and Exercise Area (PEXA) (DECC, 2016), however there are no licence conditions for any military activities associated with Blocks 49/12, 49/18 and 49/23 (OGA, 2019).

4.6.8 Wrecks

No protected wrecks or non-designated wrecks are located in the vicinity of the Wenlock infrastructure and no wrecks were observed during the 2020 pre-decommissioning survey (MMO, 2020; N Sea, 2020a; 2020b).

Figure 4.16. Offshore Renewable Energy and Industrial Activities in the Vicinity of the Wenlock Infrastructure



5 Environmental Assessment Methodology

This section describes the process followed by APRL to identify and screen the relative significance of the potential environmental impacts associated with the proposed Wenlock 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 Wenlock DPs.

Table 5.1. Summary of Stakeholder Comments

Stakeholder	Summary of Comments	Addressed in EA Report
OPRED – Environmental Management Team (EMT)	Meeting held on 28th April 2020. No initial concerns with pre-decommissioning plans. Subsequently, APRL observed nesting kittiwake on the Wenlock platform. Meeting to discuss this issue with OPRED was held on 22nd September 2020. Wild birds, their eggs and nests are protected in UK offshore waters through the transposition of EU Wild Birds Directive. OPRED advised that as the decommissioning works are being planned in advanced, topside removal should ideally occur outwith the breeding bird season. OPRED can only grant a Wild Birds Licence if there is no other satisfactory solution and the grant of the licence would be consistent with the restrictions of Article 9(1)(c) of the Wild Birds Directive (namely under "strictly supervised conditions and on a selective basis" and in respect of a small number of birds.	Section 4.2.4.2 & Sections 6.1.4 – 6.1.6
Joint Nature Conservation Committee (JNCC)	Meeting held on 25th February 2020. No initial concerns with pre-decommissioning plans. Recommended that the following issues are considered in the EA report:	
	• Provide evidence that the possibility of upheaval buckling along the pipeline is low, particularly where it crosses the southern part of the Indefatigable Banks;	Sections 4.1.4 & 6.1.1
	• For the NNS&SR SAC consider the impact of introducing additional hard substrate into the sandy sediment environment. For the in-combination assessment, consider nearby aggregate activity, offshore wind farm projects, other oil and gas decommissioning projects (including Viking) and impacts from fishing (e.g. trawling activity);	Section 7.1
	• For the SNS SAC, as no impulsive noise sources are associated with the DPs, consider impacts to the harbour porpoise's prey (e.g. sandeels).	Section 7.2
National Federation of Fishermen's Organisations (NFFO)	Meeting held on 10th March 2020. No concerns with pre-decommissioning plans. Regular communication and updates requested. Note APRL also contacted the Scottish Fishermen's Federation and Northern Irish Fish Producer's Organisation Limited, but both organisations confirmed that point of contact should be with NFFO.	-
Global Marine Group	Confirmed that no other nearby cable assets are influenced by the DPs other than Tampnet AS operational fibre optic cable nearby.	-
Tampnet AS	Agreed with the recommendation that existing crossing infrastructure and pipeline is left in place.	-

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 Wenlock decommissioning activities (both from planned (routine) activities and unplanned (accidental) events), the APRL 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 Wenlock 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 Wenlock infrastructure is located within the NNS&SR SAC and SNS SAC (refer to Section 4.2.6), 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 Wenlock decommissioning activities, either alone or in-combination with other plans or projects. This assessment is documented separately within Section 7.

Table 5.1. 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 Wenlock platform (topside and jacket) and associated 500m safety zone								A		P	P	P									
	- Legacy of infrastructure decommissioned in situ										A		A									
Seabed Disturbance	- Anchoring of HLV	A	A				A	A			A											
	- Footprint of jack-up vessel	A	A				A	A			A											
	- Internal dredging and cutting of piles and removal of jacket	A	A				A	A			A											
	- Cutting of pipeline ends and removal of exposed pipeline sections / tie-in spools	A	A				A	A			A											
	- Removal of the mid-line tee structure	A	A				A	A			A											
	- Removal / redeployment of mattresses and gravel bags	A	A				A	A			A											
	- Leaving in situ of rock dump along the pipelines	A					A	A			A											
	- Cutting and removal of legacy appraisal well conductor	A	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
Underwater Noise Emissions	- Use of propellers / DP thrusters on vessels							A		A	A		A									
	- Use of underwater cutting tools and ROVs							A		A	A		A									
	- Use of geophysical equipment (MBES & SSS) during post decommissioning survey							A		A	A		A									
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											
	- Release 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 (offshore)	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									

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
	- Leak of hydraulic fluid from cutting equipment	A	A			A	A	A	A	A	A		A									

Key:

(dark green)	Potentially significant effects (aspects scoped in for further assessment)	(light green)	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 Wenlock 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 Wenlock Decommissioning Activities

Activity [1]	Emissions (tonnes) [2]							
	CO_2	CO	NO_X	N_2O	SO_2	CH_4	VOC	CO_2e
Topside Removal	1,683.20	8.26	31.24	0.12	2.10	0.09	1.05	1,720
Jacket Removal	2,016.00	9.89	37.42	0.14	2.52	0.11	1.26	2,060
Decommissioning of Pipelines and Stabilisation Material	1,612.80	7.91	29.94	0.11	2.02	0.09	1.01	1,648
Mid-line Tee Structure Removal	307.20	1.51	5.70	0.02	0.38	0.02	0.19	314
P&A and Conductor Removal	3,820.80	18.75	70.92	0.26	4.78	0.21	2.39	3,904
Total:	**9,440**	**46.32**	**175.22**	**0.65**	**11.8**	**0.52**	**5.9**	**9,646**

[1] See assumptions relating to vessel types, timings and fuel consumption detailed in Section 3.
[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 Wenlock decommissioning options equate to 0.07% of the total UK offshore CO_2e emissions in 2018 (14,630,000 tonnes; OGUK, 2019) and 0.003% of the UK net total CO_2e emissions in 2018 (364,100,000; BEIS, 2019a).

To minimise the emissions generated, APRL will look to reduce vessel time in the field as far as practicable and will make use of vessel synergies where possible. In addition, APRL'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.

APRL 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 release of any residual chemicals / condensate remaining within the pipelines. However, as stated in Section 3.4.1, as part of the preparatory work the export pipeline and chemical injection pipeline will be flushed and depressurised. It is anticipated that agreed cleanliness criteria will be aligned with accepted industry thresholds for discharge of oil in produced water, under The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended), which is 30 mg/l or less. As such, any release of chemicals / condensate will be minimal and is anticipated to dissipate before it reaches the surface with no long-term persistence expected.

In addition, as the pipelines will be decommissioned in situ they will degrade overtime and contaminants contained within the pipeline material (e.g. coating) may be released. Any releases are expected to occur in very small quantities and over a long period of time. Additionally, since the pipelines are fully trenched and buried, the pathway for contaminant releases will be limited. Given the small quantities of contaminants expected to be released and the long-term degradation of the pipeline left in situ, no significant effects on the marine environment are predicted.

Given the above, APRL 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, APRL 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 APRL 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 release, 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.

On this basis, ARPL 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 Wenlock 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. Of the types of vessels which may be utilised during the proposed decommissioning activities, the HLV typically has the largest fuel inventory. This could be in the region of 500 to 800

m^3 of diesel, although the HLV's fuel inventory is likely to be split between a number of separate fuel tanks, significantly reducing the potential of an instantaneous release of the full inventory.

Oil spill response arrangements for the Wenlock infrastructure are currently documented in PUK's Inde Hub Oil Pollution Emergency Plan (OPEP). This contains modelling of an instantaneous release of 500 m^3 of diesel from a vessel at the Inde 49/23A platform and indicates that the probability of a diesel release beaching on the UK coastline is low in all seasons (up to 3%), with the shortest arrival time after 118.5 hrs (Norfolk coastline in Spring). The maximum mass accumulated onshore across all beaching locations in any one season is 3.65 m^3 after 10 days. The probability of a release of diesel crossing into international waters is up to 19% (UK / Netherlands median line in winter), with the shortest arrival time within 1 hour in Spring. A total of 20 marine protected areas may be subject to surface oiling (> 0.3 µm) or beaching. 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 for the proposed Wenlock 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 Wenlock platform minimising the risk of a collision. This zone is clearly marked on navigation charts and has been in place for a number of years. 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, APRL 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 Wenlock 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. 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 platform and legacy appraisal well conductor will be present on location within the existing 500 m safety exclusion zone surrounding the Wenlock platform. An existing 500 m safety exclusion zone also surrounds the Inde 23A platform. These zones are clearly marked on navigation charts and have been in place for a number of years. If an anchored HLV is used to remove the platform, the anchor lines are likely to extend outside the exclusion zone, although this should not present a significant hazard to shipping or fishing vessels as they are unlikely to transit immediately adjacent to an existing exclusion zone. Activity outside the existing exclusion zones, largely associated with removal of the mid-line tee structure, 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 Wenlock platform has been removed, the 500 m safety exclusion zone surrounding the platform 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 Wenlock infrastructure. The receptor has a low value as fishing effort is relatively low compared to the wider region, but 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, APRL is proposing to remove any exposed subsea infrastructure, including the mid-line tee structure. Mattresses or gravel bags will be redeployed and deposited over the cut ends of the pipelines, if exposed, to prevent a possible snagging point. The majority of the pipelines are currently buried to a depth well in excess of 0.6 m (normally between 1.0 and 1.5 m deep), with little change seen in their profile when comparing the 2020 pre-decommissioning survey and operational life interim general inspection surveys with the original as trenched surveys. The exception to the burial depth is at the cable crossing (KP 14.460) and the locations where rock dump was placed to prevent upheaval buckling during the operational life of the pipelines, although the current profile at these locations is over-trawlable. In addition, data from the 2020 pre-decommissioning survey indicates that the rock which has been deposited is very stable and there has been no migration due to seabed currents or fishing activity over the area. In a flooded condition (as would be the decommissioned left in situ state) both pipelines are significantly negatively buoyant and so no upward movement of the pipelines 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 Wenlock infrastructure decommissioned in situ is therefore predicted to be **Low**.

6.1.2 Mitigation Measures

APRL 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;
- If the jacket is removed in a separate campaign to the topside, a solar navaid / foghorn will be installed to warn other sea users of its presence;
- If the legacy appraisal well conductor has not yet been removed after the 500 m safety exclusion zone surrounding the Wenlock platform is withdrawn, APRL will advise the UK Hydrographic Office (UKHO) at least 6 weeks in advance so the conductor can be marked on navigation charts;
- 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 Wenlock platform 500m radius and a (minimum) 100m corridor (50m either side) along the route of the Wenlock pipelines 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 necessary.

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 Wenlock 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 Wenlock platform 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 Wenlock pipelines 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 pipelines and the mitigation measures that will be in place.

6.1.4 Potential Impacts to Seabirds

The physical presence of vessels associated with the decommissioning activities may potentially cause displacement and/or other behavioural responses in seabirds foraging in the vicinity of the Wenlock infrastructure. However, given the temporary and short term presence of the decommissioning vessels and in the context of other vessel activity in the area, significant disturbance or displacement of foraging seabirds from the area is unlikely. Considering the availability of alternative habitat in the surrounding area, no significant impacts on foraging seabirds are therefore predicted.

APRL is aware, however, that the physical presence of the Wenlock platform, particularly during the Lighthouse Mode phase, has the potential to provide nesting habitat to breeding seabirds, which forage in the southern North Sea. Black-legged kittiwake have nested on the platform in previous years (see Section 4.2.4) and therefore the presence of this species during the breeding season (April to September) cannot be ruled out.

The removal of the Wenlock topside therefore has the potential to result in significant impacts to seabirds nesting on the platform through disturbance by operational movement and noise. Once the chicks start hatching in June they are particularly vulnerable to human disturbance that may spook them from the nest, resulting in them falling or being pushed to sea.

All wild birds are protected under the Wild Birds Directive, which is transposed for the UK offshore area by The Conservation of Offshore Marine Habitats and Species Regulations 2017. Under Part 3 (40) of the 2017 Regulations it is an offence to deliberately:

- Capture, injure, or kill any wild bird;
- Take, damage or destroy the nest of any wild bird while that nest is in use or being built; or
- Take or destroy an egg of any wild bird.

The sensitivity of nesting birds on the Wenlock platform is considered to be **Very High**. Due to the conservation status of kittiwake, nesting birds have a very high value and their tolerance to accommodate pressure is limited with a medium resistance and resilience. The magnitude of any disturbance is considered to be **Moderate** with nesting potentially abandoned for the year/season or chicks being spooked from the nest. Effects on nesting birds from the removal of the Wenlock platform during the breeding bird season are therefore predicted to be **Moderate** and significant before mitigation measures are applied.

6.1.5 Mitigation Measures

The following measures will be put in place during the Wenlock decommissioning activities to ensure any adverse effects on nesting seabirds are mitigated:

- Installation of nesting bird deterrents will be considered when the preparatory work is being undertaken to discourage birds from nesting on the platform once it enters the Lighthouse Mode phase;
- Planning of operations to programme topside removal activities outside of the breeding bird season (April - September), if possible. In the event an opportunity arises to use a lift vessel during the breeding season, the platform will be checked by a qualified ornithologist for the presence of nesting birds and the results will be shared with OPRED to ascertain if it is possible for a Wild Birds Licence to be granted to allow the works to go ahead;
- If any other decommissioning activity (e.g. preparatory works) is to be undertaken on the topside during the breeding season, the platform will be checked for nesting birds prior to commencing work. OPRED will be informed of the results and, if necessary, a Wild Birds Licence applied for. In the event nesting birds are observed, APRL currently propose to erect signage in the area advising offshore personnel of the nests and personnel will be briefed on instructions to minimise possible disturbance to the juveniles and attending adults. The nests will also be monitored on a daily basis to record bird presence and activity.

6.1.6 Residual Effects

By programing the Wenlock topside removal activities outside of the breeding bird season, the magnitude of impact is reduced to **Negligible** as there should be no impact on nesting success. Residual effects on nesting birds from the removal of the Wenlock platform are therefore predicted to be **Negligible** and not significant.

6.2 Seabed Disturbance

6.2.1 Quantification of Seabed Disturbance

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

- HLV anchoring and anchor line scour for removal of the topside and jacket;
- Footprint of jack-up vessel used to remove the legacy appraisal well conductor and P&A the platform wells;
- Removal of the jacket following internal dredging and cutting of piles;
- Cutting of pipeline ends, removal of exposed pipeline sections / tie-in spools, including mattresses and grout bags at the approaches to the Wenlock and Inde 23A platforms and redeployment of mattresses and/or gravel bags to protect the cut ends of the pipelines, if exposed at the seabed;

- Removal of legacy appraisal well conductor following internal cutting;
- Removal of mid-line tee protection structure.

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. 75,565 m^2 (0.08 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 and/or gravel bags redeployed to cover the cut pipeline ends, if exposed at the seabed. The area of seabed currently covered by rock dump is ca. 5,920 m^2 (0.006 km^2), this is based on a 10m^2 seabed footprint per metre length of rock dump, with rock berms nominally 1 m high with a 2 m top width and 1:4 side slopes, covering a total area of 592 m. The redeployment of stabilisation material, if required, is likely to impact an area of ca. 72 m^2 (< 0.00007 km^2), on the assumption one (6 m x 4m) mattress is left at the Wenlock end and two (6 m x 4 m) mattresses are left at the Inde 23A end.

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

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

Activity	Description of Impact	Estimated Area Impacted	
		(m^2)	(km^2)
Use of an anchor moored HLV to remove topside and jacket	Although selection of a HLV is still to be made, it is assumed that the HLV will have eight anchors (ca. 4 m by 4 m in dimension) and associated anchor chain/cable (each extending up to 1,200 m from the HLV). Each anchor chain/cable will have a 600 m length section in contact with the seabed, which will be subject to lateral movement of ca. 5 m. This equates to an impact area of 16 m^2 per anchor and 3,000 m^2 per anchor chain/cable. As a worst case, it is assumed the topside and jacket will be removed separately and therefore the estimated area of impact accounts for disturbance from two anchored HLVs.	48,256	0.0483
Use of jack-up vessel to remove the legacy appraisal well conductor (and P&A the platform wells)[1]	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. It is assumed that the vessel will be jacked down on the seabed at two different locations; at the Wenlock platform and at the legacy appraisal well. In addition, the vessel may also need to deploy anchors to assist in final positioning. As a worst case, it is assumed that four anchors (ca. 4m by 4m in dimension) and associated chain/cable (each extending 600m from the vessel, with the entire length laid on the seabed and subject to a lateral movement of ca. 5 m) will disturb the seabed. This equates to an impact area of 16 m^2 per anchor and 3,000 m^2 per anchor chain/cable. Once the vessel is in position, the anchors (including the wires and chains) will be recovered for the duration of the P&A operations. 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 Wenlock location.	25,360	0.0254
Removal of the jacket following internal dredging and cutting of piles	The piles will be dredged to remove the soil inside the jacket skirts to a depth of ca. 4 m below the seabed to provide access for the abrasive cutting tool. As no dredging is planned around the exterior of the jacket, disturbance to the seabed will primarily occur when the jacket is lifted from the seabed and will be within close proximity to the existing physical footprint of the jacket (21 m by 21 m). To facilitate the release of the jacket from the seabed, it is estimated that an area of ca. 529 m^2 will be disturbed during removal operations, based on a contingency buffer of 2 m around the jacket footprint. All the abrasive material will be deposited in the hole and not the surrounding area. Once the jacket has been removed, the piles cut at least 3 m below the seabed will result in depressions, but these are expected to be temporary and will refill with natural backfill given the highly dynamic nature of the area.	529	0.0005

Activity	Description of Impact	Estimated Area Impacted	
		(m^2)	(km^2)
Cutting of pipeline ends, removal of exposed pipeline sections / tie-in spools, including mattresses and gravel bags at the approaches to the Wenlock and Inde 23A platforms and redeployment of mattresses or gravel bags to protect the cut ends of the pipelines	The Wenlock and Inde 23A riser to pipeline spool sections will be cut (using either shear cutting or diamond wire cutting tools) to allow recovery of the Wenlock jacket and isolate the pipeline from the Inde 23A platform. Mattresses and gravel bags will be removed to allow access to cut the pipeline ends. The pipeline section and tie-in spool pieces will then be removed using a vessel crane. In total it is assumed that the length of pipeline / tie-in spool pieces to be removed is ca. 168 m. Based on the largest mattress size (6 m x 4 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. 1,344 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.	1,344	0.0013
Removal of legacy appraisal well conductor following internal cutting	The conductor will be internally dredged to remove the soil inside to a depth of ca. 4 m below the seabed to provide access for the abrasive cutting tool. As no external excavation will be required, disturbance to the seabed will primarily occur when the conductor is lifted from the seabed. It is estimated that an area of ca. 17.8 m^2 will be disturbed during removal of the conductor, based on a contingency buffer of 2 m around the footprint of the 30 inch conductor. Once the conductor has been removed, a depression (ca. 3m deep) will be temporarily left in the seabed, but this will rapidly refill with natural backfill given the highly dynamic nature of the area.	17.8	0.00002
Removal of mid-line tee protection structure	In order to access the protection structure, the seabed will first need to be cleared which may be done by water jetting. The structure will then be cut and lifted from the seabed. As worst case it is assumed that the seabed maybe disturbed within a 2 m buffer around the footprint of mid-line tee structure, the dimensions of which are 4.5 m x 2.8 m. Once the structure has been removed, a depression will be temporarily left in the seabed, but this will rapidly refill with natural backfill given the highly dynamic nature of the area.	57.8	0.00006
	Total Area of Seabed Impacted:	**75,565**	**0.08**

[1] Although the P&A operations will be consented via appropriate environmental permits and consents under the OPRED PETS UK Energy Portal, for completeness the area of seabed disturbed by the jack-up vessel has been accounted for in the above table.

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 and anchoring of the HLV is likely to cause displacement or mortality of benthic species, such as sessile organisms, that are unable to move out of the impacted area. However, species in highly dynamic, tidally-influenced areas such as those found in the shallow waters of the southern North Sea, are generally tolerant of physical disturbance (DOER, 2000). With the exception of the legacy impact from the stabilisation material decommissioned in situ, the proposed Wenlock 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. 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 majority of seabed species recorded from the area are known, or believed to have, short lifespans (a few years or less) and relatively high reproductive rates, indicating the potential for rapid population recovery, such that any effects will be temporary. Species with opportunistic life strategies, including the polychaete *Mediomastus fragilis* which was recorded during the 2020 pre-decommissioning survey, are likely to recolonize the disturbed areas first (Tillin, 2016). *Alcyonium digitatum* also has a high recovery potential (Budd, 2008). In contrast, the recovery of bivalves that recruit episodically and the establishment of a representative age-structured population for larger, longer-lived organisms may require longer than two years.

Of note is one aggregation of potential *S. spinulosa* biogenic reef, classified as having low reefiness, was identified approximately 446 m to the north west of the Wenlock platform from the camera transects obtained during the 2020 pre-decommissioning survey. In addition, a further six areas exhibiting potential low reefiness and one area exhibiting potential low to medium reefiness were identified from the geophysical data collected during the survey to the north west, west, south west, east and south-south east of the platform (refer to Figure 4.8 in Section 4.2.2). As such, these areas could be impacted by the anchoring of the HLV and jack-up vessel. Abrasion at the surface of *S. spinulosa* reefs is known to damage the tubes and result in sub-lethal and lethal damage to the worms (Gibb *et al.* 2014). The anchor and anchor chain/wire placement will therefore be positioned to avoid direct physical impact to the identified *S. spinulosa* aggregation, where possible.

The proposed decommissioning activities will also lead to an increase in turbidity through sediment resuspension resulting in smothering of sensitive benthic species. As previously noted, the Wenlock platform 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. Where sedimentation does impact negatively on benthic species, consequences are likely to be short-lived as most of the smaller sedentary species (such as polychaete worms) have short lifecycles and recruitment of new individuals from outside of the disturbed area will be rapid (Tillin and Tyler-Walters, 2014). *S. spinulosa* is unlikely to be significantly impacted as it relies on a supply of suspended solids and organic matter in order to filter feed and build protective tubes and therefore it is often found in areas with high levels of turbidity (Gibb *et al.* 2014; Hendrick, 2007). Jackson & Hiscock (2008) indicates that evidence points towards *S. spinulosa* having very little sensitivity to smothering or to increases in sedimentation rates, and that its recoverability potential from such impacts is very high.

Retrieval of mattresses and gravel bags at the approaches to the Wenlock and Inde 23A platforms will result in hard / coarse substratum habitats being replaced by sediment habitats, more typical of this area of the southern North Sea. 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.

Given the above, the sensitivity of seabed communities to seabed disturbance in the vicinity of the Wenlock location is considered to be **Medium**, with a very high value due to some species being of international importance and 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 magnitude of impact 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. 0.08 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 Wenlock location to the legacy impact is considered to be **Very High**, with a very high value due to some species being of international importance and low resistance and resilience, given that the changes will be permanent. It is estimated that this will permanently disturbed an area of ca 0.006 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 very large extent of sandy seabed available in the southern North Sea. 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:

- Jacket legs and the legacy appraisal well conductor will be cut internally, to avoid seabed disturbance from external excavation;
- An anchor management plan will be developed for the moored HLV and jack-up vessel, to ensure anchors and anchor chains/wires deployed avoid the identified potential *S. spinulosa* reef aggregations, where possible;
- Where vessels are required to hold position for only short duration, dynamic positioning (DP) 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 Wenlock infrastructure, the comparatively small area of seabed that will be impacted by the proposed decommissioning activities (ca. 0.08 km^2 will be temporary disturbed and ca. 0.006 km^2 will be subject to a legacy impact (permanent loss of habitat) from the stabilisation material decommissioned in situ) and the fact that, if possible, no identified areas of potential *S. spinulosa* reef will be subject to direct physical impact, 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 Wenlock area for nursery and/or spawning grounds at different times of the year including anglerfish, cod, herring, horse mackerel, lemon sole, mackerel, *Nephrops*, plaice, sandeel, sprat, spiny dogfish, tope shark and whiting (Coull et al. 1998 and Ellis *et al.* 2012). Harbour porpoise, white-beaked dolphin and minke whale are marine mammals that have been observed or identified as most likely to be present in the Wenlock area (see Section 4.2.5).

6.3.1 Sources of Underwater Noise Emissions

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

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

6.3.1.1 Vessel Operations

The Wenlock decommissioning activities will mobilise a variety of vessels, including the HLV, DSV / MSV, AHV, barge and tugs. Large vessels (greater than 100 m length, such as the HLV) 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 DP 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 and ROVs

It is proposed that mechanical (shear or diamond wire) cutters will be used to server the Wenlock pipelines, an abrasive cutting tool system will be used to internally cut the jacket piles and legacy appraisal well conductor. 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). 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. The ROVs will also not generate noise above that of the mother vessels supporting them. This aspect has therefore been scoped out of detailed assessment.

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, 2010b). 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 Wenlock 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 Wenlock location, the area which would be impacted represents only a small proportion of the spawning grounds available for these species in the southern North Sea. In addition, this area of the southern North Sea has a relatively high volume of vessel traffic and, as such, it is anticipated that the additional underwater noise generated by the proposed Wenlock 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 Wenlock 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 Wenlock 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 Wenlock 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 estimates from the SCANS III survey data (Hammond *et al.* 2017) and the density and abundance estimates from the MMMUs (IAMMWG, 2015) as shown in Table 6.5. In addition, density data from Russel *et al.,* 2017 has been used for harbour seal and grey seal.

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

Species	Estimated Density in the Area (animals / km²)	Estimated Number of Animals that May Experience Behavioural Disturbance [3]	% of Reference Population Disturbed [4]
Harbour porpoise [1]	0.888	28	0.01
White-beaked dolphin [1]	0.002	< 1	0.006
Minke whale [1]	0.01	< 1	0.004
White-sided dolphin [5]	0.044	< 2	0.003
Common dolphin [5]	0.036	< 2	0.004
Harbour seal [2]	0.04	<2	N/A
Grey seal [2]	0.04	<2	0.02

[1] Source: Hammond et al. (2017) – SCANS-III Block O
[2] Source: Russel et al. (2017)
[3] Calculated as the estimated density x behavioural onset area
[4] Based on MMMU abundance data (IAMMWG, 2015)

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, 2010b). 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, 2010b). Considering the noise sources associated with the proposed Wenlock 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 <u>very high value</u> as marine mammals are of international importance and <u>very high resistance and resilience</u>. 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 southern North Sea 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 Wenlock 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, jack-up or moored vessel will be used in favour of DP vessels.
- 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 Wenlock 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 Wenlock decommissioning activities.

The nearest aggregate area to the Wenlock platform is Humber 5 (Area no.: 483), located approximately 4 km to the north-east of the Wenlock platform (see Section 4.3.6).

There are a large number of existing oil and gas developments adjacent to the Wenlock platform, the nearest of which is the Viking Alpha platform located approximately 7 km to the south-south west (see Section 4.3.3). The platform is operated by Chrysaor Production (U.K.) Limited, but is currently in the process of being decommissioned. Based on the schedule in the Viking DP, it is expected that the platform will be removed by the end of Q2 2021 at the latest and therefore will not overlap with the preparatory works at Wenlock. The closest operational platform is Chrysaor Production (U.K.) Limited's Tethys platform, located approximately 17 km to the north west.

In addition, there are a number of offshore wind farm developments in this region of the southern North Sea (see Section 4.3.5), although only one is operational; Hornsea Project One (operated by Ørsted) located approximately 27 km north west of the Wenlock platform. Ørsted is also planning to develop Hornsea Project Three; the proposed wind farm turbine area for which is located approximately 25 km north west of the Wenlock platform, with the export cable corridor running 9 km to the north-west. An application for a Development Consent Order (DCO) was accepted by the Planning Inspectorate in June 2018 and was granted consent by the Secretary of State for the Department for Business, Energy and Industrial Strategy on 31 December 2020. The current timeline indicates that construction activities for Horensea Project Three could be taking place in the period from 2022 to 2025 and therefore may overlap with the proposed Wenlock decommissioning activities.

Vattenfall is also planning to develop two wind farm developments; Norfolk Boreas (in-planning) and Norfolk Vanguard West (DCO granted), located approximately 26 km south east and 31 km south of the Inde 23A platform respectively. Construction activities for both these developments are provisionally scheduled for the period 2024-late 2020s and therefore could potentially overlap with the Wenlock decommissioning activities.

However, given the limited area of seabed disturbed by the proposed Wenlock decommissioning activities, coupled with the distance between the Wenlock 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 Wenlock 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 Wenlock decommissioning activities is predicted to be insignificant against the noise produced by the existing vessel traffic in this area of the southern North Sea. As such, any emissions and discharges from the proposed Wenlock 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 Wenlock 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 Wenlock platform is located approximately 45 km south west of the UK / Netherlands median line and the Inde 23A platform is located approximately 31 km south west of the UK / Netherlands median line. However, any impacts arising from emissions, discharges and seabed disturbance generated as a result of the proposed Wenlock 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 there is the potential for a worst case release of diesel to cross into international waters. 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. In the event a release of hydrocarbons enters Dutch waters it may be necessary to implement the Bonn Agreement. This Agreement is the main counter-pollution multi-state agreement for dealing with marine pollution that may affect states that border the North Sea and English Channel (Belgium, Denmark, France, Germany, Ireland, Netherlands, Norway, Sweden and the UK). It requires member states to provide early notification if hydrocarbons may affect the interests of another party and mutual assistance in the event of a spill. APRL will therefore ensure the Maritime and Coastguard Agency (and OPRED) is immediately informed once they have any indication that an accidental release of hydrocarbons from the proposed Wenlock decommissioning activities will encroach into Dutch waters.

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

7 Potential Impacts to Marine Protected Areas

APRL has identified that two MPAs, namely the North Norfolk Sandbanks and Saturn Reef (NNS&SR) SAC and Southern North Sea (SNS) SAC, are potentially at risk of being adversely impacted by the proposed Wenlock decommissioning activities. The following sections therefore assess whether the potential impacts from the proposed decommissioning activities, either alone or in-combination with other plans or projects, may cause likely significant effects to the qualifying features of the MPAs thereby affecting the integrity of the sites.

7.1 North Norfolk Sandbanks and Saturn Reef SAC

7.1.1 Qualifying Features and Conservation Objectives

The qualifying Annex I features of the NNS&SR SAC are 'sandbanks which are slightly covered by sea water all the time' and biogenic reef constructed by *Sabellaria spinulosa*. JNCC's view on the condition of the qualifying features in the site is summarised in Table 7.1.

Table 7.1. Condition of the Qualifying Features in the NNS&SR SAC (JNCC, 2017c)

Protected Feature	View of Condition
Annex I Sandbanks which are slightly covered by seawater all the time	Unfavourable
Annex I Reefs	Unfavourable

The conservation objectives for the SAC are for the features to be in favourable condition thus ensuring site integrity in the long term and contribution to Favourable Conservation Status (FCS) of Annex I Sandbanks which are slightly covered by sea water all of the time and Annex I Reefs. This contribution would be achieved by maintaining or restoring, subject to natural change:

- The extent and distribution of the qualifying habitats in the site;
- The structure and function of the qualifying habitats in the site; and
- The supporting processes on which the qualifying habitats rely.

A restore objective is advised for extent and distribution of the sandbank feature. Activities must look to minimise, as far as is practicable, changes in substratum and the biological assemblages within the site to minimise further impact on feature extent and distribution (JNCC 2017a).

A restore objective is also advised for the Annex I reef feature. Activities must look to minimise, as far as is practicable, damaging the established (i.e. high confidence) reef within the site (JNCC 2017a).

7.1.2 Potential Impacts

The Wenlock platform, legacy appraisal well and approximately 28.6 km of the route of the Wenlock pipelines, including the mid-line tee structure and cable crossing, are located within the boundary of the NNS&SR SAC. The route of the pipelines crosses one of the Indefatigable outer sandbanks between KP 5.5 to KP 9.5. The Inde 23A platform is located outside of the SAC boundary, approximately 5 km to the east (see Figure 2.1 in Section 2.2).

The proposed decommissioning activities have the potential to impact the qualifying features of the NNS&SR SAC through the physical loss of habitat and smothering by resuspension and settlement of natural seabed sediments. The pipelines and stabilisation material left in situ may also cause ongoing obstruction on the sandbank feature. The potential impact to the qualifying features are discussed in detail below.

7.1.2.1 Annex I Sandbanks

The extent of sandbank habitat within the NNS&SR SAC covers an area of 360,341 ha (3,603 km^2), reflecting the fact that the whole SAC is viewed as one integrated sandbank system (JNCC, 2017a).

Sediment composition of the offshore sandbanks primarily comprises circalittoral sand, as well as circalittoral coarse sediments and, to a lesser extent, circalittoral mixed sediments. Circalittoral mixed sediments and coarse sediments are found mainly in flanks and troughs and in places coincident with records of *Sabellaria spinulosa* reef (Parry *et al.* 2015).

The biological communities present on the sandbanks are representative of the infralittoral mobile sand biotope. Species typical of this biotope include the polychaete worm *Nephtys cirrosa* and the isopod *Eurydice pulchra* (JNCC 2017a). Characteristic species recorded during surveys within the SAC included *Mediomastus fragilis*, *Sabellaria spinulosa*, *Scalibregma inflatum* and *Notomastus.*

There is the potential for the sandbank habitat within the SAC to be impacted by the proposed Wenlock decommissioning activities due to:

- Physical impacts arising through:
    - The use of anchors and associated chains/wires used by the HLV during the removal of the topside and jacket;
    - The release of the jacket from the seabed following internal dredging and cutting of the piles. Once the jacket is removed a small depression (ca. 3 m deep) will be left in the seabed at each pile location;
    - The cutting of the pipeline ends, removal of exposed pipeline sections / tie-in spools, including mattress and gravel bags at the approaches to the Wenlock and Inde 23A platforms and, if required, redeployment of mattresses or gravel bags to protect the cut ends of the pipelines;
    - Removal of the legacy appraisal well conductor following internal cutting. Once the conductor has been removed a small depression (ca. 3 m deep) will be in the seabed;
    - Removal of mid-line tee protection structure.
- Physical loss of habitat from the existing infrastructure which will be decommissioned in situ, namely the pipelines and stabilisation material.

As detailed in Section 6.2.1, the proposed decommissioning activities will result in physical impacts in an area of seabed totalling ca. 0.075 km^2 (excluding the disturbance at the approaches to the Inde 23A platform). However, seabed sediments in the southern North Sea are routinely subject to physical impacts from strong tidal currents and therefore the subtidal sandbanks are considered to be relatively tolerant to physical disturbance with a high capacity for recovery. The highly dynamic nature of the area will also naturally backfill the small depressions in the seabed created following the removal of the jacket and legacy appraisal well conductor. Species within infralittoral mobile sand biotopes are adapted to high levels of disturbance with recovery often within a few days or weeks. Even following severe disturbances recovery would be expected to occur within a year (Tillin *et al.* 2019). As such, any physical impact to the sandbank habitat will be temporary, with the habitat and benthic communities predicted to rapidly recover once the decommissioning activities have ceased. The area which will be temporarily impacted is also relatively small compared to the extent of habitat within the SAC, equivalent to ca. 0.001% of the NNS&SR SAC total area. It is therefore concluded that any physical impacts on the sandbank habitat arising from the proposed Wenlock decommissioning activities will not have an adverse effect on the integrity of the NNS&SR SAC.

In addition to the above, there will be a legacy impact from the decommissioning in situ of the pipelines and associated stabilisation material. Sandbanks are highly mobile so the presence of solid structures can create an artificial habitat, localised scouring and sediment deposits consequently leading to a physical loss of habitat, as well as changes to the structure and diversity of sandbank communities. Assuming a potential impact on the seabed of 5 m either side of the Wenlock pipelines, the total area of seabed impacted by the physical presence of the existing pipelines within the SAC is ca. 286,000 m^2 (0.286 km^2), equivalent to ca. 0.008% of the NNS&SR SAC total area. Within this area, ca. 5,220 m^2 (0.005 km^2) of seabed is covered by rock dump, equivalent to ca. 0.001% of the NNS&SR SAC total area. In contrast, the pipelines are trenched and buried to a depth in excess of 0.6 m (normally between 1.0 and 1.5 m deep). No evidence of any trench can now be seen with the trench depressions filling back in to return the seabed to its natural level. The exception to the burial depth is at the approaches to the Wenlock platform and at the NorSea cable crossing (KP 14.373 – KP 14.530). At the crossing, the cable is located at a depth of approximately 0.5 m below seabed. Concrete mattresses were laid below the Wenlock pipelines to provide separation between the cable and pipelines before the un-trenched section of pipeline was rock dumped to provide protection over an approximate 160 m length. Subsequent surveys have shown this rock dump to be very stable on the seabed. In addition, no erosion or displacement has been noticed on or around the locations where rock has been placed along the pipeline route to prevent upheaval buckling during the operational life of the Wenlock field.

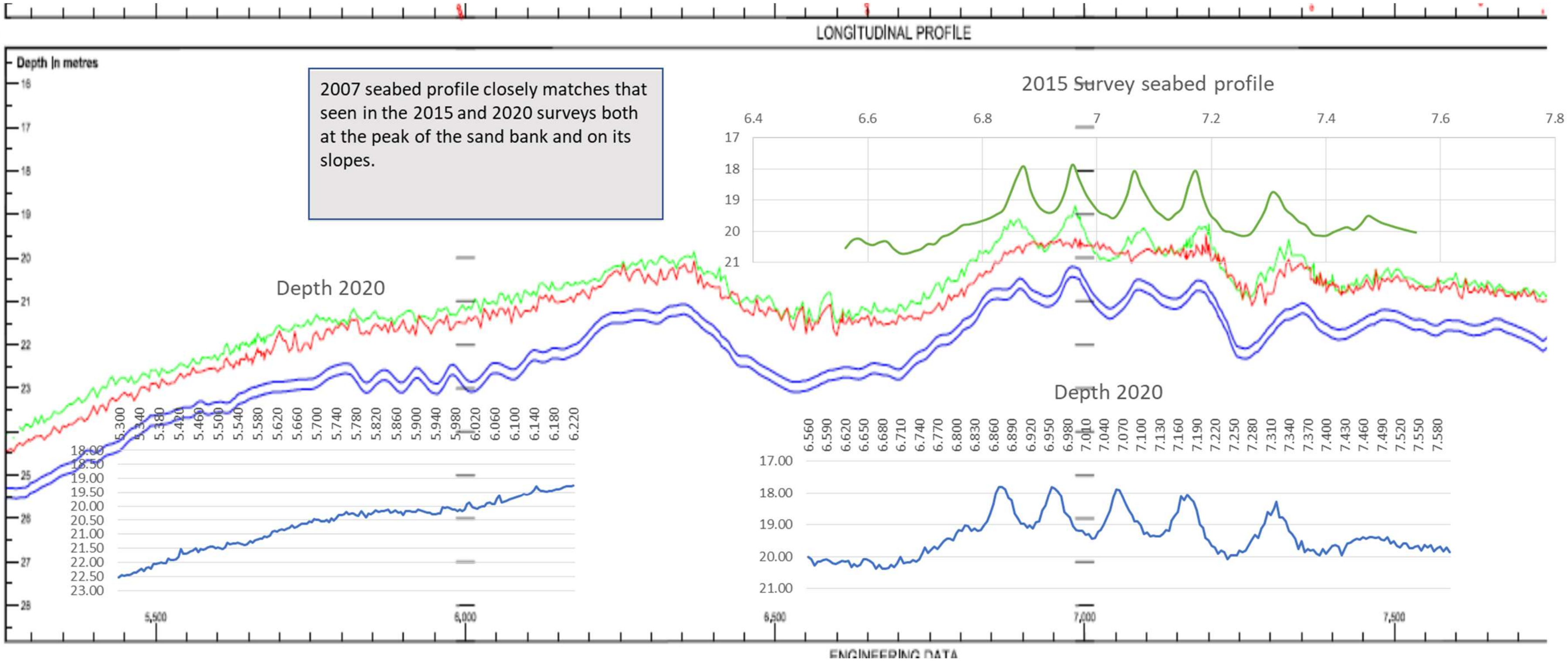
Where the pipelines cross the Indefatigable sandbank, water depth comparisons for the original as trenched survey in 2007, an operational interim survey in 2015 and the pre decommissioning survey in 2020 have shown no migration of the sandbank is occurring, with the seabed profile closely matching both at the peak of the sandbank and on its slope (see Figure 7.1). From the survey data it can also be seen that the seabed has megaripples of approximately 0.2 m in height throughout pipelines routes. Although there is no evidence from the various surveys that these miggaripples are migrating along the seabed surface it has been known for megaripples to do so in other locations. However, even if this does occur, the pipelines will still remain buried below 0.6 m. The physical presence of the pipelines below the seabed therefore does not visually appear to impact the sandbank features.

As part of the design for the pipeline systems, stability and upheaval buckling calculations were performed to ensure no movement of the pipelines during operational life was expected. In this operational condition the gas export pipeline was filled with warm gas which is significantly more buoyant than water. In a water flooded condition (as would be the decommissioned left in situ state) both pipelines are significantly negatively buoyant and so no upward movement of the pipelines would be expected during their decommissioned lifetime. The risk of the pipelines becoming exposed in the future is therefore considered to be very low. As such, it is not considered that additional remediation will be required in the future.

The stabilisation material, primarily rock, which will remain on the seabed surface will continue to represent a change in habitat from a mobile sand feature to an immobile hard substrate, although over time some of the material may potentially bury or be partially buried by sand deposition. However, the area impacted is extremely small compared to the extent of sandbank habitat in the SAC, equivalent to ca. 0.001% of the NNS&SR SAC total area. In addition, as the stabilisation material will remain in localised areas, the wider sandbank communities will not be affected.

Considering the above, it is therefore concluded that the physical loss of habitat from the existing infrastructure which will be decommissioned in situ will not have an adverse effect on the integrity of the NNS&SR SAC.

Figure 7.1. Survey Chart Illustrating 2007, 2015 and 2020 Seabed Survey Profile Comparisons



Comparison sections of the natural seabed found in the 2015 operational survey (darker green) and 2020 pre decommissioning survey (darker blue) have been imposed onto the as trenched chart. Given the similarities in seabed profiles the slight discrepancies in absolute depths between the 2007, 2015 and 2020 surveys are most likely due to survey tolerances, especially as almost the same discrepancy is seen throughout the route. Note that the 2015 and 2020 survey profiles have had their vertical scales offset for ease of comparison.

7.1.2.2 Annex I Biogenic Reefs

The total area of Annex I reef habitat classified within the SAC at the time the site was designated was 1.08 km^2 (Natura 2000, 2012); however, since then additional areas of reef habitat have been identified. The extent and distribution of Annex I *S. spinulosa* biogenic reef features within the SAC, based on JNCC's 2019 dataset, is illustrated in Figure 2.4 (Section 2.2), although it is noted that *S. spinulosa* reefs are naturally ephemeral and shift in spatial distribution (Hendrick *et al.* 2011; Benson *et al.* 2013; Roberts *et al.* 2016). It is therefore important to conserve both established reef areas and areas of potential reef within the SAC. Reefs formed by *S. spinulosa* allow the settlement of other species not found in adjacent habitats leading to a diverse community of epifaunal and infaunal species.

As noted in Section 4.2.2, one aggregation of potential *S. spinulosa* biogenic reef, classified as having low reefiness, was identified approximately 446 m to the north west of the Wenlock platform from the camera transects obtained during the 2020 pre-decommissioning survey. In addition, a further six areas exhibiting potential low reefiness and one area exhibiting potential low to medium reefiness were identified from the geophysical data collected during the survey to the north west, west, south west, east and south-south east of the platform (see mapped areas in Figure 4.8). Given the distances of these areas from the platform, which range from 73 m to 758 m away, it is possible they could be impacted by the anchoring of the HLV and jack-up vessel. Abrasion at the surface of *S. spinulosa* reefs is known to damage the tubes and result in sub-lethal and lethal damage to the worms (Gibb *et al.* 2014). APRL will therefore ensure that the anchor and anchor chain/wire placement will therefore be positioned to avoid direct physical impact to the identified *S. spinulosa* aggregation, where possible.

The proposed decommissioning activities, including anchoring of the HLV and removal of the platform and legacy appraisal well conductor, may also lead to an increase in turbidity through sediment resuspension resulting in smothering of the identified *S. spinulosa* feature. However, *S. spinulosa* is unlikely to be significantly impacted by this as it relies on a supply of suspended solids and organic matter in order to filter feed and build protective tubes and therefore it is often found in areas with high levels of turbidity (Gibb *et al.* 2014; Hendrick, 2007). Jackson & Hiscock (2008) indicates that evidence points towards *S. spinulosa* having very little sensitivity to smothering or to increases in sedimentation rates, and that its recoverability potential from such impacts is very high.

Given the above, it is therefore considered that the proposed Wenlock decommissioning activities will not have a likely significant effect on Annex I biogenic reef features.

7.1.3 In-Combination Effects

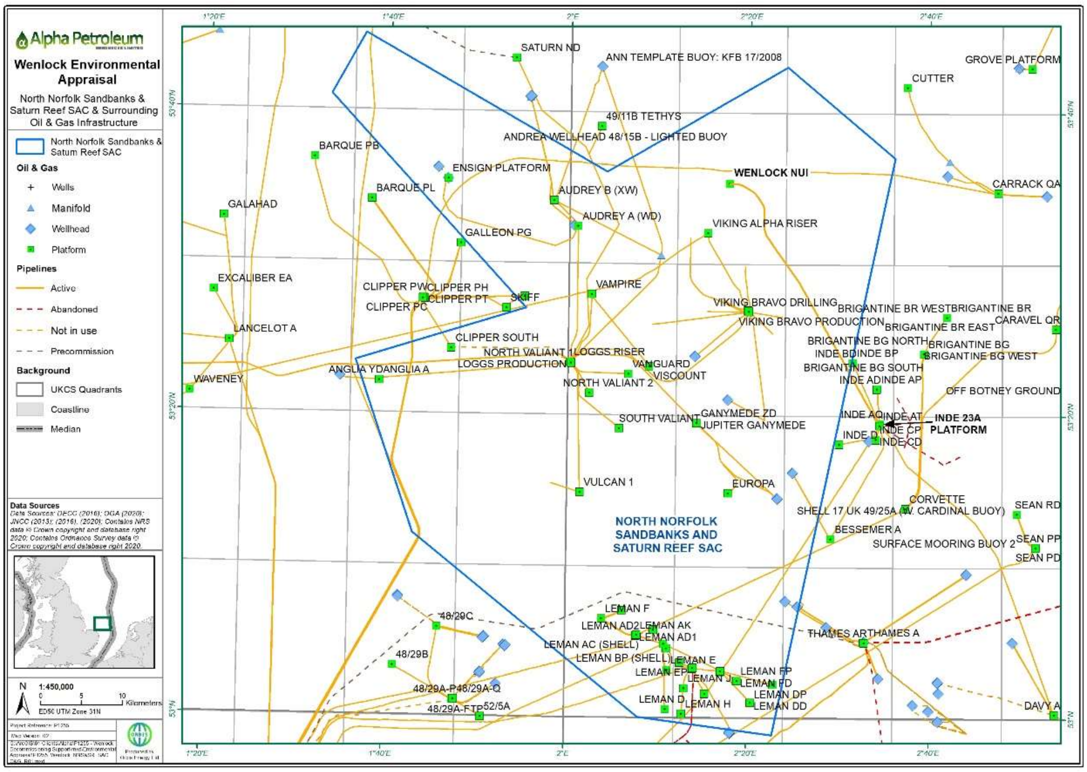
It is considered that the following activities, in-combination with the proposed Wenlock decommissioning activities, could result in-combination effects on the qualifying features of the NNS&SR SAC:

- Oil and gas activity;
- Offshore renewable activity;
- Aggregate extraction;
- Commercial fishing.

Figure 7.2 illustrates the existing oil and gas infrastructure located within the NNS&SR SAC. The majority of this infrastructure was installed over 10 years ago, prior to the area being designated as a SAC and is therefore considered to be part of the baseline environment. APRL is not aware of any proposed oil and gas field developments planned within the NNS&SR SAC; however, the following infrastructure is in the process of being decommissioned or is scheduled to be decommissioned in the next 6 years and therefore these projects could potentially overlap with the Wenlock decommissioning activities:

- Spirit Energy is planning to decommission the Ensign platform and pipelines and the 'A-fields' comprising the Ann, Alison, Saturn (Annabel) subsea installations and the Audrey platforms;
- Ithaca Energy is in the process of decommissioning the Anglia facilities;
- Chrysaor has an extensive decommissioning campaign in the area, which includes the LOGGS LDP2 – LDP5 decommissioning projects (5 manned platforms, 9 satellite platforms, 26 pipelines and 9 subsea structures). In addition, the Viking AR and the Viking Transportation System (VTS) Complex (BA, BC, BP and BD) are in cold suspension awaiting removal and Victor JM is awaiting plugging and abandonment, although it is likely this work will be completed prior to the commencement of the Wenlock decommissioning activities.

Figure 7.2. Existing Oil and Gas Infrastructure within the NNS&SR SAC

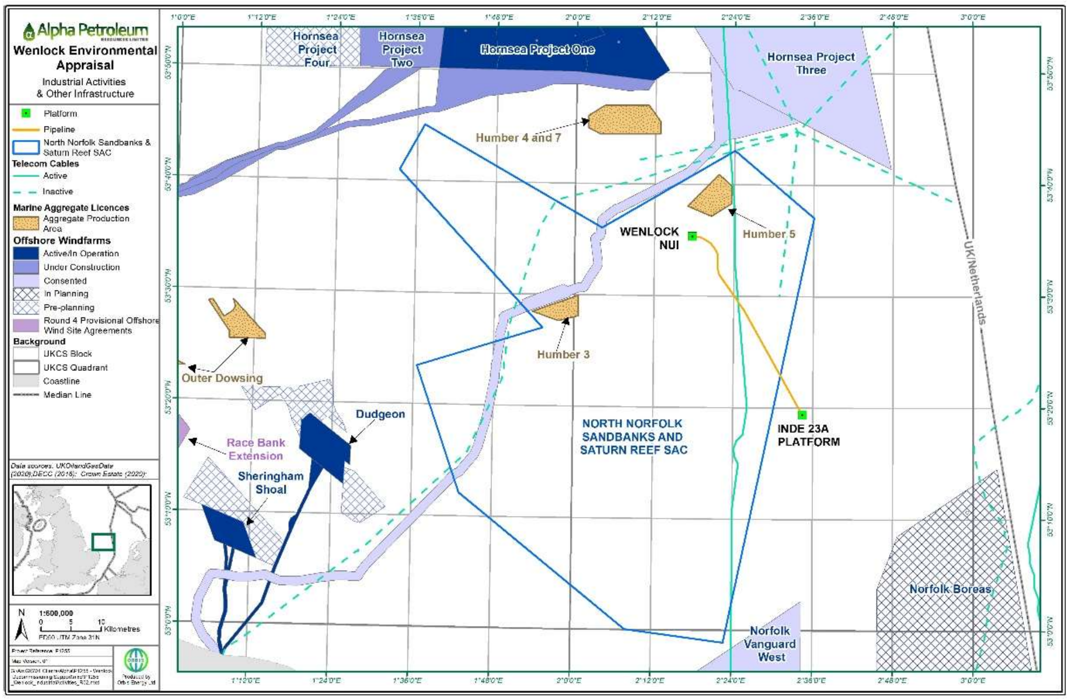


There will be a physical impact on the sandbank features and their communities within the SAC from the above listed decommissioning projects, but as discussed in Section 7.12, evidence from existing studies indicates that any physical impacts will be temporary. In addition, although the pipelines associated with these projects will primarily by decommissioned in situ, it is predicted that they will remain largely buried and will not affect the structure and function of the Annex I sandbank habitat. Of note is that although *S. spinulosa* was observed during some of the pre-decommissioning surveys, none of these aggregations were found to represent an Annex I reef structure.

There are no operational wind farm developments within the NNS&SR SAC, but an estimated 45.8 km section of the planned export cable corridor associated with Ørsted's proposed Hornsea Three offshore wind farm lies within the site (see Figure 7.3). Construction activities associated with Hornsea Project Three could take place from 2022 to 2025, potentially overlapping with the Wenlock decommissioning activities. It is estimated that an area up to approximately 9.3 km^2, which equates to 0.26% of the SAC, could be impacted by the cable installation activities, including the dumping of rocks for cable protection. Of this, an area of approximately 0.4 km^2 would be lost to rock protection, affect up to 0.01% of the SAC (BEIS, 2020).

Ørsted considers that any effects on sandwave features will be temporary because the feature would recover post cable burial. Monitoring undertaken at the Race Bank Offshore Wind Farm which also passes through similarly dynamic areas of seabed, characterised by highly mobile sediments with migrating bedform features, showed that after five months either partial or full recovery had occurred at 10 out of 12 monitoring locations comprising 14 out of 19 sandwaves. In addition, any impacts on sandbanks due to the introduced rock substrate are predicted to be highly localised, as cable protection is likely to be in relatively discrete locations along the cable corridor, and although the impacts are long-term, they are considered to be temporary as any deposits that are above or protruding from the seabed within the SAC will be removed during decommissioning. Ørsted also found no Annex I reef habitat within the cable corridor during the site surveys undertaken for the project and propose to mitigate any impacts through micrositing of the offshore export cable within the cable corridor. As such, it is considered there will be no adverse effect on the integrity of Annex I sandbank and reef features within the SAC from the cable installation activities (BEIS, 2020).

Figure 7.3. Offshore Windfarms and Aggregate Areas within the NNS&SR SAC



Two aggregate extraction areas are located within the SAC boundary, namely Humber 5 (Area no.: 483) and Humber 3 (Area no.: 484) as shown in Figure 7.3. The site consents allow up to 9 million tonnes of material to be extracted at each site over a period of 15 years. Assuming as a worst-case the total area of both sites is disturbed, 45.4 km^2 could be directly impacted by aggregate extraction from both sites, which equates to 1.2% of the SAC area.

As part of their consent, all aggregate extraction within the NNS&SR SAC is required to avoid impacting areas of reef where the feature is known to occur, therefore there is no evidence that the *S. spinulosa* is adversely impacted by this activity (JNCC, 2017b). In addition, subtidal sandbanks are judged to be relatively tolerant to physical disturbance with a high capacity for recovery, therefore they are not considered to be highly sensitive to physical disturbance from aggregate extraction.

Beam trawling is the most popular type of fishing activity in the NNS&SR SAC, targeting species such as plaice, *Nephrops* and sole (Marine Scotland, 2019). It is estimated that the extent of seabed potentially disturbed by beam trawling within the SAC is 1,312 km^2 per year, equivalent to 36.4% of the SAC (ABPMer and Ichthys Marine, 2015). Sandbank habitats may experience disturbance of the substrate on the surface of the seabed and abrasion as a result of demersal fishing, however these impacts are anticipated to be relatively short-lived (JNCC, 2017b). Demersal fishing can damage reef habitat through abrasion, disturbance of the substrate on the surface of the seabed, abrasion and siltation rate changes, including smothering, and it is therefore possible for in-combination impacts on *S. spinulosa* reef habitats to occur (JNCC, 2017c).

The overall area of seabed estimated to be impacted by the above listed activities, in-combination with the proposed Wenlock decommissioning activities, is summarised in Table 7.2.

Table 7.2. Total Estimated In-combination Seabed Impacts within North Norfolk Sandbanks and Saturn Reef SAC

Activity	Area Impacted (km²)	
	Physical Impact (Temporary)	Loss of Habitat (Permanent)
Wenlock Decommissioning	0.075	0.286
Ensign Decommissioning [1]	3.92	0.0242
'A-fields' Decommissioning [1]	27.0707	0.1062
Anglia Decommissioning [2]	0.038	0.002
LDP2 – LDP5 Infrastructure Decommissioning [3]	30.3	2.98
Aggregate Extraction (Humber 3 & 5 Areas)	-	45.4
Hornsea Project Three Cable Installation Activities	9.3	0.4
Beam Trawling (per year)	1,312 (per year)	-
Total:	**1,383**	**49**
% of NNS&SR SAC Impacted:	**38**	**1.4**

[1] Reference: Spirit Energy, 2019
[2] Reference: Ithaca Energy, 2019
[3] Reference: Chrysaor, 2020a

It can be seen from Table 7.2 that a relatively large percentage of the NNS&SR SAC will be temporary impacted, although the main contributor is the disturbance caused by beam trawling activity within the SAC. However, the disturbance to the seabed will be temporary in nature, and rapid recovery is expected following cessation of the activities that cause the physical impacts to the seabed. Some of the activities will overlap in time but many, particularly the oil and gas decommissioning activities, will occur over a more prolonged time period, such that only small areas of the total temporary disturbance will occur at any one time. In addition, once the decommissioning activities are completed no additional ongoing physical impact will occur.

In contrast, the long-term habitat loss resulting from the above listed activities represents a small percentage of the SAC, ca. 1.4%, the majority of which is attributable to aggregate extraction, and any impacts relating to the rock substrate (either rock which is introduced to the site or rock decommissioned in situ) are predicted to be highly localised.

An anchor management plan will be developed for the moored HLV and jack-up vessel, to ensure anchors and anchor chains/wires deployed avoid the identified potential *S. spinulosa* reef aggregations, where possible. Consequently, no in-combination impact on Annex I reef habitats will occur within the NNS&SR SAC.

Given the above, it is therefore considered that in-combination impacts will not have a likely significant effect on the qualifying features of the NNS&SR SAC.

7.1.3 Conclusion

In summary, based on the predicted scale of impacts and proposed mitigation measures, along with evidence from existing studies of the likely potential effects on the qualifying features, it is concluded that the proposed Wenlock decommissioning activities either alone or in-combination with other plans or projects and will not have an adverse effect on the integrity of the NNS&SR.

7.2 Southern North Sea SAC

7.2.1 Qualifying Features and Conservation Objectives

The Southern North Sea 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 Southern North Sea SAC are to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining 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

The Wenlock platform, legacy appraisal well and approximately 16.5 km of the route of the Wenlock pipelines, excluding the mid-line tee structure, are located within the northern part of the SAC. The midline tee and the Inde 23A platform are located approximately 0.25 km and 18 km, respectively from the boundary of the SAC.

As noted in Section 6.3, the underwater noise emissions generated during the proposed Wenlock 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. of 3,163 m from the noise source, equivalent to an area of ca. 31 km^2, with impacts primarily due to vessel noise. This equates to ca. 0.08% of the Southern North Sea SAC total area and ca. 0.2% of the summer area. It has been calculated that up to 28 individuals may be temporarily disturbed within this area, which is equivalent to 0.01% of the harbour porpoise North Sea MU reference population. Given the low number of harbour porpoises which may be impacted, there is considered to be sufficient foraging habitat in the wider vicinity to accommodate any temporary displacement of harbour porpoise from the area whilst the decommissioning activities are ongoing.

In addition to impacts on harbour porpoise from noise, there is the potential for impacts to supporting habitats and processes relevant to harbour porpoises and their prey within the SAC. Harbour porpoise are strongly reliant on the availability of prey species due to their high energy demands, and are highly dependent on being able to access prey species year-round. However, it is assumed that any potential effects on harbour porpoise prey species from the underwater noise generated during the proposed decommissioning activities would be the same or less than those for harbour porpoise, i.e. if prey are disturbed from an area as a result of underwater noise, harbour porpoise will be disturbed from the same or greater area, therefore any changes to prey availability would not affect harbour porpoise as they would already be disturbed from the same area.

In terms of the supporting habitats relevant to the prey of the harbour porpoise, fish species such as sandeels, herring, mackerel, cod and whiting that form part of the harbour porpoise diet and are present in the vicinity of the proposed decommissioning work. However, fish spawning and nursey grounds are not predicted to be significantly impacted by seabed disturbance activities resulting from the proposed decommissioning activities. Any disturbance to the seabed habitat that could affect the prey of the harbour porpoise or their prey within the SAC will be localised and temporary. It is estimated that the proposed decommissioning activities will temporary disturb an area of seabed totalling ca. 0.075 km^2 within the SAC, which equates to only ca. 0.0002% of the Southern North Sea SAC total area and ca. 0.0003% of the summer area. It is acknowledged that will be a permanent loss of ca. 0.005 km^2 of habitat within the SAC due to the decommissioning in situ of the protection material (rock) along the pipeline route. However, the area impacted is extremely small compared to the extent of habitat in the wider Southern North Sea SAC, approximately 0.00001% of the total area of the SAC. The loss of a relatively very small area of habitat that occurs widely within the SAC is not predicted to impact on harbour porpoise or their prey.

Given the above, it is therefore considered that the proposed Wenlock decommissioning activities will not have a likely significant effect on harbour porpoise or supporting habitats and processes relevant to harbour porpoises and their prey.

7.2.3 In-Combination Effects

Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs states that noise disturbance within an SAC from a plan/project, individually or in combination, is considered to be significant if it excludes harbour porpoises from more than (JNCC, 2020c):

- 20% of the relevant area of the site in any given day, or
- An average of 10% of the relevant area of the site over a season.

APRL is aware that construction activities associated with a number of offshore wind farm projects could be ongoing within the SAC during the period when the proposed decommissioning work will be taking place (2022-2027), including:

- Hornsea Two offshore wind farm (status: consented) (summer area): construction could be ongoing during 2022, located approximately 41 km from the Wenlock platform;
- Hornsea Four offshore wind farm (status: pre-application) (summer area): construction could be ongoing during 2023-2027, located approximately 63 km from the Wenlock platform;
- Dogger Bank Creyke Beck A and B Offshore Wind Farms (status: consented) (summer area) construction could be ongoing during 2022-2024, located approximately 120 km and 143 km respectively from the Wenlock platform;
- Norfolk Vanguard offshore wind farms (status: consented but subject to re-determination) (summer area): construction could be ongoing during 2024-late 2020s, located 31 km south of the Inde 23A platform;
- Norfolk Boreas offshore wind farm (status: in-planning) (summer area): construction could be ongoing during 2024-late 2020s, located 26 km south east of the Inde 23A platform;
- East Anglia Three offshore wind farm (status: consented) (summer and winter area): construction could be ongoing during 2022-2024, located approximately 98 km from the Wenlock platform.

However, as any disturbance caused by the proposed Wenlock decommissioning activities will result in a very small, temporary reduction in available habitat it is considered that this in-combination with the wind farm projects is unlikely to prevent the site from contributing in the best possible way to species FCS. In addition, this area of the southern North Sea is subject to a relatively high volume of vessel traffic (refer to Section 4.3.2) and therefore it is anticipated that the additional underwater noise generated by the proposed Wenlock decommissioning activities is likely to be insignificant compared to the ambient noise level.

7.2.4 Conclusion

In summary, based on the predicted scale of impacts and proposed mitigation measures, along with evidence from existing studies of the likely potential effects on the qualifying features, it is concluded that the proposed Wenlock decommissioning activities either alone or in-combination with other plans or projects and will not have an adverse effect on the integrity of the Southern North Sea SAC.

8 Conclusions

The Wenlock Field Installations DP and the Wenlock Pipelines DP involves the removal of the Wenlock platform (topside and jacket), legacy appraisal well conductor, mid-line tee protection structure and exposed tie-in spools and pipeline sections, mattresses and gravel bags, with recovery to shore. The pipelines will be left cleaned and decommissioned in situ, along with the associated stabilisation features. This EA report confirms that the Wenlock 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 Wenlock 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 Wenlock infrastructure lies within the boundary of two marine protected areas: North Norfolk Sandbanks and Saturn Reef SAC and Southern North Sea SAC. 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 Wenlock 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. APRL operates under an integrated Safety and Environmental Management System (SEMS), certified to ISO14001:2015, 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 Wenlock decommissioning activities, APRL 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. Wenlock 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; • If the jacket is removed in a separate campaign to the topside, a solar navaid / foghorn will be installed to warn other sea users of its presence; • If the legacy appraisal well conductor has not yet been removed after the 500 m safety exclusion zone surrounding the Wenlock platform is withdrawn, APRL will advise the UK Hydrographic Office (UKHO) at least 6 weeks in advance so the conductor can be marked on navigation charts; • Details of any infrastructure decommissioned in situ will be publicised through Notices to Mariners and marked on navigation and fisheries charts; • A post-decommissioning monitoring programme covering the pipelines and associated stabilisation features remaining in situ will be agreed with OPRED, if necessary; • Installation of nesting bird deterrents will be considered when the preparatory work is being undertaken to discourage birds from nesting on the platform once it enters the Lighthouse Mode phase; • Planning of operations to programme topside removal activities outside of the breeding bird season (April - September), if possible. In the event an opportunity arises to use a lift vessel during the breeding season, the platform will be checked by a qualified ornithologist for the presence of nesting birds and the results will be shared with OPRED to ascertain if it is possible for a Wild Birds Licence to be granted to allow the works to go ahead; • If any other decommissioning activity (e.g. preparatory works) is to be undertaken on the topside during the breeding season, the platform will be checked for nesting birds prior to commencing work. OPRED will be informed of the results and, if necessary, a Wild Birds Licence applied for. In the event nesting birds are observed, APRL currently propose to erect signage in the area advising offshore

personnel of the nests and personnel will be briefed on instructions to minimise possible disturbance to the juveniles and attending adults. The nests will also be monitored on a daily basis to record bird presence and activity.
Seabed Disturbance
• Jacket legs and the legacy appraisal well conductor will be cut internally, to avoid seabed disturbance from external excavation; • An anchor management plan will be developed for the moored HLV and jack-up vessel, to ensure anchors and anchor chains/wires deployed will avoid the identified potential *S. spinulosa* reef aggregations, where possible; • Where vessels are required to hold position for only short duration, DP 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, jack-up or moored vessel will be used in favour of DP vessels. • 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
• APRL will look to reduce vessel time in the field as far as practicable and will make use of vessel synergies where possible; • APRL'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
• APRL 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, APRL 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 Wenlock 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.

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