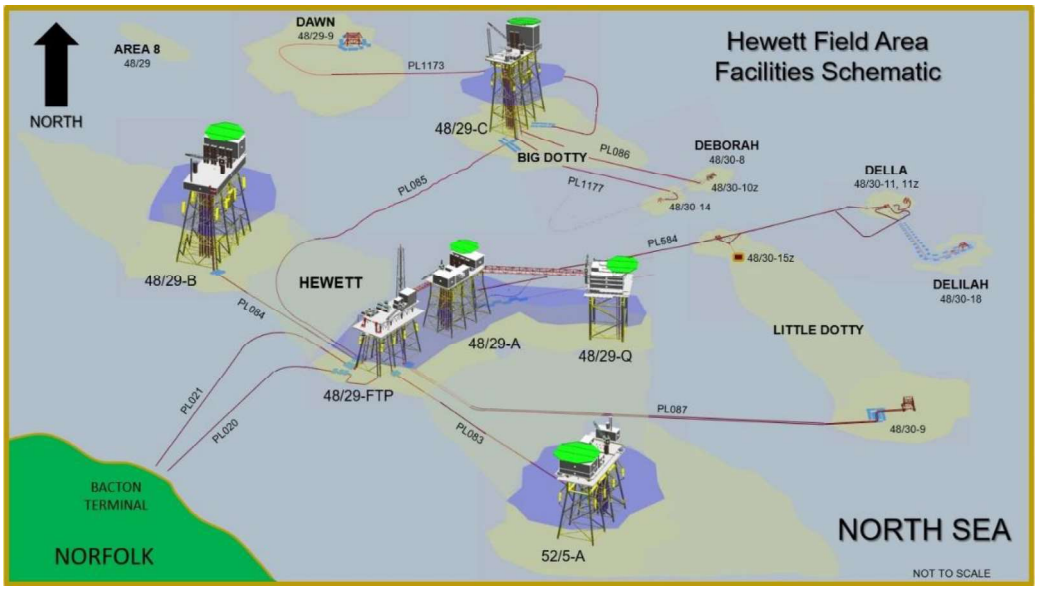
HEWETT AREA SUBSEA INSTALLATIONS DECOMMISSIONING ENVIRONMENTAL APPRAISAL



Document Verification

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Revision History

Rev.	Date	Description
0	14/09/21	Pre-Consultation Draft for Review
1	25/10/21	Update to address initial OPRED comments
2	14/12/21	Draft for Consultation
3	12/05/22	Update to address post-consultation comments
4	12/07/22	Update to address post-consultation comments
5	23/08/22	Amended schedule in line with updated Decommissioning Programme. Post-consultation Final.
6	01/11/22	Amended schedule in line with updated Decommissioning Programme. Post-consultation Final.

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ABBREVIATIONS

Abbreviation	Explanation
%	Percentage
"	Inch
<	Less than
µm	Micrometre(s)
ALARP	As Low As Reasonably Practicable
BEIS	Department for Business, Energy & Industrial Strategy
BRIG	Biodiversity Reporting and Information Group
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Coordinated Environmental Monitoring Programme
CH_4	Methane
CMAPP	Corporate Major Accident Prevention Policy
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CoP	Cessation of Production
CSV	Construction Support Vessel
dB	Decibel
DECC	Department of Energy and Climate Change (now BEIS)
DP	Decommissioning Programme
DSV	Dive Support Vessel
E&A	Exploration and appraisal
EA	Environmental Appraisal
EBS	Environmental Baseline Survey

Abbreviation	Explanation
EC	European Commission
EMS	Environmental Management System
EMT	Environmental Management Team
Eni	Eni UK Limited
ENVID	Environmental Impact Identification
EPA	Environmental Protection Agency
EPS	European Protected Species
ERL	Effects Range Low
ERT	Environment Resource Technology
ESAS	European Seabirds At Sea
EU	European Union
FCS	Favourable Conservation Status
FOCI	Features of Conservation Interest
FTP	Field Terminal Platform
HSE	Health, Safety and Environment
Hz	Hertz
ICES	International Council for the Exploration of the Sea
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
ICP-OES	Inductively Coupled Plasma-Optical Emission Spectrometry
IMS	Integrated Management System
JNCC	Joint Nature Conservation Committee
kg	Kilogramme
kHz	KiloHertz
km	Kilometer

Abbreviation	Explanation
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effect
m/s	Metres per second
MARPOL	International Convention for the Prevention of Pollution from Ships
MCAA	The Marine and Coastal Access Act
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MPA	Marine Protected Area
MTM	Midline Termination Module
MU	Marine Unit
N/A	Not Applicable
N_2O	Nitrous oxide
NE	Natural England
NFFO	National Federation of Fishermen's Organisations
NM	Nautical Mile
NOA	North Atlantic Oscillation
NORM	Naturally Occurring Radioactive Materials
NOX	Nitrogen oxide pollutants
°	Degrees
°C	Degrees Celsius
OGA	Oil and Gas Authority (now North Sea Transition Authority)
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
OSPAR	Oslo-Paris Convention

Abbreviation	Explanation
P&A	Plug and Abandon
PAH	Poly Aromatic Hydrocarbon
PEXA	Practice and Exercise Area
PLEM	Pipeline End Manifold
PSD	Particle Size Distribution
RAF	Royal Air Force
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SFF	Scottish Fishermen's Federation
SNCB	Statutory Nature Conservation Bodies
SNS	Southern North Sea
SO_2	Sulphur dioxide
SOPEP	Ship Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area
THC	Total Hydrocarbon
TOC	Total organic carbon
TOM	Total organic matter
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
US	United States
VOC	Volatile organic compound

Abbreviation	Explanation
WHPS	Wellhead Protection Structure

1.0 NON TECHNICAL SUMMARY

1.1 Project Background

This non-technical summary provides an overview of the findings of the Environmental Appraisal (EA) conducted by Eni UK Limited (hereafter referred to as 'Eni') for the decommissioning of the subsea installations in the Hewett Gas Field located in United Kingdom Continental Shelf (UKCS) Blocks 48/28a, 48/29a, 48/30a, 52/4a and 52/5a in the Southern North Sea (see Figure 1.1). Operations will take place at the Dawn, Deborah, Little Dotty, Delilah and Della Fields, with the removal of the subsea wellhead protection structures, wellheads and xmas tress and subsea manifold protection structures.

The facilities to be decommissioned comprise:

- 8 x wellheads[1], xmas trees and Subsea Wellhead Protection Structures (WHPS) associated with the following wells:
    1. Dawn Subsea Well 48/29-9;
    2. Deborah Subsea Well 48/30-8;
    3. Deborah Subsea Well 48/30-10;
    4. Deborah Subsea Well 48/30-14;
    5. Little Dotty Subsea Well 48/30-9;
    6. Little Dotty Subsea Well 48/30-15z;
    7. Delilah Subsea Well 48/30-18; and
    8. Della Subsea Well 48/30-11z;
- 2 x Subsea Manifold Protection Structures:
    1. Della Midline Termination Module (MTM); and
    2. Della Pipeline End Manifold (PLEM);

In addition, although not classified as a subsea installation, as part the subsea installation decommissioning campaign, Eni proposes to remove the wellhead on the previously abandoned 48/30-13 exploration and appraisal (E&A) well, located approximately 7m from the Deborah 48/30-8 subsea well. For completeness this work has been included in the scope of this EA report.

Note, of the above listed facilities, the Little Dotty 48/30-9 and 48/30-15z subsea wells, as well as the Della MTM, are located within the 12 nautical mile limit. All other facilities and associated subsea structures are located outside of territorial waters, as illustrated in Figure 1.1.

The purpose of this EA report is to document the potential for, and significance of, environmental and societal impacts resulting from the four Hewett Area Subsea Installations Decommissioning Programmes (DPs) and summarise the proposed mitigations measures required to minimise these impacts.

Decommissioning of the subsea pipelines and umbilicals associated with the Hewett field is outside the scope of this report and will be addressed in a separate DP and EA report. In addition, the Hewett field platform installations are already subject to a DP, which was approved in March 2021.

[1] CoP applications have been approved for each of the eight subsea wells listed above.

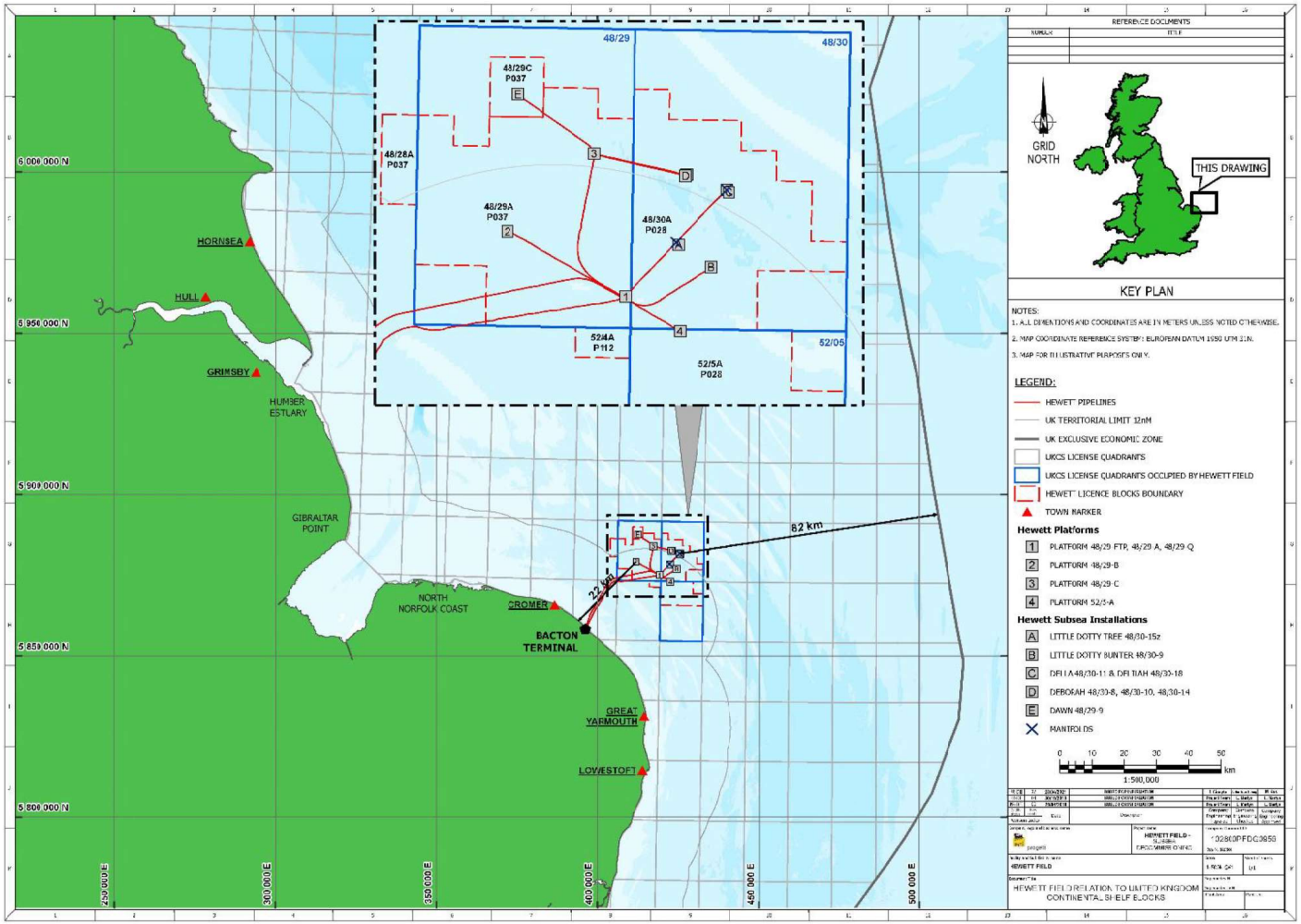


Figure 1.1: Hewett Field Area Location

1.2 Proposed Decommissioning Activities

Eni is proposing to completely remove eight Hewett subsea wellheads, xmas trees and wellhead protection structures and two subsea manifold protection structures and recover them to shore as described in Table 1.1. In addition, as part of the Hewett subsea installations campaign, Eni proposes to recover the wellhead on the previously abandoned 48/30-13 E&A well.

A Dive Support Vessel (DSV) and Construction Support Vessel (CSV) will be mobilised to remove the Hewett subsea installations. It is anticipated that the DSV will be on location for 22 days and the CSV will be on location for 11 days.

All pipelines associated with each wellhead and protection structure will be flushed and disconnected/water gapped before any removal activities take place. This work will be consented via the appropriate environmental permits and consents applied for on the UK Energy Portal.

The base case scenario is to remove mud mats providing WHPS stabilisation. If, however, due to the integrity of the mud mats, these cannot be safely removed to shore they will remain in-situ and OPRED will be advised. There is no requirement to remove concrete mattresses or other stabilisation materials in order to remove the protection structures. All concrete mattresses or other stabilisation materials are pipeline based and will therefore be captured in the dedicated Subsea Pipelines DP.

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

Table 1.1: Decommissioning Removal Options

Infrastructure	Proposed Decommissioning Solution	Worst-Case Scenario Assessed
Hewett Subsea Installations (wellheads, xmas trees, WHPS, MTM & PLEM)	Complete removal (ca. 3m below seabed) with the structures transported to an appropriate land-based facility for dismantlement, recycling and disposal. Valves and piping tees contained within both the PLEM and MTM are to be removed along with the structures.	A DSV will be used to facilitate preparatory rigging works, cutting and relocation / wet storing of the structures subsea. For those structures piled to the seabed[2], Eni proposes to cut the piles internally using an abrasive cutting system. If internal pile cutting is not possible, the structures will becut using a subsea diamond wire cutting tool. Small areas of seabed sediment local to the piles may be temporarily displaced to allow structure pile cutting. Explosives will not be used. The wellheads/xmas trees will also be cut approximately 3m below the mudline using either an abrasive cutting system or a rotary cut system. If 3m is not achievable, OPRED will be informed. Once cut and if not recovered immediately the structures, wellheads and xmas trees will be wet stored for recovery. A CSV/DSV will then be used to pick the structures, wellheads and xmas trees up and return them to shore.

[2] Of the eight WHPSs, six are piled and two are integral.

Infrastructure	Proposed Decommissioning Solution	Worst-Case Scenario Assessed
48/30-13 wellhead	Complete removal (ca. 3m below seabed) with the wellhead transported to an appropriate land-based facility for dismantlement, recycling and disposal.	The DSV will be used to cut and remove the temporary abandonment cap on the 48/30-13 E&A well and cut the wellhead approximately 3m below the mudline. An abrasive cutting system or a rotary cut system is likely to be used. The CSV crane will then be used to recover the cut wellhead to surface.

1.3 Baseline Environment

An overview of the key environmental and societal features in the vicinity of the Hewett subsea installations that may be affected by the proposed decommissioning works is provided in Table 1.2. This information has been compiled from a number of published sources as well as data collected during several surveys undertaken in the Hewett Field Area in preparation for the proposed decommissioning work.

Table 1.2: Summary of Environmental and Societal Features in the vicinity of the Hewett Subsea Installations

Feature	Description
Physical Environment	
Location	The Hewett subsea installations are located approximately 22km north-east of the Norfolk coastline and 82km west of the UK/Dutch transboundary line. Nine of the installations (Deborah, Della, Delilah, Little Dotty and the PLEM and MTM) are located in UKCS Block 48/30, with the remaining installation at Dawn located in Block 48/29.
Bathymetry	The seabed across the Hewett subsea installation survey areas ranged from 28.6m to 42.6m in depth to surface to Lowest Astronomical Tide (LAT) and was found to be relatively flat. Meggaripples occurred at each survey area with the greatest height observed at Little Dotty (48/30-9) and the greatest length observed at Deborah and Della & Delilah sites. Sandwaves were observed at all five survey areas with the highest as well as the longest observed at Della & Delilah site.
Seabed Sediments	Seabed sediments observed in the vicinity of the Hewett subsea installations consisted of rippled sand, with varying proportions of shell fragments. Particle size analysis found the sediments to be comprised of fine to coarse sand and total organic matter and total organic carbon content were reported as low. Total hydrocarbon levels recorded across the Hewett Field Area were comparable to the available regional datasets (ranging from 0.8 µg/g to 2.9 µg/g) and were below the OSPAR likely sediment effect threshold level of 50 µg/g. Polycyclic aromatic hydrocarbon levels were also considerably lower than the thresholds where impacts to sediment fauna would be expected. In general, metal concentrations were below the mean background concentrations for the Southern North Sea and the concentrations of bioavailable metals are not expected to result in detrimental effects on sediment macrofaunal communities.
Oceanography	In this region of the Southern North Sea, the tidal front keeps the water column permanently vertically mixed and there is little variation between surface and bottom temperatures, as well as the annual mean temperatures (approximately 10ºC). The annual mean significant wave height is 1.2m and the significant wave height exceeds 4m for 1.3% of the time.
Meteorology	Wind speeds range from 1–11 m/s in the summer months and 14-32 m/s in the winter months. The predominant wind direction is from south and north-west.
Biological Sensitivities	
Marine Protected Areas (MPAs)	All Hewett subsea installations apart from Dawn are located within the Southern North Sea Special Area of Conservation (SAC), designated for the protection of harbour porpoise. The following five MPAs are also located within 40km of the Hewett subsea installations (distances in brackets is to the closest structure): Haisborough, Hammond and Winterton SAC (0.9km), North Norfolk Sandbanks and Saturn Reef SAC (3.5km), Greater Wash Special Protection Area (SPA) (13.7km), Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ) (23km) and The Wash and North Norfolk Coast SAC (37.1km). The qualifying features of two other MPAs may also be impacted by the project, Humber Estuary SAC (100km) and Outer Thames Estuary SPA (41km).
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. The phytoplankton community is dominated by the dinoflagellate genus

Feature	Description
	Tripos (*T. fusus, T. furca, T. lineatus*), along with high numbers of the diatom, *Chaetoceros*. The zooplankton community in the North Sea is dominated by calanoid copepods, although other groups such as Paracalanus and pseudocalanus are also abundant.
Benthic Fauna	Benthos describes the organisms that live within and on the seabed. Benthic organisms can be classified further into infauna, organisms that live within the sediment, and epifauna, organisms that live on top of the seabed. The 'circalittoral coarse sediment' habitat surrounding the Hewett subsea installations may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves. The following species have all been observed within the Hewett subsea installations survey areas: crabs, lobster, brittle stars, starfish, anemones, hydroids, bryozan, *S. spinulosa*, *Polychaeta*. The infaunal community is largely dominated by annelids and arthropods. *S. spinulosa* reef is listed as an Annex I habitat under the Habitats Directive (Council Directive 92/43/EEC) and a UK Biodiversity Action Plan (BAP) priority marine habitat. From the video and geophysical data collected during the pre-decommissioning environmental baseline survey, *S. spinulosa* classified as 'Medium Reef' was identified 250m north-north east of the Little Dotty (48/30-15z) well and about 1km east of Della & Dellilah well cluster. 'Medium Reef' *S. spinulosa* was also recorded approximately 50m south-south east of the Little Dotty (48/30-15z) well during a separate borehole survey. A 'Low Reef' classification was also given to several areas based on data collected during both the pre-decommissioning survey and borehole survey. At their closest points, 'Low' reefs were found approximately 50m south-west of Little Dotty (48/30-15z) well, 532m south east of the Dawn well, 745m east of the Deborah well cluster, 800m east of the Della & Delilah well cluster and the PLEM, 245m, 270 m south west of the MTM and 250m north west and north east of Little Dotty (48/30-9) well. Further areas were identified as 'not a reef'; however, due to the mobile sands of the Hewett Field Area it was not possible to rule out the potential for *S. spinulosa* in locations where it was not observed during video photography. Certain patches were therefore reclassified from 'not a reef' to 'no emergent *Sabellaria*'. This includes patches approximately 43m east of Little Dotty (48/30-9), 41m north east of Deborah (48/30-10), 53m south east of Deborah (48/30-14) and 44m east of Della (48/30-11).
Fish	A number of fish species are likely to be present within the vicinity of the Hewett subsea installations. Fish species observed during the Hewett pre-decommissioning surveys include: common dragonet, pogge, dab, juvenile gadoid fish, sandeels, sole, yellow sole, mackerel, gobies and butterfish. Fish species spawning within the area include: herring, mackerel, sprat, whiting, cod, plaice, sole, lemon sole, sandeel and thornback ray. All of these fish also have nursery sites in the area, apart from sprat and sole. In addition, the Hewett subsea installations are in an area of low probability of 0 group fish (defined as fish in the first year of their lives and can also be classified as juvenile) for herring, horse mackerel, sprat and whiting, and moderate probability for anglerfish, blue whiting, cod, haddock, hake, mackerel, Norway pout, plaice and sole.
Seabirds	The Hewett subsea installations lie adjacent to several SPAs on the Norfolk coastline, which have been designated for the protection of breeding colonies of seabirds. Given the proximity to the coastline, the Hewett subsea installations lie within the maximum breeding foraging ranges of most seabird species. The most abundant species likely to be present in the vicinity of the subsea installations are fulmar, kittiwake and

Feature	Description
	guillemot in the breeding season, kittiwake, great black-backed gull, guillemot and razorbill over winter and guillemot in the post-breeding dispersal period. However, an ornithological boat based survey undertaken in July 2021 (RSK Biocensus) confirmed no birds were nesting on the Hewett field platforms. Seabird sensitivity to oil pollution within Blocks 48/29 and 48/30 is extremely high in January and February, very high in December, high in March, April and October, and medium to low from May to September.
Marine Mammals	A number of cetacean species have the potential to be in the vicinity of the Hewett subsea installations, including harbour porpoise, white-beaked dolphin and minke whale, although white-sided dolphin and common dolphin are also known to be present in the central North Sea. Harbour porpoise are the most abundant of these species. Seasonal sightings data indicates that low densities of white-beaked dolphin have been observed in May and low densities of harbour porpoise have been observed in March, May, June, August, September and December. In addition, both harbour seals and grey seals have been sighted throughout the year along the Norfolk coast, but their at-sea density is low in the vicinity of the Hewett subsea installations.
Societal Aspects	
Fisheries	The Hewett subsea installations are located within ICES Rectangle 35F1. Commercial fishing within the Hewett Field is undertaken by vessels from a number of EU states deploying a range of gear types. Fishing effort within ICES Rectangle 35F1 is generally low, with less than 100 days fished per year, with peak effort during the summer months (2010 to 2014). The dominant gear type was beam trawls and landings data shows a dominance of demersal flatfish species such as plaice, sole, turbot and dab. Data shows that fishing pressure throughout the Hewett Field Area is generally low with an average of 0 to 73 hours of fishing per year between 2009 and 2017.
Shipping	Shipping density is considered to be very high/high in the vicinity of the Hewett subsea installations. A vessel traffic survey (Xodus, 2021a) identified 25 shipping lanes passing close to the subsea wells.
Oil and Gas Activity	The closest oil and gas facilities are associated with the Perenco operated Leman Field located to the north-west approximately 26km.
Offshore Renewables	The nearest wind farm areas are the active Dudgeon and Sheringham Shoal wind farms located to the northwest, approximately 20km and 32km away respectively.
Military activities	There is a military Practice and Exercise area (PEXA) situated approximately 60km to the north, which is used by the Royal Air Force (RAF).
Wrecks	A total of eight known shipwrecks are located within the Hewett Field Area, but none are protected. No wrecks were observed during the pre-decommissioning survey.
Cables	The 'STRATOS 1' telecommunication cable is situated approximately 9 km west of Dawn 48/29-9 subsea well which runs from north-east to south-west.
Aggregate and Dredging Activity	There are no licensed offshore aggregate areas, dredging areas or known dumping areas in the vicinity of the Hewett subsea installations. The closest is 'Humber 3' Aggregate Production Area located approximately 50km.

1.4 Impact Assessment

1.4.1 Environmental Impact Identification

Potential environmental and societal impacts arising from the proposed Hewett Subsea Installations DP were initially determined through an Environmental Impact Identification (ENVID) workshop held on 27th April 2021. The workshop was attended by the following representatives from Eni: Environmental Advisor, Environmental Engineer, Pipelines Decommissioning Specialist, HSE Coordinator and Project Engineer.

The ENVID identified that no planned activities or unplanned events have the potential to result in significant effects on the marine environment, with embedded mitigation measures in place. However, for completeness it was recommended that the following aspects be subject to further assessment as these are likely to have the greatest impact on the marine environment from a Project perspective:

- Seabed disturbance from:
  - Excavation of piles;
  - Abrasive cutting discharge (i.e. garnet);
  - Removal of subsea installations, and mud mats, if present, including disturbance from wet storage.
- Underwater noise emissions from:
  - Use of propellers / DP thrusters on vessels;
  - Use of cutting tools;
  - Use of mass flow excavator (propeller noise).
  -

In addition, as the subsea installations are located within or in close proximity to a number of MPAs, an assessment was undertaken to determine whether there are likely to be any significant effects on the conservation objectives of these MPAs as a result of the Hewett Subsea Installations DP, either alone or in-combination with other plans or projects.

A summary of the results of the comprehensive assessment is provided in Section 1.4.1. A justification as to why the other aspects were scoped out of further assessment is provided in Table 1.3.

Table 1.3: Justification for Aspects Scoped out from Further Assessment

Aspect	Justification
Physical Presence	The DP vessels (DSV and CSV) required for the proposed removal options will be present on location within the 500m safety exclusion zones surrounding the Hewett subsea installations, which are clearly marked on navigation charts and have been in place for a number of years.
Energy Use and Atmospheric Emissions	Atmospheric emissions will be produced during the proposed 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 met-ocean 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 used during the decommissioning work will include grey water (domestic waste water), black water (sewage), macerated food waste, rainwater run-off from deck and ballast water. Given the hydrographic regime in the area these discharges will rapidly disperse. All vessels will comply with the requirements of the MARPOL convention and the International Maritime Organisation Ballast Water Management Convention. Any impact to the marine environment is therefore considered to be negligible.
Waste Management	The impacts of waste management are largely onshore and therefore outside the scope of the EA. Offshore, all vessels will be compliant with MARPOL and will have waste management plans in place that adhere to the waste hierarchy principle of reduce, reuse recycle. As such, there be no significant impact to the marine environment.
Accidental Events	Prior to the proposed decommissioning activities commencing, the subsea wells will be plugged and abandoned. 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. Diesel is a light oil, containing a large percentage of light and volatile compounds and, once spilt, is likely to remain on the sea surface and be subject to high rates of evaporation. It is not expected to persist for a prolonged period of time and therefore significant impacts are not anticipated. This risk from dropped objects is not considered to be significant as industry-standard dropped object procedures will be employed and debris clearance surveys will be conducted post-decommissioning. Removal of the Hewett subsea installations will require the use of subsea hydraulic cutting tools that could fail and result in a release of a small number of litres of hydraulic fluid. 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. The risk to the marine environment is therefore low.

1.4.2 Summary of Assessment Results

1.4.2.1 Seabed Disturbance

It is estimated that the total area of seabed likely to be temporary disturbed by the proposed decommissioning activities is ca. 12,259 m^2 (0.012 km^2).

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

Of note is that aggregations of *S. spinulosa* biogenic reef were identified in the vicinity of all of the subsea installations, during the pre-decommissioning environmental survey and the separate borehole survey. Research has shown that *S. spinulosa* has a limited tolerance to the direct physical impact, with recovery not expected for an extended period of time. At their closest points, 'Medium Reef' and 'Low Reef' were identified approximately 50m south west from the Little Dotty (48/30-15z) well. 'Medium Reef' was also identified 250m north-north east of the Little Dotty (48/30-15z) well and about 1 km east of Della & Dellilah well cluster and the PLEM. 'Low' reefs were also found 532m south east of the Dawn well, 745m east of the Deborah well cluster, 800m east of the Della & Delilah well cluster and the PLEM, 245m, 270m south west of the MTM and 250m

north west and north east of Little Dotty (48/30-9) well. Further areas were identified as 'not a reef', but due to the mobile sands of the Hewett Field Area it was not possible to rule out the potential for *S. spinulosa* in locations where it was not observed during video photography. Certain patches were therefore reclassified from 'not a reef' to 'no emergent *Sabellaria*'. This includes patches approximately 43m east of Little Dotty (48/30-9), 41m north east of Deborah (48/30-10), 53m south east of Deborah (48/30-14) and 44m east of Della (48/30-11). However, due to the distance of the operations from the identified *S. spinulosa* aggregations, direct physical impact as a result of the decommissioning activities is not expected.

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 subsea installations are 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.

Some demersal spawning fish may be temporarily displaced due to the proposed decommissioning activities, however there are suitable spawning grounds in similar sediments nearby. The spawning grounds for herring and sandeel in the vicinity of the Hewett Field Area are not considered to be critical spawning habitat for these species. Given the nature of the operations, any displacement of fish will be highly localised and of short duration.

In summary, based on the nature of the seabed habitats and species present in the vicinity of the subsea installations, the comparatively small area of seabed that will be impacted by the proposed decommissioning activities and the fact that no identified areas of potential *S. spinulosa* reef will be subject to direct physical impact, residual effects on seabed communities and fish spawning and nursery grounds are predicted to be Minor and not significant.

1.4.2.2 Underwater Noise Emissions

Vessel operations (in particular the use of dynamic positioning systems) and the use of underwater cutting tools have been identified as the primary sources of underwater noise that could potentially arise from the subsea installations decommissioning activities.

There is potential for fish to be disturbed by the underwater noise emissions generated during the decommissioning activities, 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, although both species spawn in the vicinity of the subsea installations, 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 high volume of vessel traffic and, as such, it is anticipated that the additional underwater noise generated by the planned vessels and use of cutting tools is likely to be insignificant.

The underwater noise emissions generated during the proposed 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. 1.6 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 Hewett decommissioning activities would result in injury or significant disturbance to marine fauna. Although there is potential for some behavioural disturbance, any impacts will be localised and temporary. Residual effects are therefore predicted to Minor and not significant.

1.4.2.3 Cumulative Impacts

Cumulative impacts may arise from incremental changes caused by other past, present or reasonably foreseeable projects/proposals together with the proposed Hewett subsea installation decommissioning activities. Ongoing industrial activities located closest to the Hewett Field Area include the Perenco operated Leman Field located approximately 26km to the north-west, the 'Humber 3' Aggregate Production Area located approximately 50km to the north east and the Dudgeon and Sherinham Shoal operational wind farms (both operated by Equinor) located approximately 20km and 32km north west of the Dawn 48/29-9 subsea well respectively. In addition, the Sheringham and Dudgeon extension project is expected to submit an application in Q2 2022 and could be in construction within the timescales of the Hewett decommissioning work. Construction may also be ongoing at the proposed Norfolk Vanguard and the Norfolk Boreas offshore windfarms. Discussions with IOG have also identified that development activities associated with the Vulcan Satellites Hub Project, located 12km north west of the Hewett Field Area, are ongoing with first gas planned for late Q3 2021. However, given the distances between the Hewett Field Area and these activities and projects and the fact that any impacts arising from the proposed Hewett decommissioning operations will be localised, no significant cumulative effects on marine receptors are predicted.

1.4.2.4 Transboundary Impacts

The Hewett subsea installations are located approximately 82km west of the UK/Dutch transboundary line at their closest point. 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, Eni will ensure regulations governing transfrontier shipment of waste are complied with.

1.4.2.5 Marine Protected Areas

Of note is that all the Hewett subsea installations, with the exception of the Dawn (48/29-9) subsea well, are located within the boundary of the Southern North Sea SAC designated for the protection of harbour porpoise. The underwater noise emissions generated during the proposed decommissioning activities have the potential to cause disturbance to harbour porpoise out to a distance of ca. 1.6km from the noise source, equivalent to an area of ca. 8km^2. This equates to ca. 0.02% of the Southern North Sea SAC total area. It has been calculated that less than three individuals may be temporarily disturbed within this area, which is equivalent to 0.0013% 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 Hewett Field Area whilst the decommissioning activities are ongoing. In addition, it is assumed that any potential effects on harbour porpoise prey species (specifically sandeels, herring, mackerel, cod and whiting) from underwater noise would be the same or less than those for harbour porpoise. Therefore, in view of the conservation objectives of the SAC, no LSE on the Southern North Sea SAC are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

A further five MPAs are located within 40km of the installations, namely Haisborough, Hammond and Winterton SAC, North Norfolk Sandbanks and Saturn Reef SAC, Greater Wash SPA, Cromer Shoal Chalk Beds MCZ and The Wash and North Norfolk Coast SAC. Two additional MPAs, the Humber Estuary SAC and Outer Thames Estuary SPA, have also been screened into the assessment as one or more of the qualifying features of these sites has the potential to be impacted by the proposed decommissioning activities. However, the EA has concluded that there will not be any likely significant effects on the conservation objectives of these MPAs as a result of the proposed Hewett decommissioning activities, either alone or in-combination with other plans or projects. This is primarily due to distance between the sites and the Hewett Field Area (the closest being the Haisborough, Hammond and Winterton SAC, approximately 0.9km from 48/30-9), the scheduling of the

proposed operations and the fact that any impacts arising from emissions and discharges are predicted to be highly localised and temporary.

1.4.3 Mitigation Measures

The mitigation measures Eni will adopt for the Hewett Subsea Installations DP to ensure any potential environmental or societal impacts are minimised, as far as practical, are summarised in Table 1.4.

Table 1.4: Mitigation Measures

Physical Presence
• Notifications will be made to regular users of the area via fisheries notices, Notices to Mariners and NAVTEX/NAVAREA warnings. • Operations will be planned to minimise the number of boat movement, as far as reasonably practicable. • The timing of the removal works is targeted to occur between April and September, which avoids the period when large aggregations of overwintering red-throated diver and common scoter are present within the Greater Wash SPA and Outer Thames Estuary SPA; • Restricting, to the extent possible, vessel movements within the Greater Wash SPA and Outer Thames Estuary SPA to existing navigation routes when transiting to / from the Hewett Field Area; • Following marine best practices, such as avoiding over-revving of engines; • Briefing vessel crew on the purpose and implications of vessel management practices within the Greater Wash SPA and Outer Thames Estuary SPA.
Seabed Disturbance
• Piles will be cut internally, if possible, to avoid seabed disturbance. • Tool use will be minimised where feasible whilst still achieving the desired result. • Working areas will be minimised, as far as practicable. • In advance of the removal operations commencing, Eni will survey (via MBES and GVI) any area where it is proposed to land an item on the seabed to confirm it is clear of debris or obvious surface features that could be damaged. If the area is deemed not to be suitbale, a new area would be selected accordingly. • Eni intends to remove the subsea installations immediately following cutting, where appropriate, preventing the need for any items to be wet stored.
Underwater Noise Emissions
• Operations will be planned to reduce vessel movements and minimise the overall duration of the project. • Internal cutting techniques will be utilised where possible, which do not produce any significant noise emissions. • Where internal cuts are not possible, the preference for external cuts will be mechanical methods because they produce significantly less noise than of abrasive methods. • No use of explosives.
Energy Use and Atmospheric Emissions
• Vessel time in the field will be reduced, as far as practicable. • Eni'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
• Any waste water discharged to sea from vessels will be treated to comply with the requirements of the MARPOL Convention. • Vessels will operate in compliance with the International Maritime Organisation Ballast Water Management Convention.
Waste Management
• A Materials Inventory has been developed for the Project to identify the types of waste generated and the management procedures for each waste stream will be included in the contractor's Waste Management Plan. The principles of the Waste Management Hierarchy will be followed. • Good housekeeping standards will be maintained on board all vessels in accordance with the contractor waste management strategy. • Transfer notes will accompany all non-hazardous waste to shore and consignment notes will be in place for any hazardous waste. • Checks will be carried out on the selected waste yard to ensure all permits and licenses are in place for the handling and disposal of the waste types identified. Eni will ensure that waste is transferred by an appropriately-licensed carrier who should have a Waste Carrier Registration, Waste Management Licence or Exemption, as appropriate for the type of waste. • The amount of NORM Waste is unknown at this time, however there remains a possibility that it will be present during decommissioning activities. Eni will ensure appropriate RSR permits are in place and conditions that dictate the management and control of radioactive waste are met. • Marine growth, if found, will be removed onshore at the waste yard will be done with appropriate odour control implemented through an odour management plan and will be disposed of in accordance with the principles of the Waste Management Hierarchy.
Accidental Events
• Shipping and fishing bodies will be kept informed of the project and appropriate notifications made in a timely manner. • Vessels selected to undertake the decommissioning activities will have effective operational systems and on board control measures. • Dropped object procedures 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. • Appropriate maintenance and pre-use checks on hydraulic equipment 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. • All vessels undertaking decommissioning activities will have an approved SOPEP.

1.5 Conclusions

The EA has confirmed that the Hewett Subsea Installations DP can be executed with no significant adverse effects on the marine environment.

Comprehensive identification of potential impacts from the Hewett Subsea Installations DP to environmental and societal receptors was achieved through an ENVID workshop. The ENVID identified that no planned activities or unplanned events have the potential to result in significant effects on the marine environment, with embedded mitigation measures in place. However, for completeness it was recommended that activities resulting in seabed disturbance and underwater noise emissions be subject to further assessment as these are likely to have the greatest impact on the marine environment from a Project perspective, which could be

reduced via additional mitigation. Following further assessment and upon implementation of the identified mitigation measures, it has been concluded that all residual effects from these aspects are Minor and not significant, with the majority of impacts being localised and temporary in nature.

Of note is that all the Hewett subsea installations, with the exception of the Dawn (48/29-9) subsea well are located within the boundary of the Southern North Sea SAC. A further five MPAs are also located within 40km of the installations. Two additional MPAs, Humber Estuary SAC and Outer Thames Estuary SPA, were also been screened into the assessment as one or more of the qualifying features of these sites has the potential to be impacted by the proposed decommissioning activities. However, the EA has concluded that there will not be any likely significant effects on the conservation objectives of these MPAs as a result of the proposed Hewett decommissioning activities, either alone or in-combination with other plans or projects.

Eni operates under a HSE IMS, certified to ISO14001:2015 and has established contractor selection and management procedures. Eni will develop an interface document for the Project when a removals contractor is appointed to help ensure the mitigation measures identified in this EA report are successfully implemented during the proposed decommissioning activities.

2.0 INTRODUCTION

2.1 Background

Eni UK Limited (hereafter referred to as 'Eni') is Operator of the Hewett Gas Field located in United Kingdom Continental Shelf (UKCS) Blocks 48/28a, 48/30a, 48/29a, 52/4a and 52/5a in the Southern North Sea. The Hewett Gas Field, which commenced production in 1968, is coming to the end of its productive time and is in the process of being decommissioned.

The Hewett field area contains the main Hewett field, consisting of five horizons vertically situated above each other, and six adjacent satellite fields: Big Dotty, Little Dotty, Deborah, Dawn, Della, and Delilah (see Figure 2.1).

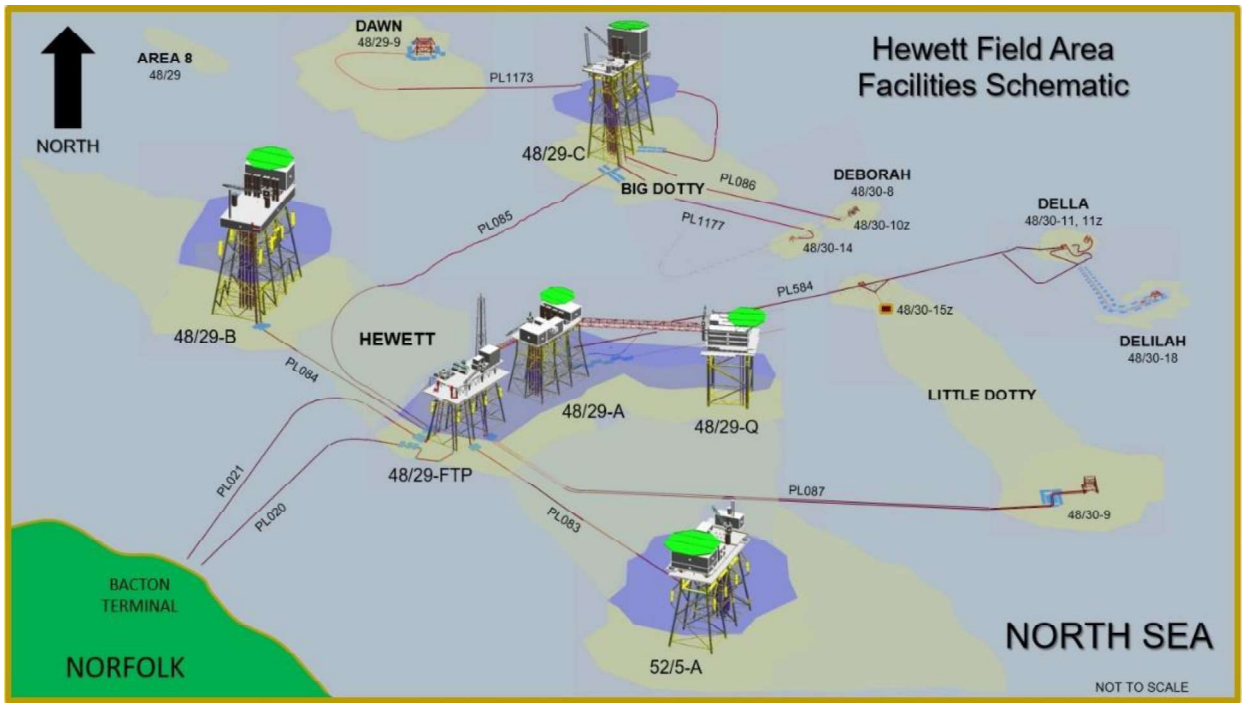


Figure 2.1: Hewett Field Area Facilities Schematic

Eni as Operator of the Hewett Gas Field and on behalf of the Section 29 notice holders[3] is now applying to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to obtain approval for the removal of the Hewett subsea installations, in accordance with the Petroleum Act 1998. This includes removal of the wellheads, xmas trees, wellhead protection structures and subsea manifold protection structures associated with the Deborah, Little Dotty, Dawn, Della and Delilah Fields located within Blocks 48/29 and 48/30, approximately 22km north-east of the Norfolk coast and 82km west of the UK/Dutch transboundary line (see Figure 1.1).

The Deborah Field is accessed via three subsea wells tied back to the 48/29-C Platform. Little Dotty is accessed by two subsea wells, one tied back to the 48/29-FTP Platform and the other tied back to 48/29-A Platform via a tee into the Della flowline. Dawn is accessed via one subsea well tied back to the 48/29-C Platform, and Della and Delilah are each accessed via one subsea well tied back to the 48/29-A Complex.

A summary of the Hewett subsea installations to be removed is provided in Table 2.1.

[3] Chrysaor Petroleum Company U.K. Limited (0% equity), Eni Hewett Limited (0%), Eni LNS Limited (0%), Eni UK Limited (89.3133%) and Perenco Gas (UK) Limited (10.68667%).

Table 2.1: Hewett Area Subsea Installations Being Decommissioned

Fields	Deborah, Little Dotty, Dawn, Della and Delilah	**Production Type**	Gas / Condensate
Water Depth (m)	33.0 – 38.0	**UKCS Blocks**	48/29 and 48/30
Distance to Median Line (km)	82	**Distance to UK Coastline (km)**	22
Wellheads, Xmas trees and Wellhead Protection Structures	8	**Manifold Protection Structures**	2

2.2 Scope and Purpose of the Environmental Appraisal

This Environmental Appraisal (EA) report has been written by Eni to support the Hewett Area Subsea Installations DPs and has been prepared in accordance with 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 Hewett subsea installations and demonstrate the extent to which these impacts will be mitigated and controlled to an acceptable level.

Well plug and abandonment (P&A) activities, flushing and cleaning of associated pipelines/umbilicals and disconnection of pipelines tie-in spool pieces undertaken as part of the preparatory work preceding the removal of the subsea installations are outside the scope of this EA and will be consented under appropriate environmental permits and consents. Decommissioning of the subsea pipelines and umbilicals associated with the Hewett Gas Field is also outside the scope of this EA and will be addressed in a separate DP and EA report.

2.3 Overview of Hewett Area Subsea Installations

The Hewett subsea installations to be decommissioned comprises:

- 8 x wellheads[4], xmas trees and Subsea Wellhead Protection Structures (WHPS) associated with the following wells:
    1. Dawn Subsea Well 48/29-9;
    2. Deborah Subsea Well 48/30-8;
    3. Deborah Subsea Well 48/30-10;
    4. Deborah Subsea Well 48/30-14;
    5. Little Dotty Subsea Well 48/30-9;
    6. Little Dotty Subsea Well 48/30-15z;
    7. Delilah Subsea Well 48/30-18; and
    8. Della Subsea Well 48/30-11z;

    Off the eight WHPS, six are piled and two are integral.

    2 x Subsea Manifold Protection Structures:
    1. Midline Termination Module (MTM); and
    2. Pipeline End Manifold (PLEM).

[4] CoP applications have been approved for each of the eight subsea wells listed above.

Valves and piping tees contained within both the PLEM and MTM are to be removed along with the structures.

In addition, although not classified as a subsea installation, as part the subsea installation decommissioning campaign, Eni proposes to remove the wellhead on the previously abandoned 48/30-13 exploration and appraisal (E&A) well, located approximately 7m from the Deborah 48/30-8 subsea well. For completeness this work has been included in the scope of this EA report.

The intent is to remove any mud mats, if present. None are expected; however, legacy mud mats could exist deeper than 2m providing WHPS stabilisation. If mud mats are discovered, but cannot be safely removed to shore due to integrity issues, Eni proposes to leave them in-situ and will advise OPRED accordingly. There is no requirement to remove any other stabilisation materials in order to remove the protection structures. All other stabilisation materials are pipeline based and will therefore be captured in the dedicated Subsea Pipelines DP.

Table 2.2 gives an overview of the above listed Hewett subsea installations, with a more detailed description of the infrastructure provided below.

Table 2.2: Hewett Area Subsea Installations

Field	Subsea Well	Well Status	Subsea Structure	Weight (tonnes)	Dimensions (m)	Block	Location (WGS84)	Water Depth (m)	Within MPA[1]
Dawn	48/29-9	Shut-in	Wellhead/tree	33.2	-	48/29	53° 05.211'N; 01° 51.087'E	33	No
			WHPS (piled)	27.3	11.0 L x 11.0 W x 4.9 H				
Deborah	48/30-8	Shut-in	Wellhead/tree	26	-	48/30	53° 05.216'N; 01° 51.070'E	38	Yes
			WHPS (piled)	29.3	7.7 L x 7.7 W x 9.8 H				
	48/30-10	Shut-in	Wellhead/tree	35	-		53° 05.216'N; 01° 51.082'E		Yes
			WHPS (piled)	17.5	9.0 L x 12.0 W x 10.7 H				
	48/30-14	Shut-in	Wellhead/tree	33.2	-		53° 05.174'N; 01° 51.017'E		Yes
			WHPS (piled)	28.5	11.5 L x 11.5 W x 5.5 H				
Little Dotty	48/30-9	Shut-in	Wellhead/tree	26	-		53° 05.216'N; 01° 51/.070'E	35	Yes
			WHPS (piled)	20.6	7.7 L x 7.7 W x 7.0 H				
	48/30-15z	Shut-in	Wellhead/tree	32.58	-		53° 02.865'N; 01° 50.780'E	38	Yes
			WHPS (integral)	39.8	8.5 L x 8.5 W x 7.2 H				
Delilah	48/30-18	Shut-in	Wellhead/tree	32.58	-		53° 04.646'N; 01° 53.447'E	38	Yes
			WHPS (integral)	39.8	8.5 L x 8.5 W x 7.2 H				
Della	48/30-11z	Shut-in	Wellhead/tree	35	-			33	Yes

Field	Subsea Well	Well Status	Subsea Structure	Weight (tonnes)	Dimensions (m)	Block	Location (WGS84)	Water Depth (m)	Within MPA[1]
			WHPS (piled)	24.1	13.1 L x 13.1 W x 7.0 H		53º 04.730'N; 01º 53.340'E		
-	-	-	MTM	26.18	11.4 L x 10.9 W x 3.9 H	48/30	53º 02.938'N; 01º 50.568'E	33	Yes
-	-	-	PLEM	26.18	11.4 L x 10.9 W x 3.9 H		53º 04.722'N; 01º 53.312'E	38	Yes
-	48/30-13	Abandoned	Wellhead[2]	27	-		53° 05.216'N; 01° 51.083'E	38	Yes

[1] The subsea installations at Deborah, Little Dotty, Delilah and Della, the MTM and PLEM and the 48/30-13 E&A well are located within the Southern North Sea Special Area of Conservation (SAC), designated for the protection of harbour porpoise (refer to Section 6.2).

[2] As the 48/30-13 E&A well is not connected to an installation there is no regulatory requirement for an approved DP to be in place to remove the wellhead, however, it has been included in this EA report for completeness.

2.3.1 Dawn Subsea Well (48/29-9)

The Dawn Field is accessed via a single slot subsea well (48/29-9) located approximately 7km west by north west of the Hewett 48/29-C Platform in Block 48/29 at a water depth of 33m LAT. The well is tied back to 48/29-C Platform by a 6.3km length 8-inch gas production rigid flowline PL1177. The control of the well and chemical supply (MEG) was via a subsea control umbilical.

The well ceased production in 2010, is shut-in and is protected by a piled open framed steel structure positioned over the wellhead and xmas tree, weighing 27.3 tonnes. The dimensions of the structure are 11m (L) by 11m (W) by 4.9m (H).

2.3.2 Deborah Subsea Wells (48/30-8, 48/30-10 & 48/30-14)

The Deborah Field is accessed via a cluster of three single slot subsea satellite wells (48/30-8, 48/30-10 and 48/30-14) located approximately 6km east of the Hewett 48/29-C Platform in Block 48/30 at a water depth of approximately 38m LAT. The 48/30-8 and 48/30-10 wells are tied back to the 48/29-C Platform by a 5.9km length 10-inch gas production rigid flowline (PL86) and the 48/30-14 well is tied back to the 48/29-C Platform by a 5.8km length 8-inch gas production rigid flowline PL1177.

The control of the wells was via individual subsea control containing a bundle of electrical control cables, hydraulic control cores/hoses as follows:

- 5.9km length electro hydraulic control umbilical PLU4689 U30-8 (well 48/30-8);
- 5.9km length electro hydraulic control umbilical PLU4690 U30-10 (well 48/30-10);
- 6.0km length electro hydraulic control umbilical PLU4688 U30-14 (well 48/30-14).

All three wells are currently shut-in, with each well protected by a piled open framed steel structure positioned over the wellhead and xmas tree, the dimensions and weight of which are as follows:

- 48/30-8 WHPS: 7.7m (L) by 7.7m (W) by 9.8m (H), weighing 29.3 tonnes;
- 48/30-10 WHPS: 9.0m (L) by 12.0m (W) by 10.7m (H), weighing 17.5 tonnes;
- 48/30-14 WHPS: 11.5m (L) by 11.5m (W) by 5.5m (H), weighing 28.5 tonnes.

2.3.3 Little Dotty Subsea Wells (48/30-9 and 48/30-15z)

The Little Dotty Field is accessed via two single slot subsea satellite wells (48/30-9 and 48/30-15z).

The 48/30-9 well is located approximately 6km east by north east of the Hewett 48/29-FTP Platform in Block 48/30 at a water depth of approximately 35m LAT. The well is tied back to 48/29-FTP Platform by a 6.2km length 8-inch gas production rigid flowline (PL87). The chemical supply (MEG) was via 2-inch service pipelines (PL136A/B). The control of the well was via a subsea control umbilical containing a bundle of hydraulic control cores/hoses. The well is currently shut-in and is protected by a piled open framed steel structure positioned over the wellhead and xmas tree. The dimensions of the 48/30-9 WHPS are 7.7m (L) by 7.7m (W) by 7.0m (H) and the structure weighs 20.6 tonnes.

The 48/30-15z well is located approximately 5km north east of the Hewett 48/29-A Platform in Block 48/30 at a water depth of approximately 38m LAT. The production of the subsea well is via an 8 inch flexible gas production flowline (PL1325) connected to the MTM on the 10 inch Della gas production rigid flowline (PL584) where the production is routed onward to the 48/29-A Platform. An umbilical with methanol cores (PL1324.1-3) is connected between the Little Dotty Xmas tree and the MTM structure where it is tied into the PL1323 umbilical. The 48/30-15z xmas tree is protected by an integral protective structure, which weighs 39.8 tonnes, the dimensions of which are 8.5 (L) x 8.5 (W) x 7.2 (H).

2.3.4 Delilah Subsea Well (48/30-18)

The Delilah Field is accessed via a single slot subea well (48/30-18) located approximately 8.6 km southeast of the Hewett 48/29-C Platform in Block 48/30 at a water depth of 38m LAT. Production of the well is via an 8-inch production flowline (PL1629) and umbilical routed to the 48/29-A Platform. The 48/30-18 xmas tree is protected by an integral protective structure, which weighs 39.8 tonnes, the dimensions of which are 8.5 (L) x 8.5 (W) x 7.2 (H).

2.3.5 Della Subsea Well (48/30-11z)

The Della Field is accessed via a single slot subea well (48/30-11z) located approximately 9km north east of the Hewett 48/29-A Platform in Block 48/30 at a water depth of 33m LAT. The production of the well is via the 10-inch Della gas production rigid flowline (PL584) routed to the 48/29-A Platform. The well is tied back to the main pipeline by a 6-inch flexible flowline jumper from the Xmas tree to the PLEM tee where the production is routed onward to the 48/29-A Platform.

The 48/30-11z well is currently shut-in and is protected by a piled open framed steel structure positioned over the wellhead and xmas tree, weighing 24.1 tonnes. The dimensions of the structure are 13.1m (L) by 13.1m (W) by 7.0m (H).

2.3.6 Midline Termination Module (MTM)

The MTM is an open framed steel protection structure positioned over the piping tee and valves which facilitates tie-in of the 8 inch flexible flowline from Little Dotty (PL1325) into the Della 10 inch gas production pipeline (PL584), as well as the control system which includes the hydraulic subsea control module (SCM) and the subsea umbilical termination (SUT) connected to the Little Dotty subsea well via an umbilical jumper. It is supported by mud mats and by four steel piles which are connected to structure with grouted connections. The MTM weighs 26.18 tonnes and has an overall size of 11.4 m (L) x 10.9 m (W) x 3.85 m (H).

2.3.7 Pipeline End Termination Manifold

The PLEM is an open framed steel protection structure positioned over the piping tee and valves which facilitates tie-in of the 6 inch flexible flowline from the Della subsea well and the 8 inch flexible flowline (PL1630) from the Delilah subsea well into the Della 10 inch gas production pipeline (PL584), as well as the control system which includes hydraulic SCM and the SUT connected to Della and Delilah wells via umbilical jumpers. The structure also provides protection for the Della and Delilah venturi flowmeters.

The general arrangement of the PLEM is in most respects identical to that of the MTM structure. It is supported by mud mats and by four steel piles which are connected to structure with grouted connections. The PLEM weighs 26.18 tonnes and has an overall size of 11.4m (L) x 10.9m (W) x 3.85m (H).

3.0 POLICY AND REGULATORY CONTEXT

3.1 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 the Department of Business, Energy and Industrial Strategy (BEIS) and is managed through its regulatory body the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).

The Petroleum Act requires the operator of an offshore installation 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 the infrastructure being decommissioned and the method by which the decommissioning will take place and is supported by an Environmental Appraisal (EA).

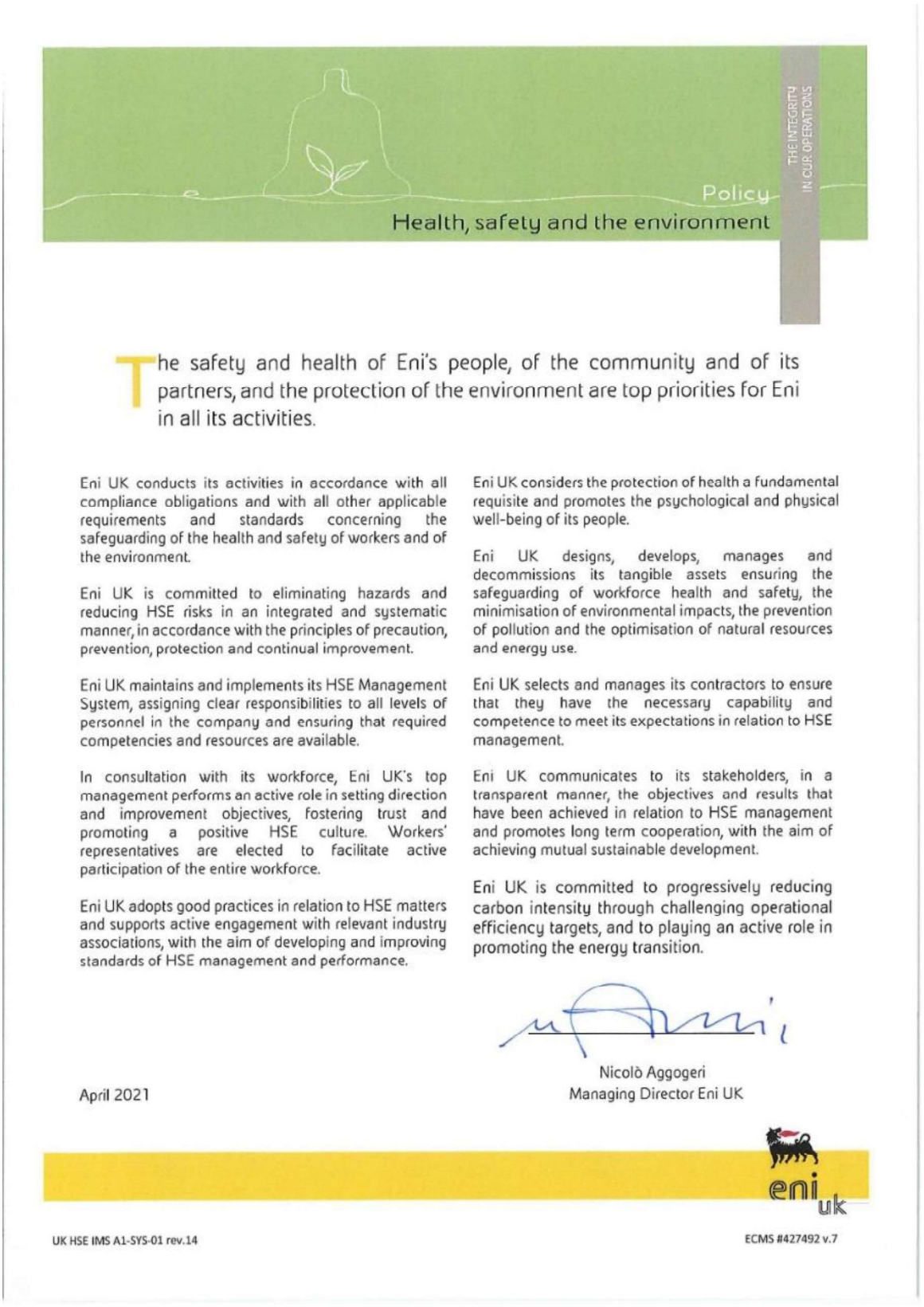
The UK's international obligations on decommissioning are primarily governed by the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (the Oslo Paris (OSPAR) Convention). OPRED is also the competent authority on decommissioning in the UK for OSPAR purposes. OSPAR 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 must be completely removed for re-use, recycling or final disposal on land.

3.2 Marine Planning Policy

The Marine Coastal Access Act 2009 introduced a number of measures to deliver the UK Government's vision of "clean, healthy, safe, productive and biologically diverse oceans and seas", including the introduction of marine plan areas. The Hewett subsea installations lie within the East Offshore Marine Plan area. The plan documents a set of objectives and associated policies which need to be met in order to deliver the Government's vision for the area, Eni considers that the Hewett Area Subsea Installations DP is in broad alignment with the objectives and policies of the East Offshore Marine Plan, as documented in Appendix A.

3.3 Environmental Management

Eni is committed to conducting its activities in a manner that protects people and the environment and is in compliance with applicable regulatory requirements. The Eni UK Health, Safety and Environmental (HSE) Policy shown in Figure 3.1, supported by the Corporate Major Accident Prevention Policy (CMAPP) and Integrated Management System (HSE IMS), sets out guiding principles and mechanisms for managing HSE risks, impacts and compliance. Eni's HSE IMS is certified to ISO 14001: 2015. As part of HSE IMS, Sustainability and Biodiversity and Ecosystem Services (BES) Policies, Eni applies a Mitigation Hierarchy framework combined with precautionary principle and stakeholder engagement, to reduce the risks of decommissioning. This reflects Eni's commitment towards continuous improvement of BES management performance towards no net loss and net gain of biodiversity, to follow the currently employed industry guidance and best practice as well as search for scientific solutions into novel mitigation and innovation technologies.



Policy

Health, safety and the environment

THE INTEGRITY IN OUR OPERATIONS

The safety and health of Eni's people, of the community and of its partners, and the protection of the environment are top priorities for Eni in all its activities.

Eni UK conducts its activities in accordance with all compliance obligations and with all other applicable requirements and standards concerning the safeguarding of the health and safety of workers and of the environment.

Eni UK is committed to eliminating hazards and reducing HSE risks in an integrated and systematic manner, in accordance with the principles of precaution, prevention, protection and continual improvement.

Eni UK maintains and implements its HSE Management System, assigning clear responsibilities to all levels of personnel in the company and ensuring that required competencies and resources are available.

In consultation with its workforce, Eni UK's top management performs an active role in setting direction and improvement objectives, fostering trust and promoting a positive HSE culture. Workers' representatives are elected to facilitate active participation of the entire workforce.

Eni UK adopts good practices in relation to HSE matters and supports active engagement with relevant industry associations, with the aim of developing and improving standards of HSE management and performance.

Eni UK considers the protection of health a fundamental requisite and promotes the psychological and physical well-being of its people.

Eni UK designs, develops, manages and decommissions its tangible assets ensuring the safeguarding of workforce health and safety, the minimisation of environmental impacts, the prevention of pollution and the optimisation of natural resources and energy use.

Eni UK selects and manages its contractors to ensure that they have the necessary capability and competence to meet its expectations in relation to HSE management.

Eni UK communicates to its stakeholders, in a transparent manner, the objectives and results that have been achieved in relation to HSE management and promotes long term cooperation, with the aim of achieving mutual sustainable development.

Eni UK is committed to progressively reducing carbon intensity through challenging operational efficiency targets, and to playing an active role in promoting the energy transition.

Nicolò Aggogeri
Managing Director Eni UK

April 2021

UK HSE IMS A1-SYS-01 rev.14

ECMS #427492 v.7

Figure 3.1: Eni HSE Policy

4.0 STAKEHOLDER CONSULTATION

A dialogue with stakeholders on decommissioning the Hewett Gas Field has continued since October 2017 to allow early recognition and implementation of recommendations. Table 4.1 provides a summary of the feedback received during the wider Hewett decommissioning informal consultations held to date which is of relevance to the Hewett Area Subsea Installations DP.

Meetings to discuss decommissioning of the Hewett Area Subsea installations were held with OPRED Environmental Management Team (EMT) on 21st May 2021 and with the Joint Nature Conservation Committee (JNCC) and Natural England (NE) on 10th June 2021. No additional recommendations in relation to this EA Report were made over and above those already noted in Table 4.1.

The Hewett Are Subsea Installations DP provides further information on planned and completed stakeholder engagement.

Table 4.1: Hewett Stakeholder Engagement

Stakeholder	Discussion Topics / Recommendations	Eni's Response / Comments Noted	Addressed in EA
OPRED EMT	October 2017: 1. Pre-decommissioning Environmental Baseline Seabed Survey design (incl. subsea wells locations): engage Natural England. April 2019: 2. EA Scope: proportionate to the size of the project and assessment of the worst-case scenarios. 3. Conservation Objectives and integrity of the MPAs sites within Hewett Field, specifically for SNS SAC harbour porpoise and the potential impacts on prey availability to be assessed. 4. *Sabellaria spinulosa* presence summarising various surveys undertaken by Eni to be presented. 5. Engage other Operators for cumulative impacts and assess any potential for synergies. May 2021: 6. Shared Subsea Infrastructures ENVID results and engaged on EA. No comments were received.	1. Eni has engaged with NE. 2. Worst- case scenarios have been assessed. 3. The EA report has been written to facilitate the competent authority undertaking a Habitat Regulations Assessment. 4. Addressed by the relevant maps within this EA which are based on two survey efforts to map *Sabellaria spinulosa* presence. 5. Eni contacted Perenco, Chrysaor, INEOS and IOG to establish their approach to developing other EAs and to obtain advice on lessons learned. 6. N/A.	1. See feedback received from NE below 2. Sections 7 - 9 3. Section 9 4. Sections 6.1 & 6.4.2 5. Section 8.3 6. N/A

Stakeholder	Discussion Topics / Recommendations	Eni's Response / Comments Noted	Addressed in EA
JNCC	October 2017: 1. Pre-decommissioning Environmental Baseline Seabed Survey design (incl. subsea wells locations): reference stations, *Sabellaria spinulosa* 'reefinness' assessments guidance and survey to have 100% coverage. Engage Natural England. April 2019: 2. Southern North Sea SAC: consideration to be given to updated Conservation Objectives, specifically noise potential effects on supporting habitats and availability of prey and in-combination effects with other projects (spatial and temporal). For noise levels recommendation to use the newest NOAA 2016/2018 study or Southall *et al.* 2019. 3. Minimise the introduction of new hard substrate materials to the seabed and consideration given to materials that can be removed. June 2021: 4. Shared Subsea Infrastructures ENVID results and engaged on EA. No comments were received.	1. Survey design amended and survey completed according to advice provided. Eni engaged Natural England. 2. Addressed in the relevant sections of this EA. 3. Hewett subsea installations are to be removed. No new hard substrate materials will be deposited. 4. N/A.	1. Section 6.1 and feedback received from NE below 2. Sections 6.2, 8.2.3 & 9.1 3. Section 5.3 4. N/A

Stakeholder	Discussion Topics / Recommendations	Eni's Response / Comments Noted	Addressed in EA
NE	December 2017: 1. Pre-decommissioning Environmental Baseline Seabed Survey design (incl. subsea wells locations): reference stations selection in similar sediment type and in the similar water depth. 2. Minimise the introduction of new hard substrate materials to the seabed and consideration given to materials that can be removed. June 2021: 3. Shared Subsea Infrastructures ENVID results and engaged on EA. No comments were received.	1. Survey design amended and survey completed according to advice provided. 2. Hewett subsea installations are to be removed. No new hard substrate materials will be deposited. 3. N/A.	1. Section 6.1 2. Section 5.3 3. N/A
Environment Agency (EA)	August 2018: 1. Marine Growth advice if brought onshore. 2. Transfortier Shipment of Waste process.	1. Eni will follow the regulations and requirements. 2. Eni will follow the regulations and requirements.	1. Section 5.4 2. Section 5.4
National Federation of Fishermen's Organisations (NFFO)	April 2018: 1. Pre-decommissioning Environmental Baseline Seabed Survey design (incl. subsea wells locations) and FLO arrangements. 2. Fishing activity on Hewett field – reach out to the MMO and Inshore Fisheries Conservation Authority (IFCA). 3. Overtrawlability versus pre-clearance ROV survey and debris clearance. Support the use of guard vessels. October 2021: 4. Advised that due to the mobile commercial fishing activity in the area an overtrawl survey is carried out over the full 500m zones, which subject to no snagging hazards being	1. FLO arrangements implemented for the duration of the survey. 2. Eni obtained fish landings data from the MMO. 3. The use of guard vessels for decommissioning of the subsea structures is not considered necessary. 4. DP has been updated to reflect this survey. ENI has engaged with NFFO for scope details and estimated cost. Note: the proposed method for clear seabed validation is through non-intrusive methodologies such as Side Scan Sonar /	1. N/A 2. Section 5.3 and Section 6.5.1 3. N/A 4. N/A

Stakeholder	Discussion Topics / Recommendations	Eni's Response / Comments Noted	Addressed in EA
	encountered, the NFFO will issue a clean seabed certification.	ROV. If non-intrusive methods are deemed inconclusive during verification alternative methods will be discussed and agreed with OPRED.	
Scottish Fishermen's Federation (SFF)	June 2018: 1. SFF indicated that all aspects of the Hewett decommissioning should be discussed with NFFO. 2. Consider undertaking Fishing Intensity Study in the wider Hewett area via NFFO. October 2021: 3. ENI has discussed the proposed Subsea Installations Removal DP. SFF indicated that due to Hewett location SFF are content for the NFFO to provide any appropriate feedback	1. Eni engaged with NFFO 2. Fisheries Interaction Risk Assessment completed for the Pipelines CA. The results have been incorporated in this EA report. 3. Eni engaged with SFF and thanked them for the immediate reply.	1. See row above 2. Section 6.5.1 3. N/A

5.0 DECOMMISSIONING ACTIVITIES

5.1 Proposed Decommissioning Strategy

Eni is proposing to completely remove eight Hewett subsea wellheads, xmas trees and wellhead protection structures and two subsea manifold protection structures and recover them to shore as described in Table 5.1. In addition, as part of the Hewett subsea installations campaign, Eni proposes to remove the temporary abandonment cap on the previously abandoned 48/30-13 E&A well, cut the wellhead approximately 3m below the mudline and recover the cut wellhead to surface. Further detail on the proposed removal activities is provided in Section 5.3.

Table 5.1: Subsea installations Decommissioning Information

Installation / Feature	Proposed Decommissioning Solution	Reason for Selection
Subsea Installations (wellheads, xmas trees, WHPS, MTM & PLEM)	Complete removal (~3m below seabed) by Construction Support Vessel (CSV) and Dive Support Vessel (DSV), with the structures transported to an appropriate land-based facility for dismantlement, recycling and disposal. Valves and piping tees contained within both the PLEM and MTM are to be removed along with the structures. The intent is to remove mud mats, if present. None are expected, but legacy mud mats could exist deeper than 2m below the seabed. If due to the integrity of the mud mats these cannot be safely removed to shore they will remain in-situ and OPRED will be advised.	The subsea installations will be completely removed as they do not fall under any derogation case outlined by OSPAR decision 98/3 or associated legislation and guidance. Re-use of the installations is deemed unfeasible as they have passed their design life.

5.2 Project Schedule

The proposed schedule for the Hewett subsea installations decommissioning project is shown in Figure 5.1. It is currently envisaged that the subsea installations will be removed at some point between 2022 and 2028.

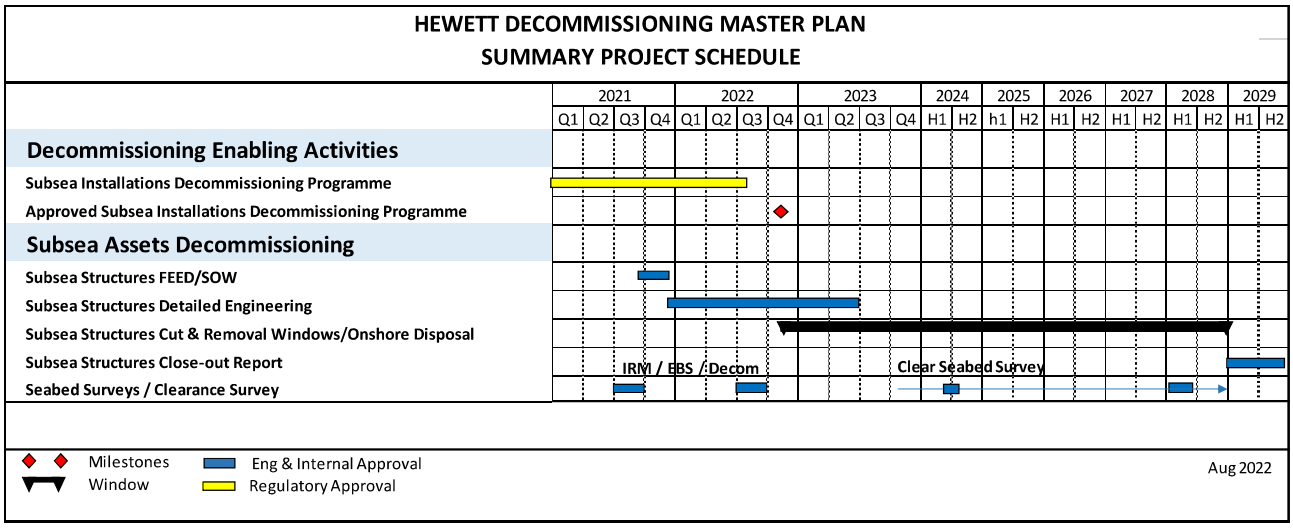


Figure 5.1: Hewett Area Subsea Installations Decommissioning Project Schedule

5.3 Proposed Removal Activities

Removal of the Hewett subsea installations can only occur after Eni has completed a series of preparatory works. These activities will be consented via the appropriate environmental permits and consents applied for on the UK Energy Portal. The preparatory works include:

1. Plug and abandonment (P&A) of the subsea wells in accordance with Oil & Gas UK Guidelines;
2. Flushing and cleaning of associated pipelines and umbilicals;
3. Disconnection and possible removal of pipeline tie-in spool pieces (note all disconnected pipeline ends will be protected with existing stabilisation materials).

The flushing and cleaning of pipelines and disconnection of pipeline tie in spools will be detailed retrospectively in the Pipelines DP. Note, from the most recent data all proposed pipeline disconnected locations do not require any de-burial; however, if local excavation is required in the future, this will be conducted using diver dredging equipment. On completion the exposed sections will be covered by mattresses that are already in-situ and any exposed areas will be backfilled.

Following completion of the above work, the Hewett subsea installations will be removed with the use of a dynamically positioned (DP) diving support vessel (DSV) and construction support vessel (CSV). Mud mats will also be removed, if present. None are expected; however, legacy mud mats could exist deeper than 2m below the seabed providing WHPS stabilisation. If mud mats are discovered, but cannot be safely removed to shore due to due integrity issues, Eni propose to leave them in-situ and will advise OPRED accordingly. No concrete mattresses or other stabilisation material will need to be removed to gain access to the structures.

The DSV will be used to facilitate preparatory rigging works, cutting and relocation / wet storing of the structures subsea.

For those structures piled to the seabed, Eni proposes to cut the piles internally using an abrasive cutting system thus avoiding the need for any excavation work, with best endeavours made to achieve 3m below the seabed. Any change in this depth will be discussed with OPRED at the time of execution. If internal pile cutting is not possible, the structures will be cut using a subsea diamond wire cutting tool. Small areas of seabed sediment local to the piles may be temporarily displaced to allow for the piles to be cut. Eni confirms they do not plan to use explosives. A final decision on the removal method will be made following an engineering feasibility and commercial tendering process

The wellheads/xmas trees will also be cut approximately 3m below the mudline most likely with the use of an abrasive cutting system or a rotary cut system, with the chosen method also subject to confirmation following the engineering feasibility and commercial tendering process. If 3m is not achievable, OPRED will be informed.

Once cut and if not recovered immediately, the structures, wellheads and xmas trees will be temporarily wet stored in a location immediately adjacent to their current position. A CSV/DSV will then be used to pick the structures up and return them to shore.

In addition to the above, the DSV will be used to cut and remove the temporary abandonment cap on the previously abandoned 48/30-13 E&A well and cut the wellhead approximately 3m below the mudline. An abrasive cutting system or a rotary cut system is likely to be used, subject to the engineering feasibility and commercial tendering process. As such, it will not be necessary to excavate externally around the wellhead. The CSV crane will be used to recover the cut wellhead to surface.

A summary of the vessel requirements for the project and their typical fuel consumption is provided in Table 5.2. The DSV is likely to be on location for two days per subsea installation and an additional two days at the 48/30-13 E&A well, with the CSV on location for one day per installation and an additional day at the 48/30-13 E&A well.

Table 5.2: Vessel Requirements

Vessel	Days on Location	Fuel Consumption Rate	Total Fuel Consumption
DSV	22 days	18 tonnes per day	396 tonnes
CSV	11 days	20 tonnes per day	220 tonnes

Throughout the proposed decommissioning activities, Eni will ensure that vessel work programmes are designed to minimise operational durations and reduce manning. Vessels will be selected to ensure that there are effective operational systems and that on board control measures are in place.

5.4 Waste Management

The project waste hierarchy aligns with the principles of the EU Waste Framework Directive (Directive 2008/98/EC) (see Figure 5.2). Contractor and onshore site selection process will be implemented to ensure compliance with waste hierarchy and all applicable waste regulations and Duty of Care.

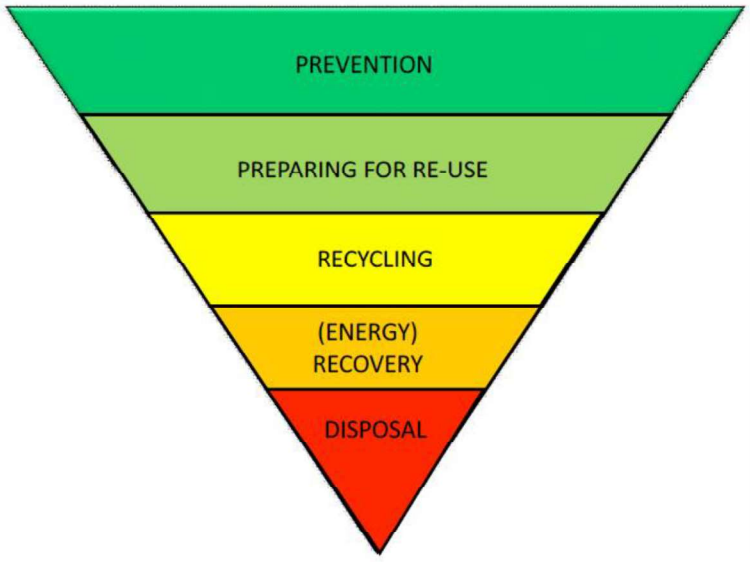


Figure 5.2: Waste Hierarchy (EU Waste Framework Directive)

As the re-use of installations (or parts thereof) is first in the order of preferred waste management options, it has been fully assessed and, deemed unfeasible due to the age and the extent to which the subsea installations have passed their design life.

Table 5.3 summarises the current estimated overall breakdown of materials to be removed. These quantities relate to the subsea installations and are limited to everything above the seabed cutline (3m below seabed) – wells materials and structure piling below this level are not included, and will be left in place, in accordance with guidance. Concrete mattresses will not be removed, but the base case scenario is to remove mud mats providing WHPS stabilisation. If, however, the mud mats cannot be safely removed to shore due to integrity issues they will remain in-situ and OPRED will be advised.

Recyclable metals, steel, account for 100 percent of the materials inventory. The current plan is to transport the structures (wellheads, xmas trees, wellhead protection structures and manifold structures) to an onshore decommissioning facility for re-use, recycling and disposal using an appropriately licenced contractor. It is not currently possible to predict the market for re-usable materials with confidence however there is a target material re-use / recycling rate of better than 95%.

Contractor and site selection process is in early stages and thus the potential trans-frontier shipment of waste cannot be dismissed for certainty. Should any structures be considered for removal and disposal outside of the UK, an application under the Transfrontier Shipment of Waste Regulations shall be made to the Environment Agency.

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

A comprehensive Waste Management Plan will be developed for all waste disposal activities prior to the commencement of those activities. In addition, a detailed audit programme will be developed to ensure that all waste disposal routes and facilities are fully audited to ensure regulatory compliance prior to commencement of activities.

The amount of naturally occurring radioactive material (NORM) is unknown at this time, however, it remains the possibility that low levels of NORM may be present during decommissioning activities therefore Eni will ensure appropriate Radioactive Substance Regulation (RSR) permits are in place and conditions that dictate the management and control of radioactive waste are met, including the requirement to minimise radioactive waste volumes, for monitoring and measurement regimes, and to meet storage conditions and duration.

Table 5.3: Estimated Waste Inventory

Structure	Hazardous material (Te)	Concrete (Te)	Ferrous Metal (Te)	Non-Ferrous Metal (Te)	Plastics (Te)	Rubber (Te)	Total (Te)
48/29-9	0	N/A	60.5	N/A	N/A	N/A	60.5
48/30-8	0	N/A	55.3	N/A	N/A	N/A	55.3
48/30-9	0	N/A	46.6	N/A	N/A	N/A	46.6
48/30-10	0	N/A	52.5	N/A	N/A	N/A	52.5
48/30-11z	0	N/A	59.1	N/A	N/A	N/A	59.1

Structure		Hazardous material (Te)	Concrete (Te)	Ferrous Metal (Te)	Non-Ferrous Metal (Te)	Plastics (Te)	Rubber (Te)	Total (Te)
48/30-14		0	N/A	61.7	N/A	N/A	N/A	61.7
48/30-15z		0	N/A	72.38	N/A	N/A	N/A	72.38
48/30-18		0	N/A	72.38	N/A	N/A	N/A	72.38
MTM		0	N/A	26.18	N/A	N/A	N/A	26.18
PLEM		0	N/A	26.18	N/A	N/A	N/A	26.18
48/30-13		0	N/A	27.00	N/A	N/A	N/A	27.00
Total	**Te**	**0**	N/A	**559.82**	N/A	N/A	N/A	**559.82**
	%	0	N/A	**100**	N/A	N/A	N/A	**100**

Note: Eni recognises there will be a very small amount of plastic and rubber made up from gaskets/seals etc., this is deemed insignificant with regards to the waste listed in Table 5.3 above, but shall be managed and disposed of according to the relevant project Waste Management Plan.

5.5 Post Decommissioning

Post decommissioning, appropriate debris clearance and verification work will be undertaken. Further environmental survey and monitoring requirements, (e.g. seabed sampling analysis), will be agreed with OPRED and reported in a close-out report, including any observed immediate consequences of the decommissioning.

6.0 ENVIRONMENTAL BASELINE

This section provides an overview of the key environmental features in the vicinity of the Hewett subsea installations that may be affected by the proposed decommissioning works. The information has been used to assess the level of impact that the activities will potentially have on the environment.

6.1 Pre-Decommissioning Environmental Surveys

Several surveys have been undertaken in the Hewett Field Area in preparation for decommissioning as detailed below. The location and key findings of the surveys in relation to the Hewett subsea installations are shown in Figure 6.1 (Dawn Subsea Well 48/29-9), Figure 6.2 (Deborah Subsea Wells 48/30-8, 48/30-10 and 48/30-14 and 48/30-13 E&A well), Figure 6.3 (Della Subsea Well 48/30-11z, Delilah Subsea Well 48/30-18 and PLEM), Figure 6.4 (Little Dotty Subsea Well 48/30-15z and MTM) and Figure 6.5 (Little Dotty Subsea Well 48/30-9).

Hewett Pre-Decommissioning Habitat Assessment and Environmental Baseline Survey (Fugro, 2019a; Fugro, 2019b): nine separate 2km by 2km areas in the Hewett Field Area were subject to geophysical site surveys, shallow geotechnical and environmental surveys. This included five subsea installation sites. The survey work was conducted on board the MV Fugro Venturer from 18 August to 10 September 2018. The aim of the habitat assessment (Fugro, 2019a) was to acquire high quality ground-truthing (video and photographs) of the seabed to identify benthic communities and habitats recorded within the survey areas and to identify and delineate the extent of any potentially sensitive or protected habitats as specified by the EC Habitats Directive and the OSPAR Convention (OSPAR, 2008). The aim of the environmental baseline survey (Fugro, 2019b) was to acquire environmental samples to describe the existing physico-chemical and biological properties of the sediment at key locations, primarily around the platforms and subsea well locations. At each of the Hewett subsea installation survey areas, eight stations were sampled. These stations were arranged in tidally aligned cruciforms centred on the subsea wells. In addition, three additional reference stations were sampled located away from the subsea installations to act as a baseline. To inform the habitat assessment a number of transects were surveyed to ascertain the extent and reefiness of potential *S. spinulosa* areas. These included one transect to the south west of Dawn, one to the south east and one to the south west of Deborah, one to the east, one south, one south west and one to the north west of Della and Delilah, one to the south west, one to the west and one to the north west of Little Dotty 48/30-15z and two to the north east of Little Dotty 48/30-9.

***Sabellaria spinulosa* Assessment (Fugro, 2019c):** video footage and photographs were obtained at a number of locations close to each subsea well (apart from 48/30-8) during a borehole survey undertaken by Gardline on behalf of Eni, from April to May 2019. The data was provided to Fugro for analysis with the aim of assessing the potential presence of *S. spinulosa* and shown in Figures 6.1 to 6.5.

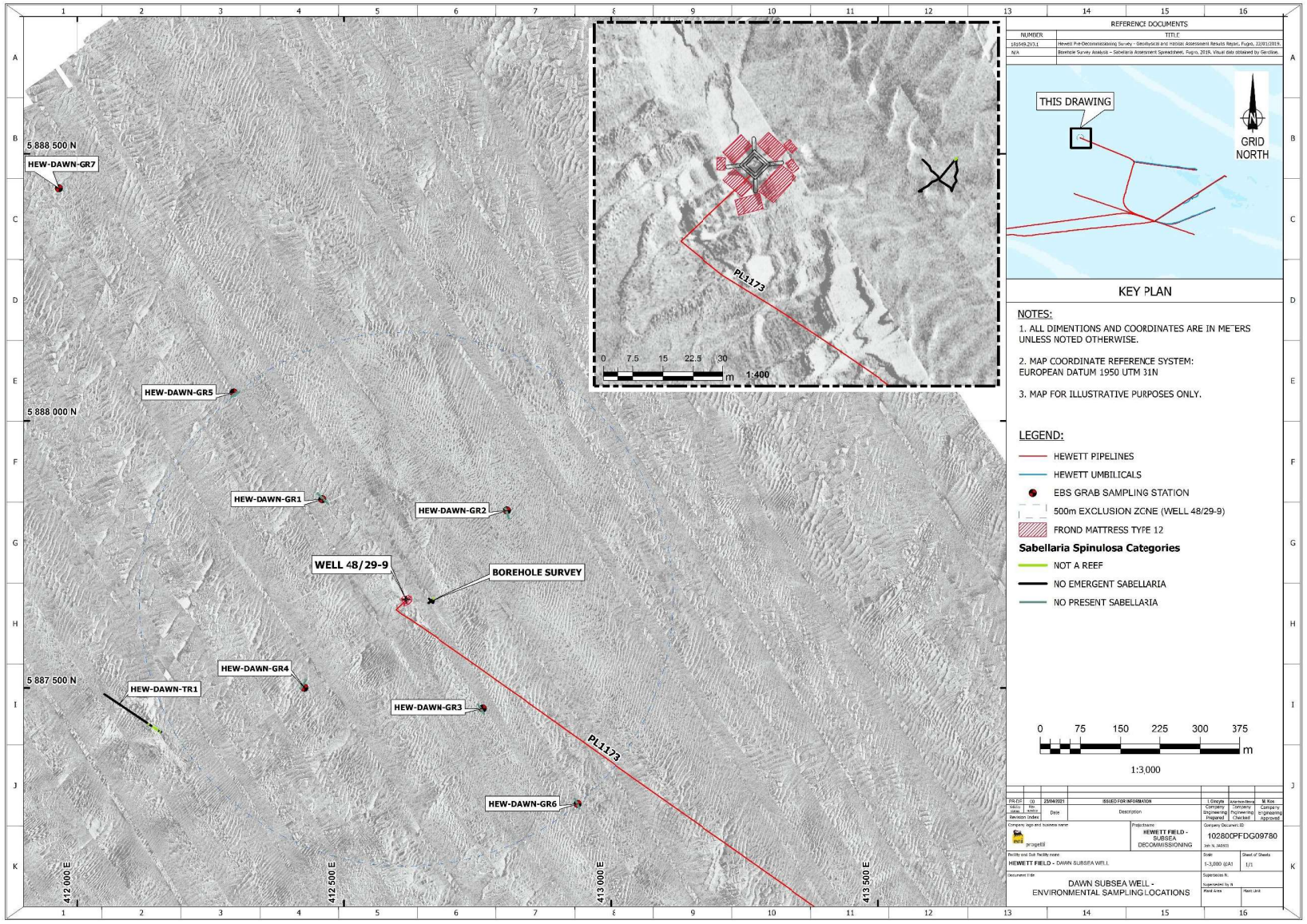


Figure 6.1: Environmental Survey Locations at Dawn Subsea Well (48/29-9)

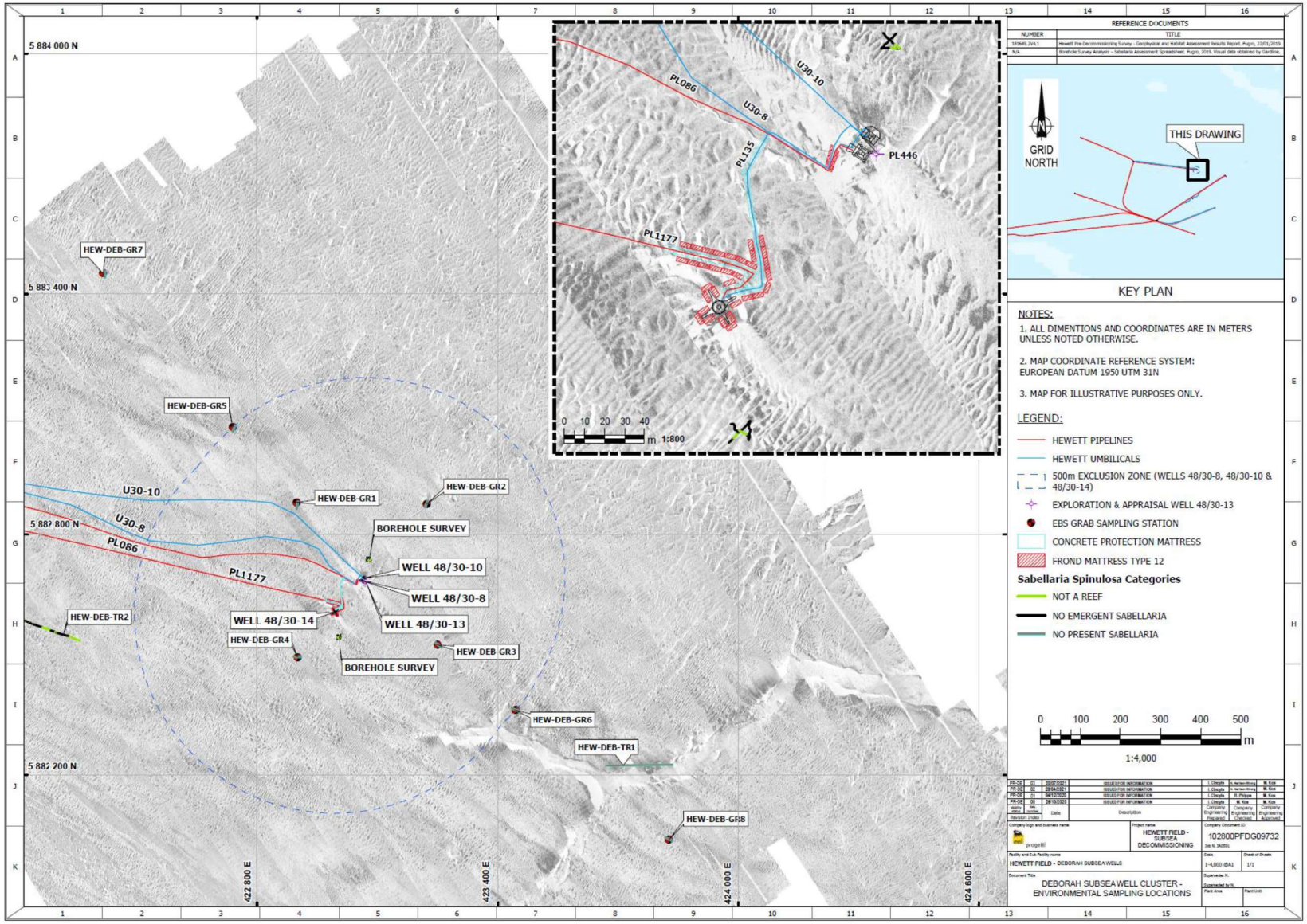


Figure 6.2: Environmental Survey Locations at Deborah Subsea Wells (48/30-8, 48/30-10 and 48/30-14) and 48/30-13 Well

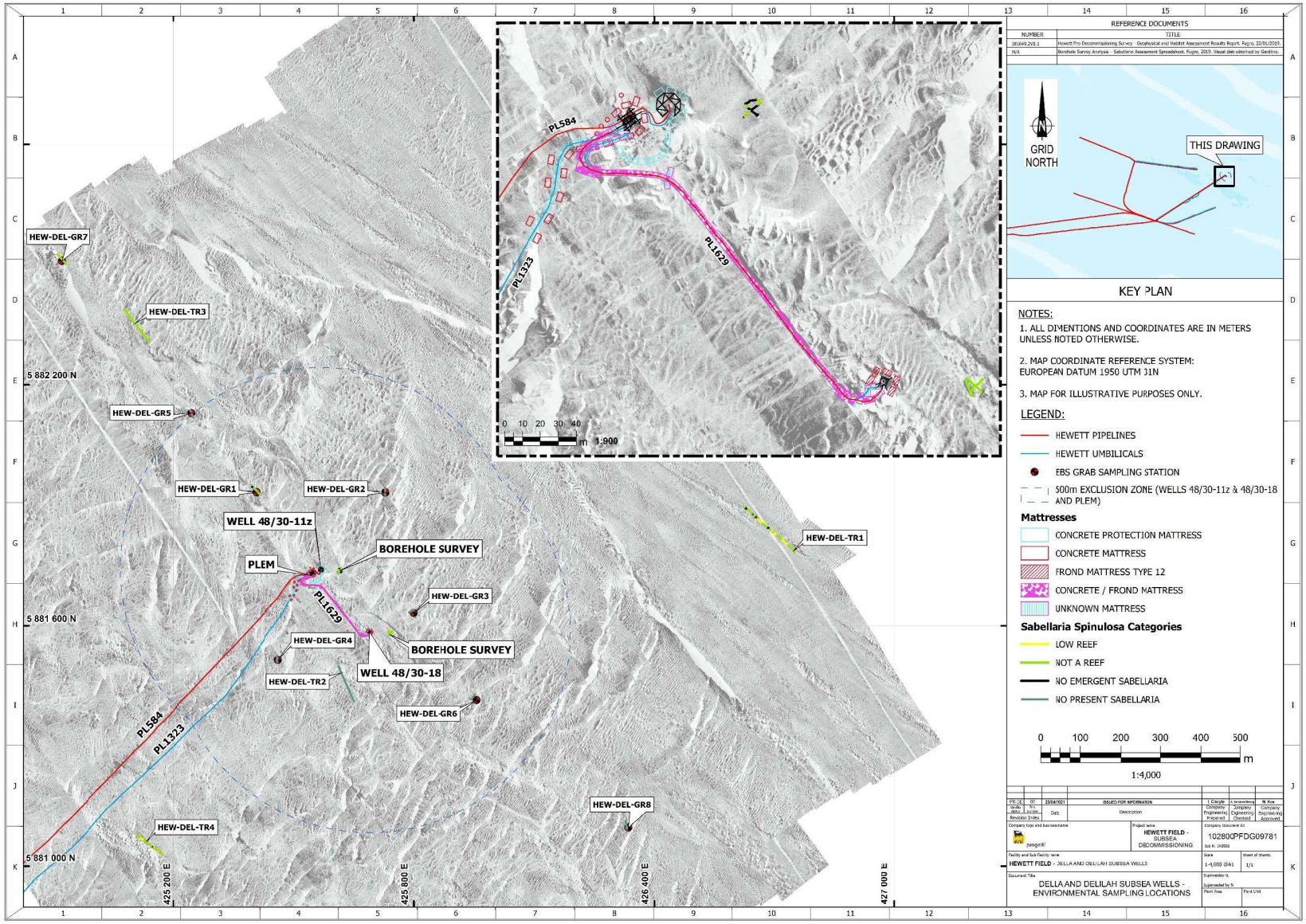


Figure 6.3: Environmental Survey Locations at Della Subsea Well (48/30-11z), Delilah Subsea Well (48/30-18) and PLEM

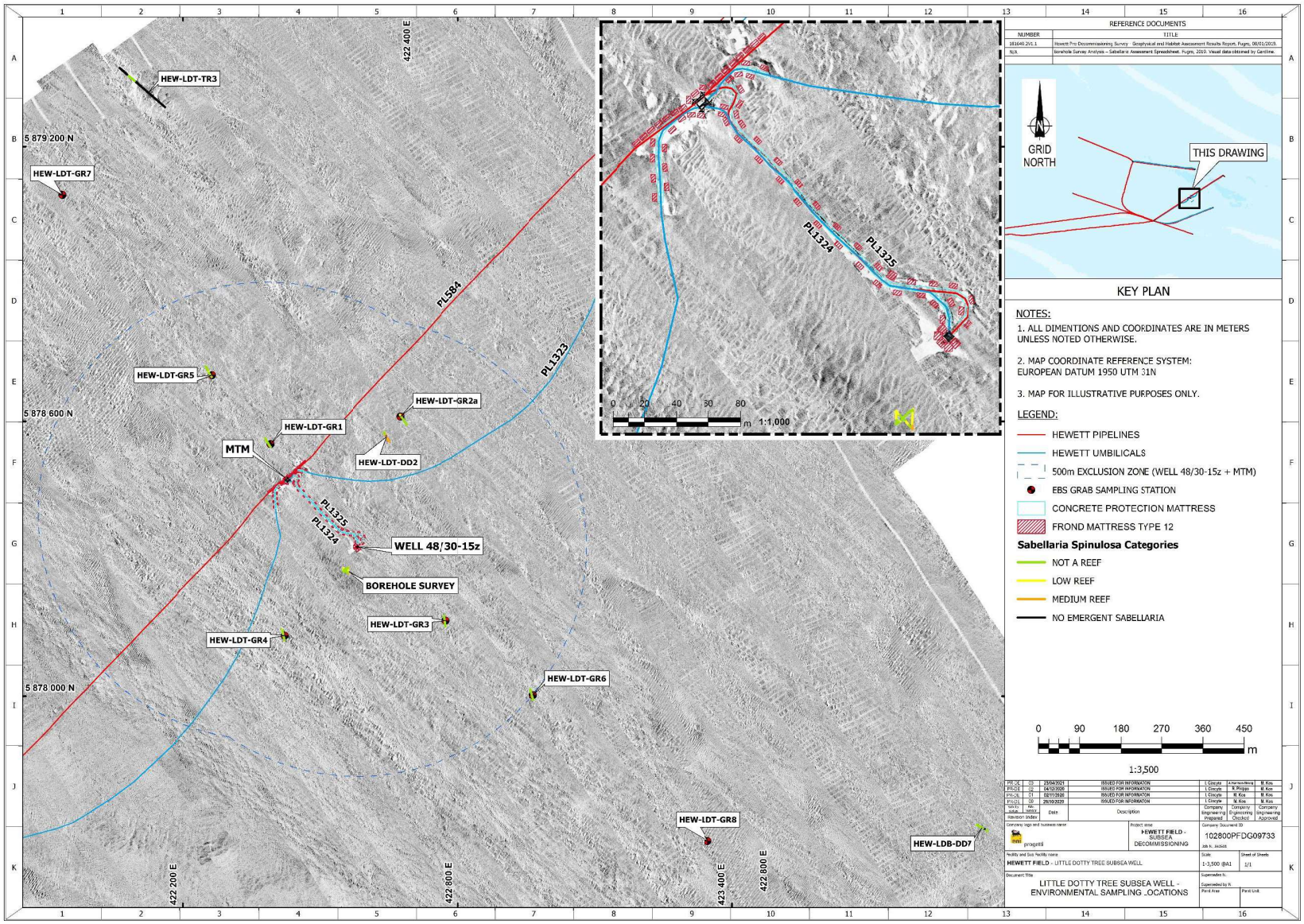


Figure 6.4: Environmental Survey Locations at Little Dotty Subsea Well (48/30-15z) and MTM

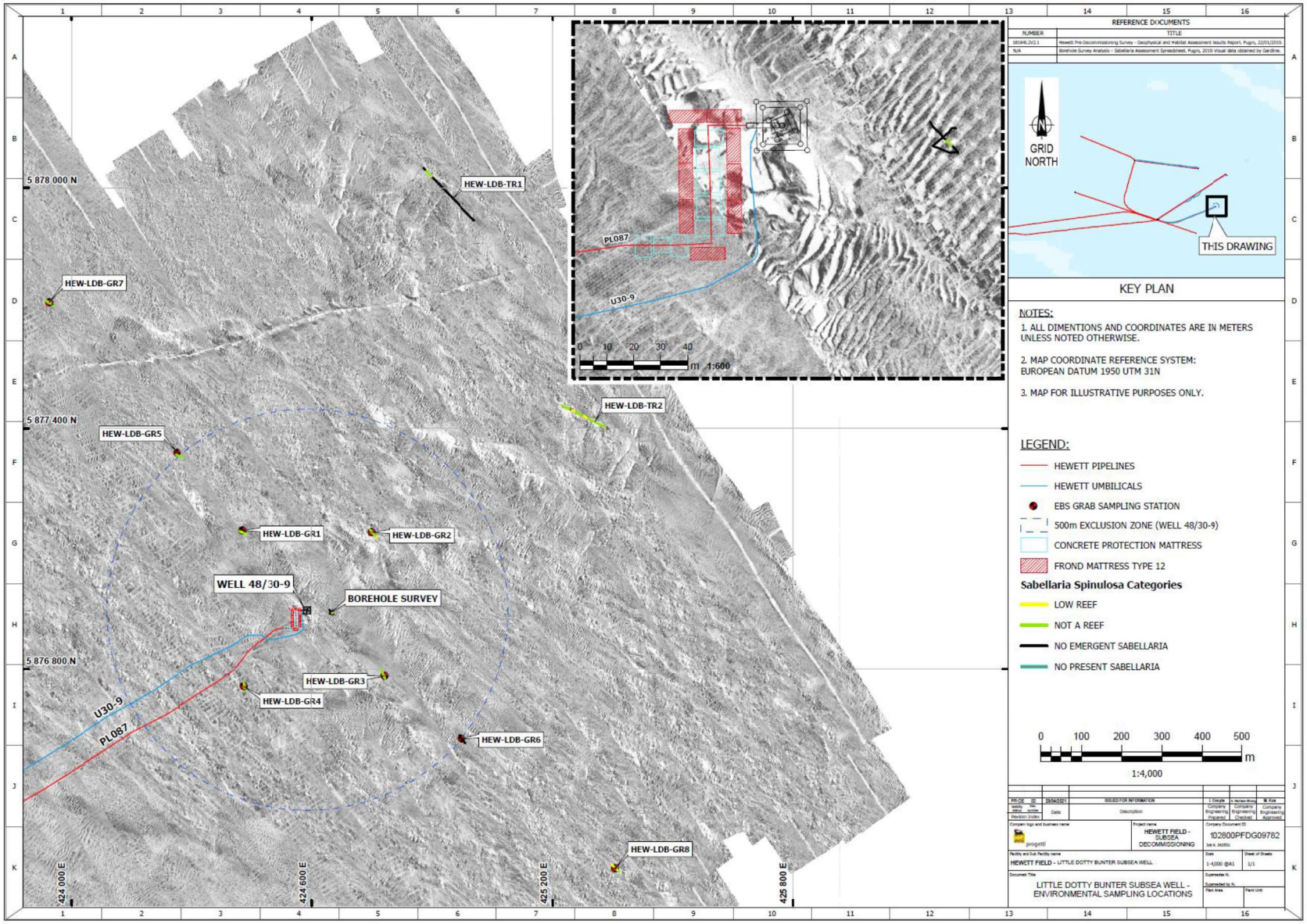


Figure 6.5: Environmental Survey Locations at Little Dotty Subsea Well (48/30-9)

6.2 Marine Protected Areas

The Hewett subsea installations are located within 40km of six marine protected areas (MPAs) as illustrated in Figure 6.6. A brief description of the MPAs and their qualifying features are detailed in Table 6.1. Of note is that all the subsea installations apart from the Dawn subsea well (48/29-9) are located within the Southern North Sea SAC, designated for the protection of harbour porpoise. Additionally, the Humber Estuary SAC has been included in Table 6.1 as it designated for the protection of grey seal which can forage up to distances of up to 100 km offshore, and if project vessels are mobilised from Great Yarmouth, they would also have to traverse the Outer Thames Estuary SPA.

Table 6.1: Marine Protected Areas in the vicinity of the Hewett Field Area (JNCC, 2019b)

Marine Protected Area	Qualifying Features and Site Description	Approx. Distance From Subsea Installations
Southern North Sea SAC	**Features:** Annex II species: Harbour porpoise (*Phocoena phocoena*). **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 are recognised as important for porpoises during the summer season, whilst the southern part (in which the Hewett Field Area is located) supports persistently higher densities during the winter.	48/30-8, 48/30-9, 48/30-10, 48/30-11z, 48/30-14, 48/30-15z, 48/30-18, 48/30-13 MTM and PLEM are located within the SAC boundary 48/29-9 = 3.7km
Hainsborough, Hammond and Winterton SAC	**Features:** Annex I habitats: Sandbanks which are slightly covered by sea water all the time and Reefs. **Description:** The site contains a series of sandbanks that were formed via headland associated geological processes since the 5th Century AD. These sandbanks are curved and orientated parallel to the coast, composed of sandy sediment and lie in full salinity water with intermediate coastal influence. The site contains a mosaic of different physical habitats with correspondingly different biological communities. The fauna of the sandbank crests is predominantly low diversity polychaete (bristle worms) and amphipod (shrimp-like crustaceans) communities which are typical of mobile sediment environments. The banks are separated by troughs which contain more gravelly sediments and support diverse infaunal and epifaunal communities with occurrences of reefs of the tube-building ross worm *Sabellaria spinulosa*. Aggregations of *Sabellaria spinulosa* provide additional hard substrate for the development of rich epifaunal communities.	48/29-9 = 9.5km 48/30-8, 48/30-10 and 48/30-14 = 6.2km 48/30-15z = 1.8km 48/30-9 = 0.9km 48/30-11z = 5.8km 48/30-18 = 5.7km 48/30-13 = 6.4km MTM = 1.8km PLEM = 5.7km

Marine Protected Area	Qualifying Features and Site Description	Approx. Distance From Subsea Installations
Greater Wash SPA	**Features:** Annex I bird species: Red throated diver (*Gavia stellata*), little gull (*Hydrocoloeus minutus*), little tern (*Sternula albifrons*), sandwich tern (*Sterna sandvicencis*), common tern (*Sternula albifrons*); and Migratory species: common scoter (*Melanitta nigra*). **Description:** The site is located predominantly in the coastal waters of the mid-southern North Sea between the counties of Yorkshire and Suffolk, covering an area of 3,536km^2. This area supports the largest breeding populations of little terns within the UK SPA network by protecting important foraging areas, and supports the second largest aggregations of non-breeding red-throated diver and little gull. The SPA includes a range of marine habitats, including intertidal mudflats and sandflats, subtidal sandbanks and biogenic reef, including *Sabellaria* reefs and mussel beds.	48/29-9 = 20km 48/30-8, 48/30-10, 48/30-14 = 17.5km 48/30-15z = 13.7km 48/30-9 = 14.2km 48/30-11z = 18.2km 48/30-18 = 18.3km 48/30-13 = 17.4km MTM = 13.7km PLEM = 18.2km
North Norfolk Sandbanks and Saturn Reef SAC	**Features:** Annex I habitats: Sandbanks which are slightly covered by sea water all the time and Reefs. **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 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 sandtubes made by ross worms (polychaetes) which have consolidated together to create solid structures rising above the seabed.	48/29-9 = 7.2km 48/30-8, 48/30-10, 48/30-14 = 4.4km 48/30-15z = 8.1km 48/30-9 = 7.9km 48/30-11z = 3.5km 48/30-18 = 3.6km 48/30-13 = 4.2km MTM = 8.2km PLEM = 3.7km
Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ)	**Features:** Broad Scale Habitats: High energy infralittoral rock, Moderate energy infralittoral rock, High energy circalittoral rock, Moderate energy circalittoral rock, Subtidal coarse sediment, Subtidal sand and Subtidal mixed sediments; FOCI: Peat and clay exposures, Subtidal chalk and North Norfolk Coast (subtidal); One geological feature. **Description:** The site is located between Weybourne and Happisborough, extending around 10 km out to sea and covering an area of 321 km^2. This area is designated for the presence of seaweed-dominated infralittoral rock, which is a habitat for a variety of small animals that shelter and feed amongst seaweeds. The site also contains chalk beds that serve as nursery areas for juvenile fish and support populations of lobsters and crabs. Other common species include sea squirts, hermit crabs and pipefish.	48/29-9 = 23km 48/30-8, 48/30-10 and 48/30-14 = 26.9km 48/30-15z = 24.6km 48/30-9 = 26km 48/30-11z and 48/30-18 = 28.7km 48/30-13 = 28.6km MTM = 24.3km PLEM = 28.6km

Marine Protected Area	Qualifying Features and Site Description	Approx. Distance From Subsea Installations
The Wash and North Norfolk Coast SAC	**Features:** Annex I habitats: Sandbanks which are slightly covered by sea water all the time, Mudflats and sandflats not covered by seawater at low tide, Large shallow inlets and bays, Reefs, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) and Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*); Annex II (primary) species: harbour seal (*Phoca vitulina*) and Annex II (qualifying) species: Otter (*Lutra Lutra)* **Description**: The submerged sandbanks at the site support sublittoral communities including beds of brittlestars (*Ophiothrix fragilis*), sandmason worm (*Lanice conchilega*) and the tellin (*Angulus tenuis*). Areas of biogenic reef, formed by the polychaete worm *Sabllaria spinulosa* are located within the SAC. This is the only known location of well-developed stable *Sabellaria* reef in the UK (standing up to 30m tall) and supporting fauna such as the pink shrimp (*Pandalus montagui*). The intertidal flats at the site provide ideal conditions for harbour seal breeding and hauling out, as well as supporting the largest colony of common seals in the UK (7% of the total population).	48/29-9 = 37.1km All other subsea installations are >40km away.
Humber Estuary SAC	**Features:** Annex I habitats: Estuaries, Mudflats and sandflats not covered by seawater at low tide, Sandbanks which are slightly covered by sea water all the time, Coastal lagoons, Salicornia and other annuals colonizing mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), Embryonic shifting dunes, Shifting dunes along the shoreline with *Ammophila arenaria*, Fixed coastal dunes with herbaceous vegetation, Dunes with Hippoph, rhamnoides, Annex II species: Sea lamprey (*Petromyzon marinus*), River lamprey (*Lampetra fluviatilis*), Grey seal (*Halichoerus grypus*). **Description:** The Humber is the second largest coastal plain Estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. The range of salinity, substrate and exposure to wave action influences the estuarine habitats and the range of species that utilise them; these include a breeding bird assemblage, winter and passage waterfowl, river and sea lamprey, grey seals, vascular plants and invertebrates.	(48/29-9) = 100 km All other subsea wells are >100 km away.

Marine Protected Area	Qualifying Features and Site Description	Approx. Distance From Subsea Installations
Outer Thames Estuary SPA	**Features:** Annex I bird species: red-throated diver (*Gavia stellata*), common tern (*Sterna hirundo*) and little tern (*Sternula albifrons*). Description: The SPA lies along the east coast of England in the southern North Sea and extends northward from the Thames Estuary to the sea area off Great Yarmouth on the East Norfolk Coast. It covers an area of c. 3,924 km^2 and is classified for the protection of the largest aggregation of wintering red-throated diver in the UK, an estimated population of 6,466 individuals, which is 38% of the wintering population of Great Britain. It also protects foraging areas for common tern and little tern during the breeding season.	(48/30-9) = 41 km All other subsea wells are >41 km away.

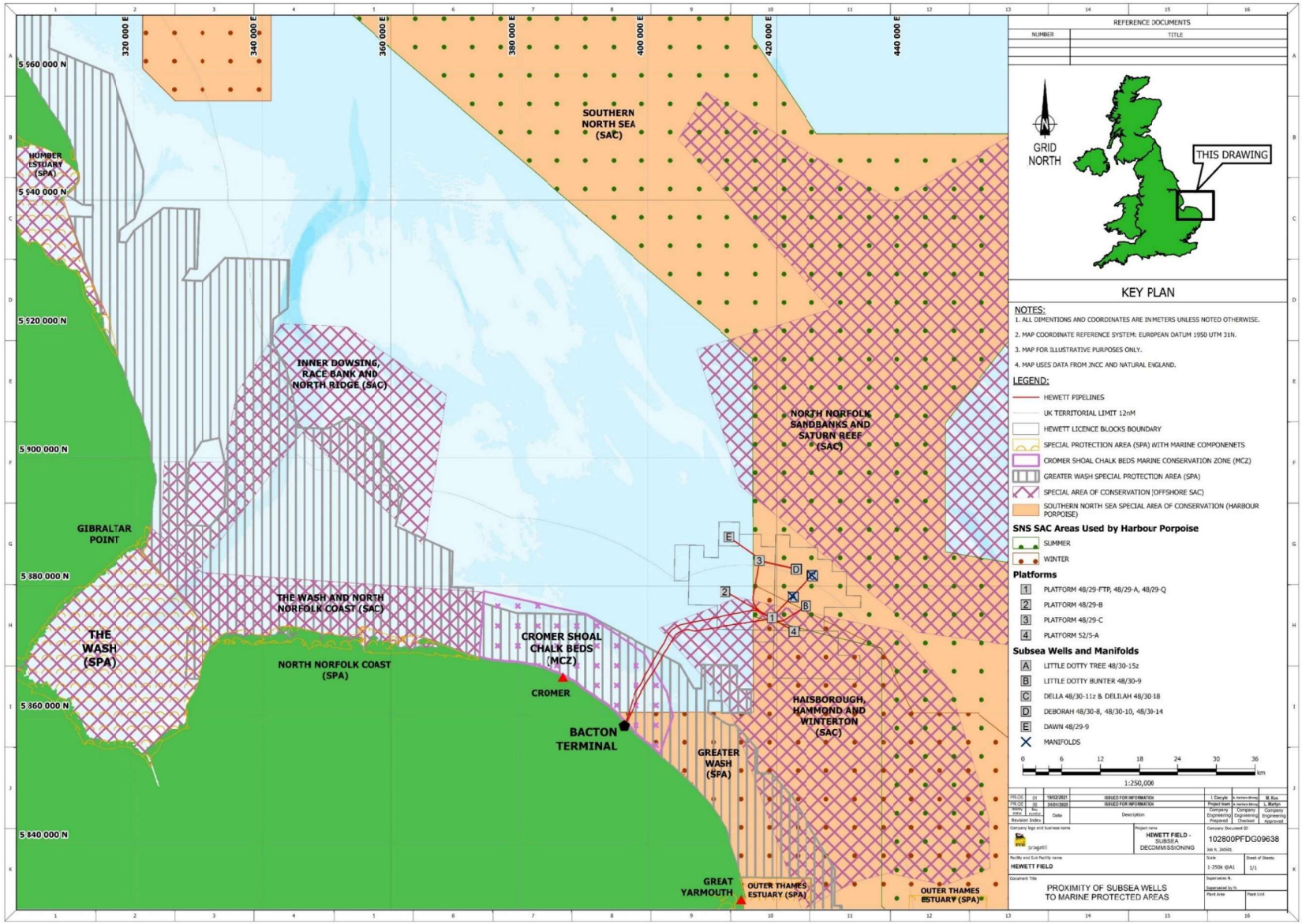


Figure 6.6: Marine Protected Areas in the vicinity of the Hewett Field Area

6.3 Physical Environment

6.3.1 Bathymetry

The seabed across the subsea installation survey areas ranged from 28.6m to 42.6m in depth to surface to Lowest Astronomical Tide (LAT) at the Dawn site and the Della & Delilah site respectively (see Table 6.2). The greatest difference in depth within each sample area was at the Della and Delilah site - 11.6 m LAT followed by the Dawn site – 10.1 m LAT.

The average seabed gradient indicates that the survey areas are relatively flat, with an average gradient of 1-5° and maximum seabed gradient of 50° at the Della & Delilah site. Megaripples occurred at each survey area with the greatest height observed at Little Dotty (48/30-9) and the greatest length observed at the Deborah and Della & Delilah sites. Sandwaves were observed at all five survey areas with the highest as well as the longest observed at Della & Delilah site.

Table 6.2: Summary of Bathymetry

Parameter	Dawn	Deborah & 48/30-13	Della & Delilah (including PLEM)	Little Dotty (48/30-15z) & MTM	Little Dotty (48/30-9)
Minimum water depth within the survey area (m LAT):	28.6	34.2	31	32.1	32.1
Maximum water depth within the survey area (m LAT):	38.7	40.4	42.6	38.4	40.4
Average seabed gradient within the survey area (°):	<1	5	5	2	2
Maximum significant seabed gradient within the survey area (°):	28	25	50	12	19
Megaripples height (m)	<0.7	<0.7	<0.8	<0.8	<1
Megaripples wavelength (average m)	9	12	12	8	10
Sand waves - heights (m)	<4	<3.3	<5.7	<3	<3
Sand waves - wavelength (m)	<100	<90	<120	<70	<100

6.3.2 Sediment Characteristics

Sediment samples were collected and analysed for their geotechnical composition properties, including particle size distribution (PSD), sediment composition (Wentworth scale), sorting (particle homogeneity), the proportion of total organic matter (TOM) and proportion of total organic carbon (TOC). The results are presented in Table 6.3.

This characterised the sediment across the project footprint and its potential mobility if disturbed. The sediment type demonstrated some variation throughout the survey areas: classified mostly as medium sand, or coarse sand at the Dawn and Deborah sites, and as fine, medium or coarse sand at the Della & Delilah and Little Dotty sites. TOM and TOC content were reported as low across the Hewett Field Area.

Table 6.3: Sediment Types Identified at the Subsea Installations Locations

Parameter	Dawn	Deborah & 48/30-13	Della & Delilah (including PLEM)	Little Dotty (48/30-15z) & MTM	Little Dotty (48/30-9)
Mean PSD (µm)	429	485	453	464	410
Sediment Composition	Medium – coarse sand	Medium – coarse sand	Fine – coarse sand	Fine – coarse sand	Fine – coarse sand
Sediment homogeneity	Moderately well - poorly sorted	Moderately well - poorly sorted	Moderately well – very poorly sorted	Moderately well – very poorly sorted	Moderately well – very poorly sorted
TOM (%)	0.72	0.78	0.94	1.15	0.96
TOC (%)	0.06	0.10	0.06	0.11	0.07

Photographs of sediment observed at each subsea installation location are provided in Figure 6.7 (Dawn), Figure 6.8 (Deborah & 48/30-13), Figure 6.9 (Della & Delilah & PLEM), Figure 6.10 (Little Dotty 48/30-15z & MTM) and Figure 6.11 (Little Dotty 48/30-9).

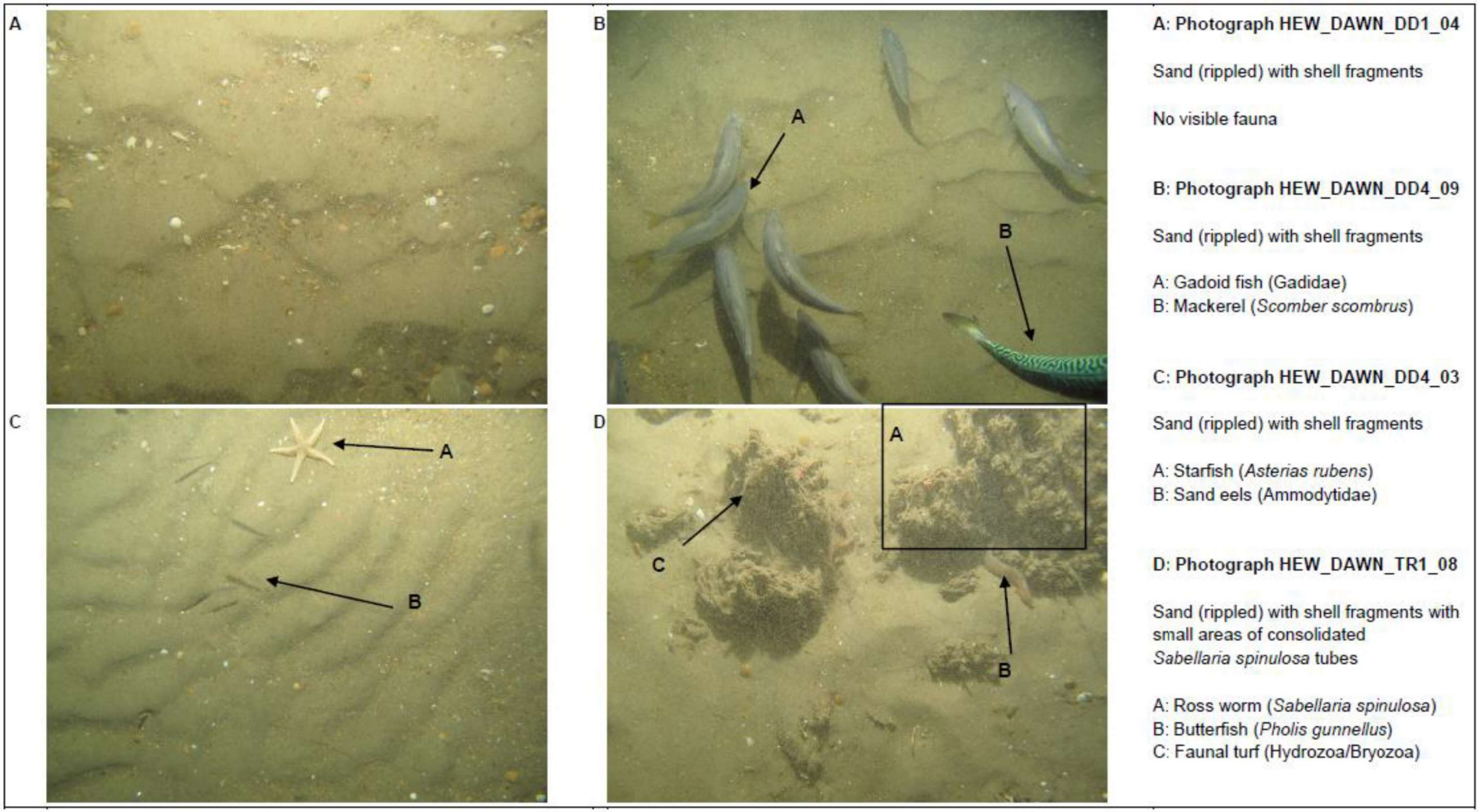


Figure 6.7: Example seabed sediment photographs at Dawn Subsea Well (48/29-9)

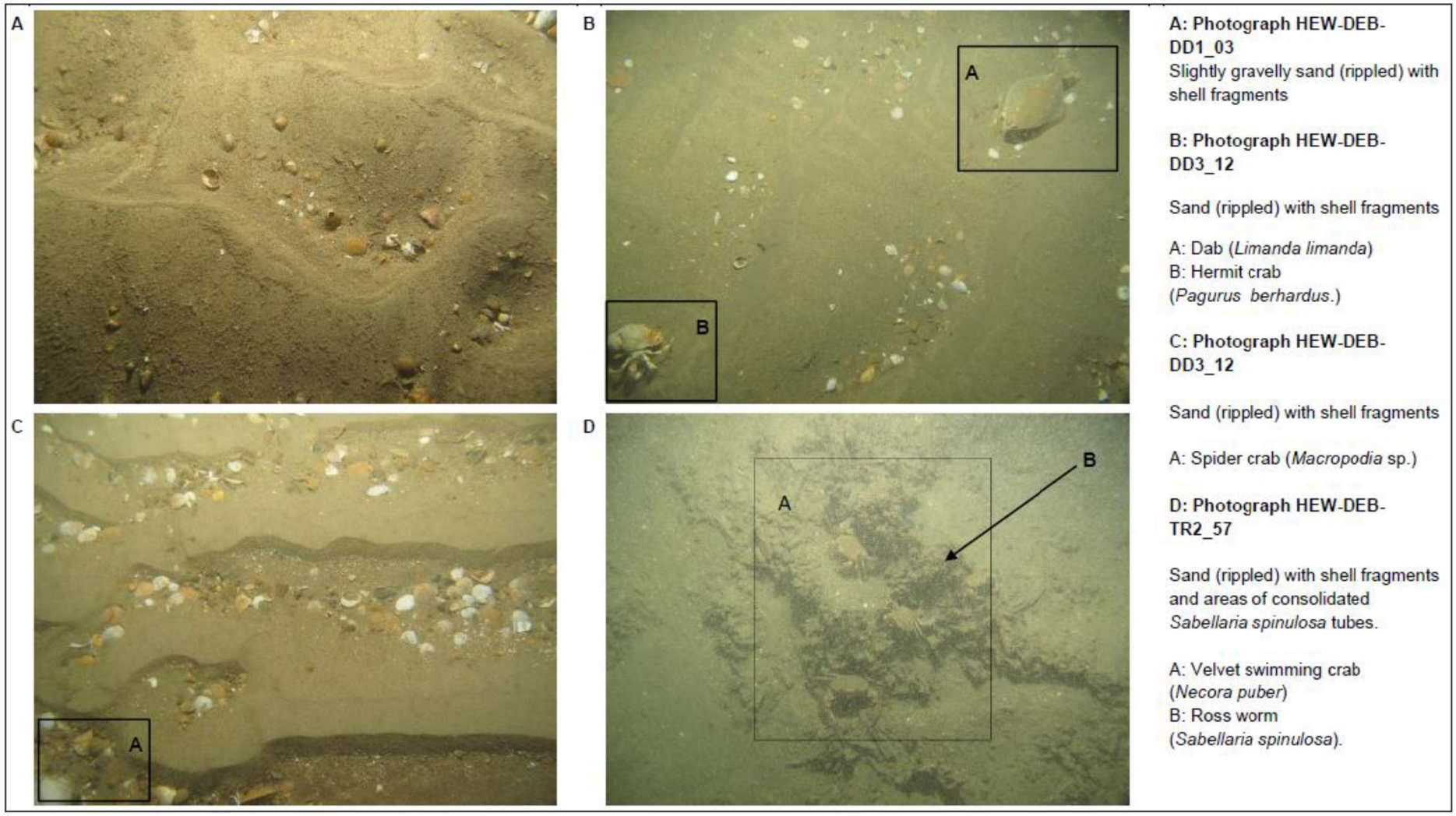


Figure 6.8: Example seabed sediment photographs at Deborah Subsea Wells (48/30-8, 48/30-10 and 48/30-14) and 48/30-13 E&A well

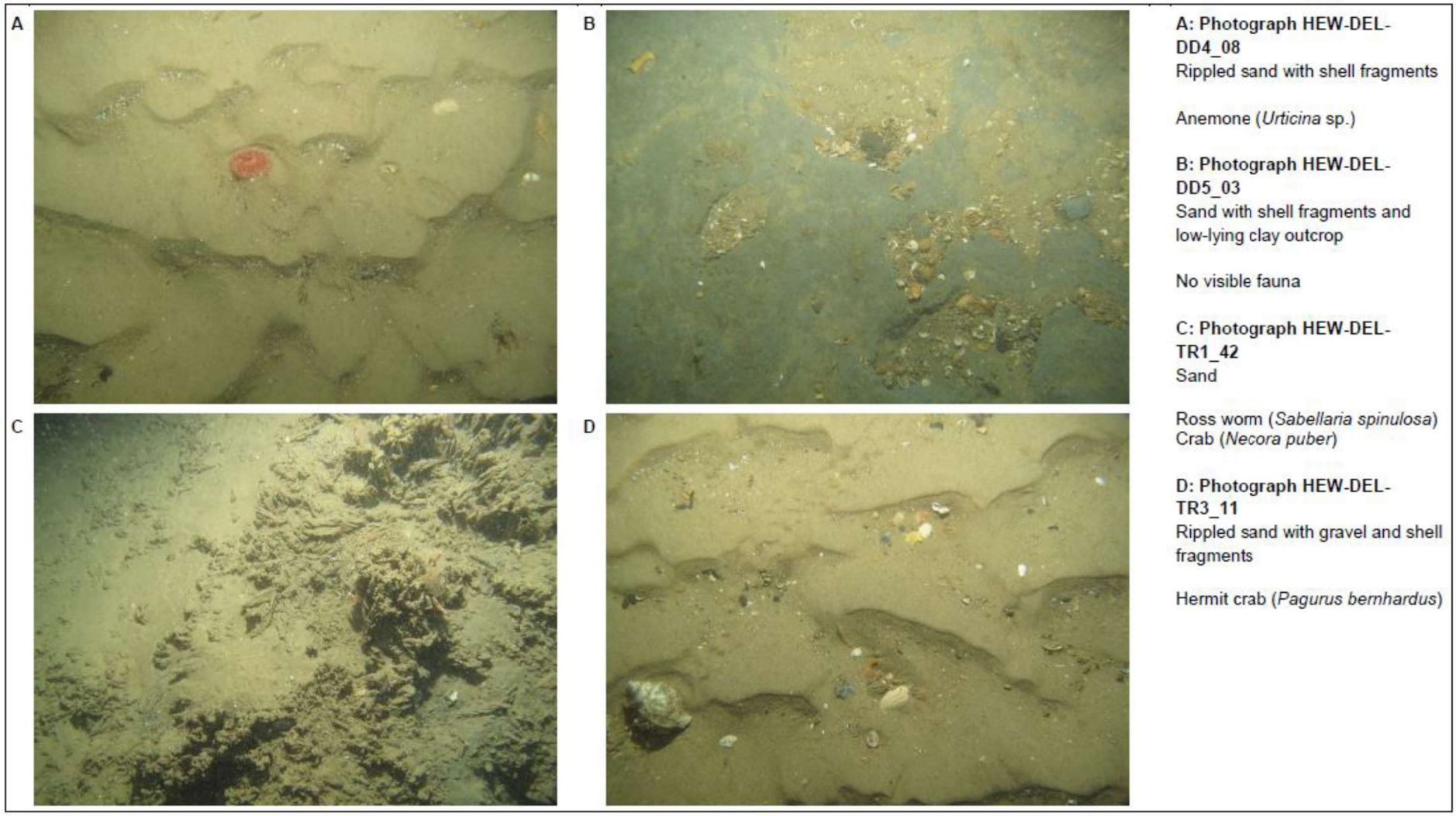


Figure 6.9: Example seabed sediment photographs at Della Subsea Well (48/30-11z), Delilah Subsea Well (48/30-18) and the PLEM

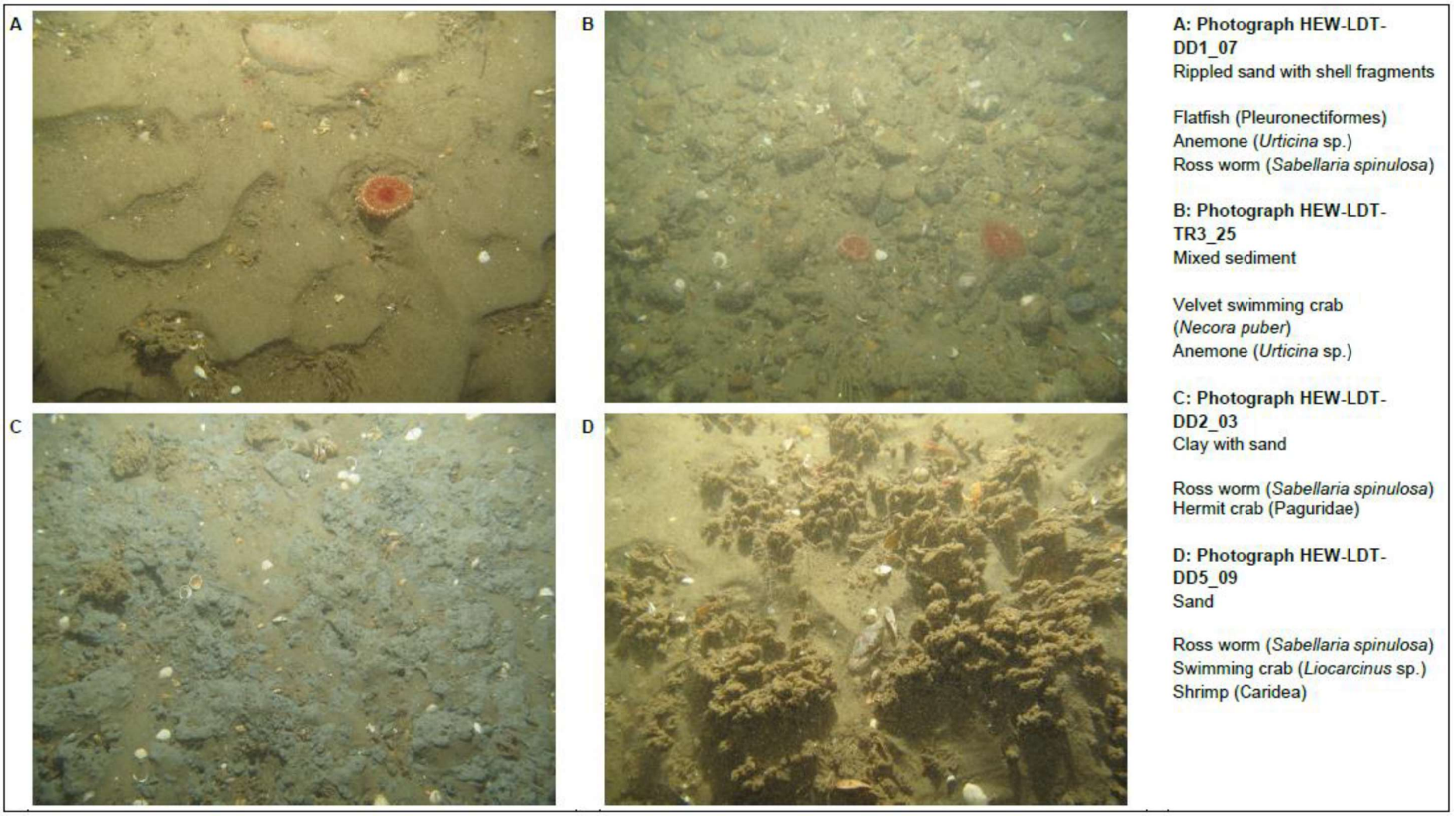


Figure 6.10: Example seabed sediment photographs at Little Dotty Subsea Well (48/30-15z) and the MTM

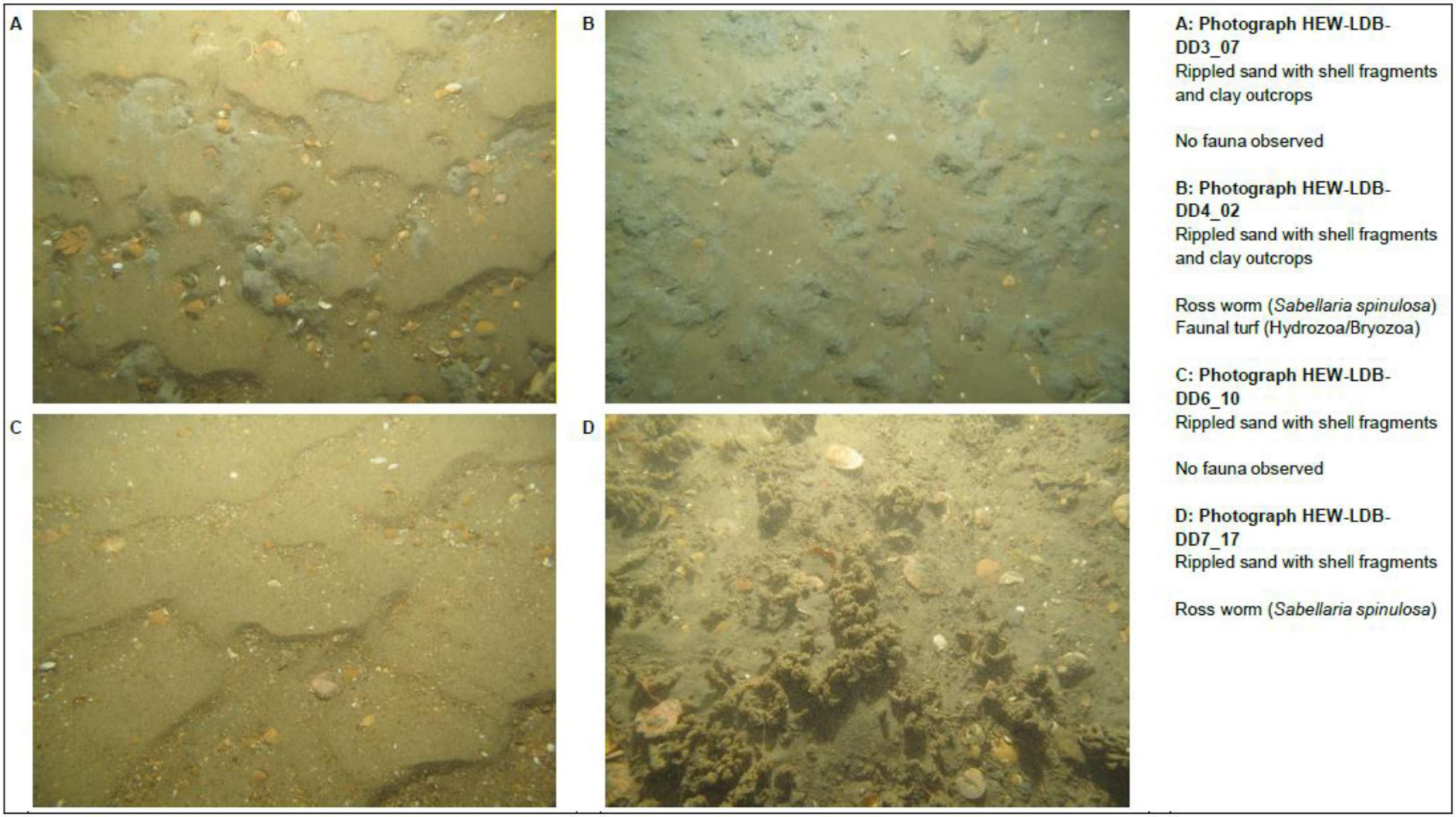


Figure 6.11: Example seabed sediment photographs at Little Dotty Subsea Well (48/30-9)

6.3.3 Sediment Hydrocarbon Content

The sediment samples collected during the pre-decommissioning environmental baseline survey were analysed for hydrocarbon content including Total Hydrocarbon Content (THC), total n-alkanes (nC10-nC36) and polycyclic aromatic hydrocarbons (PAHs), specifically the United States Environmental Protection Agency (US EPA) 16 priority PAHs[5] and alkylated PAHs. The results were compared to SNS background values from 1975 to 1995 (UKOOA, 2001), data collected from the major sandbanks off the coast of Norfolk and Lincolnshire in the SNS in 2001 (ERT, 2003a) and United States Effects Range Low (ERLs) criteria which represent the low point (10th percentile) on a continuum of chemical concentrations over which adverse biological effects have been observed from ecotoxicological studies (OSPAR, 2009). The results are presented in Table 6.4.

Table 6.4: Hydrocarbon Concentrations in Sediment

Location	Parameter – maximum concentration			
	THC (µg/g Dry Sediment)	**Total n-alkane (nC_{10} to nC_{36}) (µg/g)**	**Total US EPA16 PAH (µg/g Dry Sediment)**	**2-6 ring PAHs (µg/g Dry Sediment)**
Dawn	0.9 (HEW-DAWN-GR1)	0.05 (HEW-DAWN-GR8)	0.004 (HEW-DAWN-GR1)	0.013 (HEW-DAWN-GR1)
Deborah & 48/30-13	0.8 (HEW-DEB-GR2 & HEW-DEB-GR3)	0.11 (HEW-DEB-GR6)	0.005 (HEW-DEB-GR5)	0.016 (HEW-DEB-GR6)
Della & Delilah & PLEM	0.9 (HEW-DEL-GR1)	0.05 (HEW-DEL-GR1)	0.0055 (HEW-DEL-GR1)	0.029 (HEW-DEL-GR1)
Little Dotty (48/30-15z) & MTM	2.9 (HEW-LDT-GR4)	0.29 (HEW-LDT-GR4)	0.0286 (HEW-LDT-GR4)	0.109 (HEW-LDT-GR4)
Little Dotty (48/30-9)	0.9 (HEW-LDB-GR2 & HEW-LDB-GR8)	0.06 (HEW-LDB-GR2, GR5 & GR8)	0.0091 (HEW-LDB-GR2)	0.035 (HEW-LDB-GR2)
SNS Background (UKOOA, 2001)	4.34	0.33	-	0.208
SNS Background (ERT, 2003a)	1.6	0.16	-	0.058
ERL (OSPAR, 2009)	50	-	0.085-0.665*	-

*ERL for each individual EPA 16 PAH.

In summary, the THC concentrations across the five subsea installation survey areas showed low to moderate variation and were lower than the mean background concentration in the SNS (4.34 µg/g; UKOOA, 2001). THC at all locations except the Little Dotty (48/30-15z) & MTM site were also lower than the mean concentration taken from the sandbanks survey conducted to inform the BEIS Strategic Environmental

[5] The EPA list of 16 PAH concentrations are used globally in assessment of contamination relating to both environmental and human health studies. The EPA list of 16 PAHs is more comprehensive than the equivalent OSPAR ERLs, which comprises of 10 PAHs.

Assessment (SEA) 2[6] (1.6 µg/g; ERT, 2003a). All sediment hydrocarbon levels were well below levels that could potentially negatively impact sediment faunal communities (50 µg/g, OSPAR, 2006).

The mean total n-alkane (nC_{10} to nC_{36}) concentrations across the five subsea installation survey areas were also lower than the SNS background concentration (0.33 µg/g; UKOOA, 2001). As for THC content, only the Little Dotty (48/30-15z) & MTM site sediments n-alkane levels exceeded the SEA2 sandbanks survey mean concentrations (0.16 µg/g; ERT, 2003a).

PAH concentrations (2 to 6 ring PAHs, US EPA 16 PAHs, and naphthalenes, phenanthrenes and dibenzothiophenes (NPD) were variable and comparable to SNS background sediments mean concentration of 97 ng/g (UKOOA, 2001). Low concentrations of the total US EPA 16 PAHs (ranging from 1.4 ng/g to 28.6 ng/g) and NPD (<1 ng/g to 49 ng/g) were recorded at all sites. All sediment PAH levels were below the effects range low (ERL) toxicity threshold values indicating that concentrations in the Hewett subsea installation sediments were considerably lower than those expected to impact sediment fauna.

In addition, a visual comparison of the gas chromatography–flame ionisation detection (GC-FID) hydrocarbon profiles was undertaken to provide information on the potential origins of the hydrocarbons present in marine sediment samples. The gas chromatographic profiles obtained for most of the sediment samples were broadly similar and were generally typical of a background SNS sediment. However, the GC-FID profiles at four Little Dotty (48/30-15z) & MTM stations were indicative of a mineral oil-based drilling fluid input, similar in composition to Ecosol, and the GC-FID profile obtained at one Dawn station (HEW-DAWN-GR1) indicated evidence of a low level alkylbenzene synthetic drilling fluid input. However, the concentrations detected were low and did not increase the sediment THC concentrations above typical background levels for the SNS, additionally, the closest stations were located approximately 80m from the Little Dotty well and 35m from the Dawn well.

6.3.4 Sediment Metal Content

The sediment samples acquired from the five subsea well survey areas were analysed for selected metals: aluminium, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, strontium, vanadium and zinc. The current OSPAR Co-ordinated Environmental Monitoring Programme (CEMP) environmental focus around heavy metals is on cadmium, mercury and lead (OSPAR, 2014a), all of which have the potential for bioaccumulation. The concentrations of metals in the sediments were compared to the UKOOA, ERT and ERL concentrations, with exceedances above these criteria presented in Table 6.5. It should be noted that the concentration of cadmium and mercury did not exceed any of the UKOOA, ERT and ERL concentrations at any of the sample stations for any of the subsea wells, therefore, the results for these metals have not been presented in Table 6.5.

[6] SEA2 covers the area encompassing the central spine of the North Sea which contains the majority of existing UK oil and gas fields.

Table 6.5: Metal Concentrations in Sediment (Fugro, 2019b)

Subsea well	Sample Station	Recorded Exceedance of Mean Background levels (µg/g)***								
		Arsenic 10.9**	Chromium 4.00**	Copper 3.83*	Iron 7595*	Manganese 112**	Nickel 5.47*	Lead 8.39*	Vanadium 17.0**	Zinc 10.0**
Dawn	HEW-DAWN-GR1	25.6	4.87		8780	394			31.9	16.5
	HEW-DAWN-GR2	19.4	4.18			227			27.1	
	HEW-DAWN-GR3	11.9	4.36						18.9	
	HEW-DAWN-GR4	20.8				142			27.2	
	HEW-DAWN-GR5	24.3	4.48		8350	221			31.7	
	HEW-DAWN-GR6	67.9	6.36		19600	554		13.6	77.2	25.9
	HEW-DAWN-GR7	35.4	5.16		11800	328			40.2	21.2
	HEW-DAWN-GR8	23.4	4.80		8090	166			29.4	
Deborah & 48/30-13	HEW-DEB-GR1	16.1							19.7	
	HEW-DEB-GR2	20.8	4.11			141			24.2	
	HEW-DEB-GR3	50.3	5.61		14700	391		10.6	53.9	23.7
	HEW-DEB-GR4	33.4			9420	194			34.2	17.0
	HEW-DEB-GR5	30.1	6.47		29100	614	6.32	13.2	91.1	35.1
	HEW-DEB-GR6	100	4.16		8610	188			28.2	
	HEW-DEB-GR7	24.0	5.11		13900	403		8.92	48.7	24.5
	HEW-DEB-GR8	20.0	4.84		8150	221			27.9	17.0
	HEW-DEL-GR1		4.56							

Subsea well	Sample Station	Recorded Exceedance of Mean Background levels (µg/g)***								
		Arsenic 10.9**	Chromium 4.00**	Copper 3.83*	Iron 7595*	Manganese 112**	Nickel 5.47*	Lead 8.39*	Vanadium 17.0**	Zinc 10.0**
Della & Delilah & PLEM	HEW-DEL-GR2	45.5	5.70		14500	301			49.4	19.0
	HEW-DEL-GR3	27.9	5.33		8870	170			32.0	
	HEW-DEL-GR4	17.2	4.82						21.4	
	HEW-DEL-GR5	51.5	6.64		14500	305		9.34	51.9	20.2
	HEW-DEL-GR6	43.7	6.33		13400	390		8.51	44.4	19.2
	HEW-DEL-GR7	18.9	4.26			154			22.7	
	HEW-DEL-GR8	32.5	4.51		10000	264			41.0	18.8
Little Dotty (48/30-15z) & MTM	HEW-LDT-GR1		16.5	4.72	10400	164	11.7		28.3	29.4
	HEW-LDT-GR3	14.0				142			21.8	
	HEW-LDT-GR4		14.1		11500	180			27.7	
	HEW-LDT-GR5	13.6				135			23.2	
	HEW-LDT-GR6					182			20.8	
	HEW-LDT-GR7	54.8			14800	476		12.5	68.1	27.6
	HEW-LDT-GR8	33.1			9550	357			41.8	18.6
Little Dotty (48/30-9)	HEW-LDB-GR1	22.7	5.78		8000	221			33.6	
	HEW-LDB-GR2	24.4	5.36		8890	176			34.1	
	HEW-LDB-GR3	26.2	6.18		9440	220			35.5	17.6
	HEW-LDB-GR4	14.3	5.45			131			20.7	

Subsea well	Sample Station	Recorded Exceedance of Mean Background levels (µg/g)***								
		Arsenic 10.9**	Chromium 4.00**	Copper 3.83*	Iron 7595*	Manganese 112**	Nickel 5.47*	Lead 8.39*	Vanadium 17.0**	Zinc 10.0**
	HEW-LDB-GR5	13.1	8.09						25.0	
	HEW-LDB-GR6	58.6	6.57		16700	475		9.46	64.0	24.0
	HEW-LDB-GR7	16.2	7.29		8090	145			31.1	
	HEW-LDB-GR8	13.2	8.25			154			22.8	
ERL (OSPAR, 2014a)		-	81.0	34.0	-	-	-	47.0	-	150

*Mean estimated from data reported at stations greater than 5km from active platforms in the SNS from 1975 to 1995 (UKOOA, 2001) (µg/g). Data determined by a partial digest.

**Data collected from the major sandbanks off the coast of Norfolk and Lincolnshire in the southern North Sea (SNS) in 2001 (ERT, 2003b) (µg/g)

*** The survey sediment samples were analysed using a 50 % nitric acid digest technique, followed by multi element analysis by ICP-MS or ICP-OES. This provides a partial digest and the results obtained from this method are typically considered indicative of the concentration of metals available for biological interactions. Analysis of mercury was by CV-AFS.

The concentrations of metals in the sediments demonstrated low to moderate variation across the five subsea installation survey areas. In general, metal concentrations were below the mean background concentrations for the SNS. The metal concentrations recorded across the five survey areas were comparable to, or lower than the reference stations. None of the sediment heavy and trace metal concentrations recorded across the survey areas and reference stations exceeded their respective OSPAR CEMP ERL values, where available. Consequently, the concentrations of bioavailable metals in the subsea well survey areas are not expected to result in detrimental effects on sediment macrofaunal communities.

All reported metal concentrations were well below their respective ERL levels. Arsenic concentrations were reported above the ERT (2003a) values at most of the survey areas and reference stations, however, no relationship between the concentration and distance from the Hewett infrastructure could be identified and it is likely that arsenic concentrations are a natural feature of the sediments in the area. In fact, no spatial patterns were observed for any of the metals in relation to the distance from the subsea installations.

Mean iron and vanadium concentrations were above the UKOOA and ERT values at all survey areas. Iron and vanadium levels, however, also exceeded the UKOAA and ERT values at reference stations which were greater than 3.6km away from the Hewett subsea installations. Mean chromium and zinc concentrations were comparable to or slightly higher than ERT values (and UKOOA value for chromium) at all survey areas. All other metals mean concentrations were reported below or comparable to regional background data UKOOA and ERT values.

6.3.5 Oceanography

A summary of temperature and salinity properties for the Hewett Field Area are provided in Table 6.6.

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 10ºC.

Saline water of North Atlantic origin enters the southern North Sea via the Dover Straits, and this tends to lead to generally more salty water in the most southerly parts of the North Sea. Although slightly lower than in winter (when averages are 35.0-35.2%), salinity values remain relatively high in summer along the centre of the English Channel (between 34.75-35.0%), owing to the eastward movement of Atlantic water. Salinity values decrease towards the coast in both summer and winter but normally remain above 34.5%, except locally at river mouths where there is dilution from freshwater discharge (DECC, 2016).

Table 6.6: Temperature and salinity in the Hewett Field Area
(Marine Scotland, 2021, Physe, 2013 and DECC, 2016)

	Summer	Winter	Annual
Mean Sea Surface Temperature (ºC) (0-5m)	12.1	8.3	10.2
Mean Seabed Temperature (ºC) (below 30m)	11.9	8.0	9.9
Mean Sea Surface Salinity (%) (0-5m)	34.5	34.5	34.5
Mean Seabed Salinity (%) (0-5m)	34.5	34.5	34.5

The wave climate in the Hewett Field Area is seasonal (DECC, 2016) with maximum mean wave heights of around 1.6m during the winter months and 0.8m in the summer. Wave periods vary between 3 to 7 seconds (83% of time). The annual mean significant wave height is 1.2m and, as shown in Table 6.7, the significant wave height exceeds 4m for 1.3% of the time. The waves are multidirectional, but predominantly from the north (Physe, 2013).

Table 6.7: All-Yearly Significant Wave Height Exceedance (Fugro Geos, 2011 and Physe, 2013)

Exceedance (%)	0.04	1.3	4.8	9.3	18	33	59	90.5
Wave Height (m)	6.0	4.0	3.0	2.5	2.0	1.5	1.0	0.5

6.3.6 Meteorology

Winds in this region of the southern North Sea are generally from between south and north-west, with the frequency of northerly and easterly winds increasing in spring (DECC, 2016) as illustrated in Figure 6.12. 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).

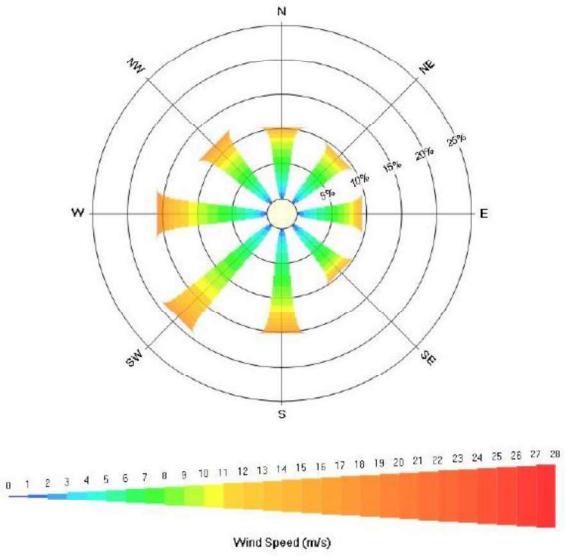


Figure 6.12: Hewett Field Area Wind Speed Rose – Annual (Physe, 2013)

6.4 Biological Sensitivities

6.4.1 Plankton

Plankton acts as an important link between the biological and physical components of the ecosystem. Members of the plankton are key producers and primary consumers in marine ecosystems, which makes them pivotal in energy/biomass transfer and, as such, their population changes will have impact on organisms at higher trophic levels with environmental and economic consequences (DECC, 2016).

Plankton are drifting organisms that inhabit the pelagic zone within the North Sea and include single celled organisms such as bacteria as well as plants (phytoplankton) and animals (zooplankton). Phytoplankton are the autotrophic components of the plankton community and a key part of the ecosystems food web that the Hewett Field Area is located in. Therefore, the distribution of plankton directly influences the movement and distribution of other marine species.

The composition of plankton community reflects environmental conditions of the shallow, well-mixed waters. The Southern North Sea region is largely enclosed by land and, as a result, the environment is dynamic, with considerable tidal mixing and nutrient-rich run-offs from the land [eutrophication reinforced by increased rainfall which is caused by the NAO (North Atlantic Oscillation) (DECC, 2016)]. 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 is dominated by the dinoflagellate genus Tripos (*T. fusus, T. furca, T. lineatus*), along with higher numbers of the diatom, *Chaetoceros* (subgenera *Hyalochaete* 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 in the North Sea is dominated by calanoid copepods, although other groups such as Paracalanus and Pseudocalanus are also abundant. There is also a high biomass of Calanus larval stages present in the region. Euphausiids, Acartia, and decapod larvae are all important components of the zooplankton assemblage (DECC, 2016). Meroplankton are the larval stages of benthic organisms that spend a short period of their lifecycle in a pelagic stage. An important group within this category are the echinodermata, whose larvae are the distributive stages of starfish and sea urchins, and they remain part of the plankton community until they settle on the benthos (SAHFOS, 2001). Fish larvae (e.g. sand eel) are also an important component of the zooplankton community.

6.4.2 Benthos

Seabed sediments observed across the five subsea installation survey areas consisted of rippled sand, with varying proportions of shell fragments, hence classified as the biotope complex ‘Circalittoral coarse sediment’ (A5.14). The biotope complex is described as tide-swept circalittoral coarse sands, gravels and shingle generally in water depths over 15m to 20m. This habitat has been observed along exposed coasts as well as offshore. This habitat may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves. The seabed within the five subsea well survey areas and the three reference stations was categorised within the broad habitat of ‘subtidal sands and gravels’, a priority habitat within UK waters. However, this habitat is thought to be of low conservation significance as this sediment type is widely distributed and will be represented elsewhere within the MPA network (Fugro, 2019a). Table 6.8 identifies the infaunal and epifaunal community that inhabits the five subsea installation survey areas.

Table 6.8: Infaunal and Epifaunal community in the Hewett Field Area (excluding fish)

Fauna	Class	Dawn	Deborah & 48/30-13	Della & Delilah & PLEM	Little Dotty (48/30-15z) & MTM	Little Dotty (48/30-9)
Crustacea	Crabs (Necora puber and Cancer pagurus, Liocarcinus sp.)	-	✓	✓	✓	✓
	Hermit Crabs (Paguridae including Pagurus bernhardus, Brachyura including Necora puber)	✓	✓	✓	✓	✓
	Lobster (Homarus gammarus)	-	✓	-	-	-
Echinoderms	Brittlestars (*Ophiuridae* including *Ophiura ophiura*)	✓	-	-	-	-
	Starfish (Asterias rubens)	-	✓	✓	-	-
Anthozoa	Anemones (Actiniaria including Sagartia sp., Metridium dianthus and Urticina sp.)	✓	✓	✓	✓	✓
Hydrozoa	Hydroids e.g. faunal turf (Hydrozoa - *Nemertesia* sp., *Tubularia indivisa* and *Hydrallmania falcate*)	✓	✓	✓	✓	✓
Gymnolaemata	Bryozoan (Vesicularia spinosa, Alcyonidium diaphanum and Flustra foliacea)	✓	✓	✓	✓	✓
Polychaetes	Ross worm S. spinulosa	✓	✓	✓	✓	✓
	Polychaeta including Pectinidariidae, Serpulidae (including Spirobranchus sp.), Tube-building worm Lanice conchilega	✓	✓	✓	-	-

The baseline analysis of sediment macrofauna identified features of the benthic taxa communities. Table 6.9 outlines the taxa identified at each subsea installation survey area, all of which were dominated by annelids.

Table 6.9: Taxonomic groups identified at each asset survey area

Taxonomic group	Dawn			Deborah & 48/30-13		
	Number of Taxa	Composition of taxa (%)	Abundance	Number of Taxa	Composition of taxa (%)	Abundance
Annelida	39	54.1	481	30	54.4	535
Arthropoda	22	30.6	194	14	25.5	282
Mollusca	5	6.9	71	4	7.3	30
Echinodermata	2	2.8	13	3	5.5	6
Other phyla*	4	5.6	10	4	7.3	26
Total Taxa	72	100	769	55	100	879
Taxonomic group	**Della & Delilah & PLEM**			**Little Dotty (48/30-15z) & MTM**		
	Number of Taxa	**Composition of taxa (%)**	**Abundance**	**Number of Taxa**	**Composition of taxa (%)**	**Abundance**
Annelida	41	61.1	396	75	58.6	2438
Arthropoda	15	22.4	364	30	23.4	567
Mollusca	4	6.0	28	11	8.6	694
Echinodermata	3	4.5	13	5	3.9	128
Other phyla*	4	6.0	38	7	5.5	481
Total Taxa	67	100	839	128	100	4308
Taxonomic group	**Little Dotty (48/30-9)**					
	Number of Taxa	**Composition of taxa (%)**	**Abundance**			
Annelida	67	57.9	2062			
Arthropoda	26	22.4	530			
Mollusca	12	10.3	126			
Echinodermata	4	3.4	98			
Other phyla*	7	6.0	303			
Total Taxa	116	100	3119			

*Other phyla include: Cnidaria, Nemertea, Phoronida, Platyhelminthes and Sipuncula.

A total of 769 animals and 72 taxa were identified at the Dawn survey area. Annelid individuals of the genus *Polycirrus* were the most dominant and most abundant taxon, followed by the annelid *O. borealis* and the mollusc *Abra prismatica*. Three of the top ten taxa reported, including the annelids *Polycirrus* and *O. borealis*, and the arthropod *Eurydice spinigera* occurred in all stations sampled. Some differences were noted between

the abundance and dominance ranks. Species accumulation and richness estimates suggest that between 64% and 78% of the area's total faunal diversity has been detected by the sampling undertaken.

A total of 879 animals and 55 taxa were identified at Deborah survey area, which includes the 48/30-13 E&A well location. Some differences were noted between the abundance and dominance ranks. Annelid individuals of the genus *Polycirrus* were the most dominant, but third most abundant group across the Deborah survey area, followed by the annelid *O. borealis* and the arthropod *Urothoe brevicornis*. *O. borealis* was the second most dominant and abundant taxon, whereas *U. brevicornis* was the third most dominant, but most abundant taxon across the survey area. Only two of the top ten taxa reported, including the annelids *Polycirrus* and *Scoloplos armiger*, occurred in all stations sampled. Annelid individuals identified as *Notomastus* were the eleventh most dominant, but fifth most abundant group, due to its high numbers recorded at station HEW-DEB-GR6. Species accumulation and richness estimates suggest that between 47% and 72% of the area's total faunal diversity has been detected by the sampling undertaken.

A total of 839 animals and 67 taxa were identified at Della & Delilah & PLEM survey area. Differences were noted between the abundance and dominance ranks. Annelid individuals of the genus *Polycirrus* were the most dominant, but fourth most abundant group across the survey area. The arthropod *U. brevicornis* that was the second most dominant and abundant taxon. *S. spinulosa* was the third most dominant, but most abundant taxon across the survey area due to its high abundance recorded at station HEW-DEL-GR1. None of the top ten taxa reported, occurred in all stations sampled. Species accumulation and richness estimates suggest that between 71% and 86% of the area's total faunal diversity has been detected by the sampling undertaken.

A total of 4308 animals and 128 taxa were identified at Little Dotty (48/30-15z) & MTM survey area, illustrated in Figure 6.13 and Figure 6.14, proving this is by far, the most diverse and abundant biomass area. The annelid *S. spinulosa* was the most dominant and most abundant taxon across the survey area, whereas the echinoderm *Amphipholis squamata* was the second most dominant and sixth most abundant taxon. Only three of the top ten taxa reported, including *A. squamata*, annelids classified as *Polycirrus* and nemerteans (*Nemertea*), occurred in all stations sampled. Differences were noted between the abundance and dominance ranks. Species accumulation and richness estimates suggest that between 76% and 85% of the area's total faunal diversity has been detected by the sampling undertaken.

A total of 3119 animals and 116 taxa were identified at Little Dotty (48/30-9) survey area. The annelid *S. spinulosa* was the most dominant and most abundant taxon across the survey area, whereas *Actiniaria* was the second most dominant and third most abundant taxon. Only two (the annelids *S. spinulosa* and *Polycirrus*) of the top ten taxa reported, occurred in all stations sampled. Some differences were noted between the abundance and dominance ranks. The arthropod *Pisidia longicornis* was the fourth most dominant but second most abundant taxon due to its high abundance at station HEW-LDB-GR8. The annelid *Lagis koreni* was the ninth most dominant, but twelfth most abundant taxon, whereas *Nemertea* was the tenth most dominant, but fourteenth most abundant taxon. Species accumulation and richness estimates suggest that between 67% and 79% of the area's total faunal diversity has been detected by the sampling undertaken.

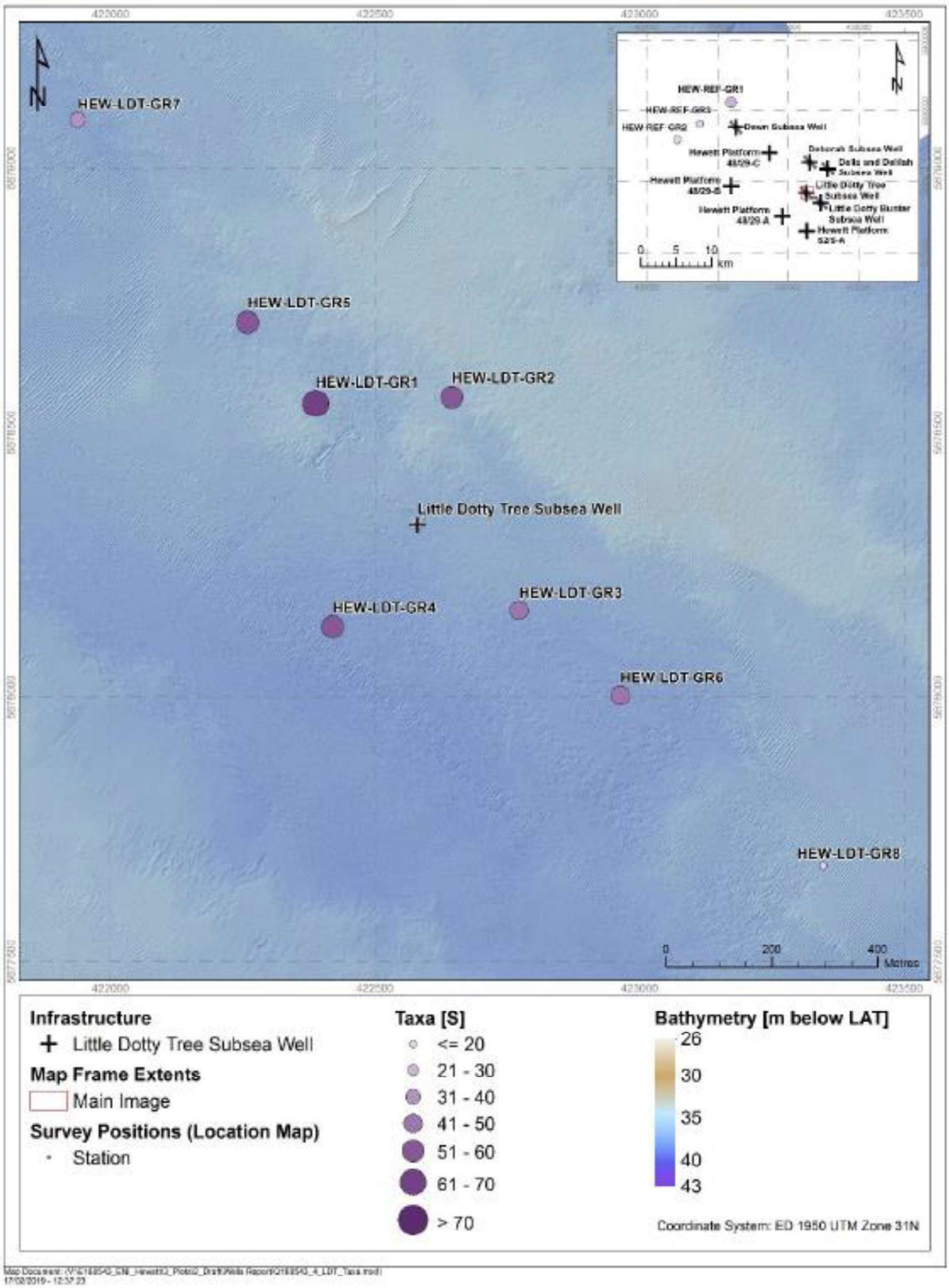


Figure 6.13: Spatial Distribution of Mean Number of Taxa per 0.2m^2 at Little Dotty (48/30-15z) & MTM (Fugro, 2019b)

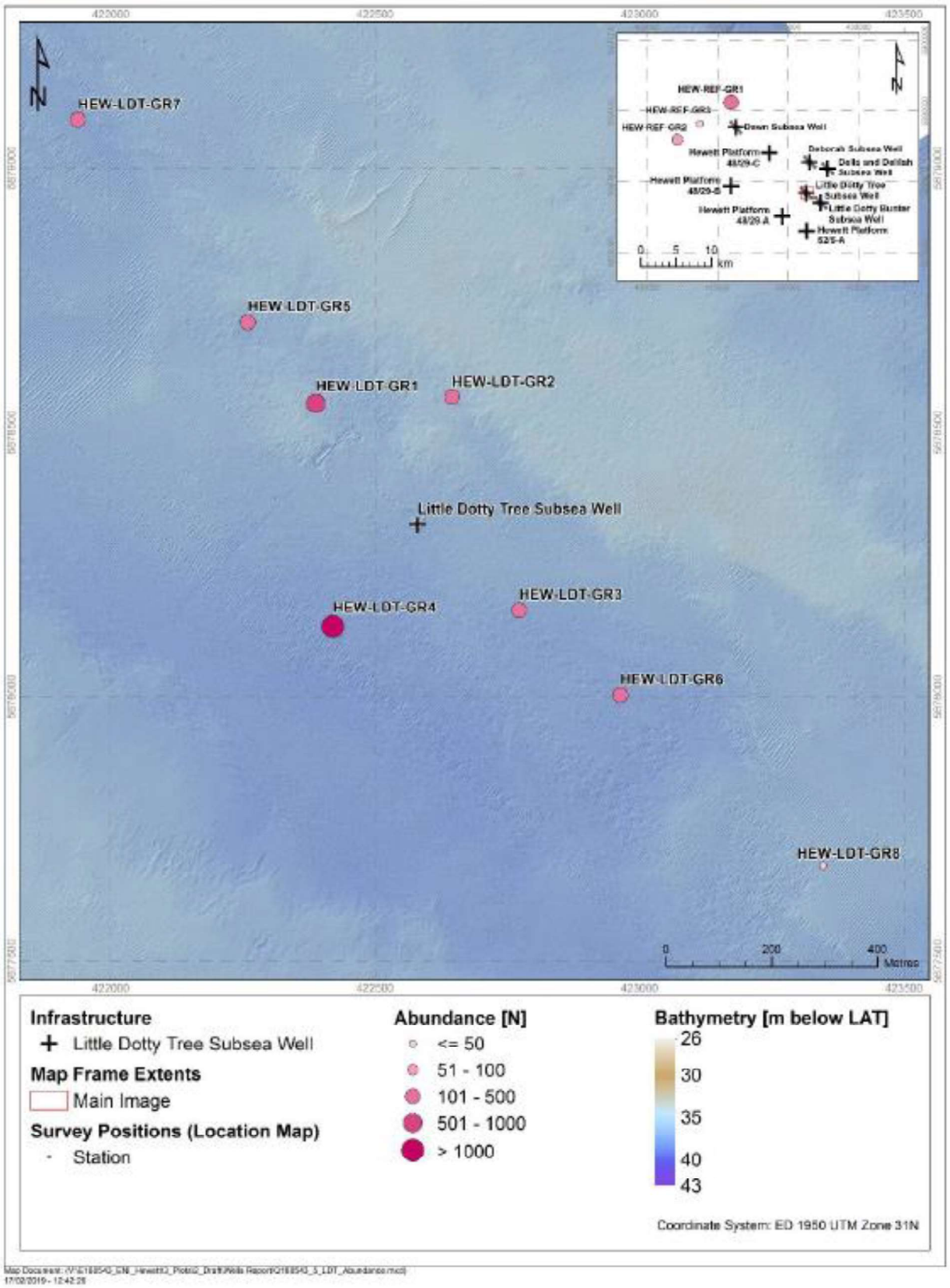


Figure 6.14: Spatial Distribution of Mean Number of Individuals per 0.2m^2 at Little Dotty (48/30-15z) & MTM (Fugro, 2019b)

All video and geophysical data collected during the pre-decommissioning environmental baseline surveys were reviewed by Fugro using the Joint Nature Conservation Committee (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).

S. spinulosa classified as 'Medium Reef' was identified 250 metres north-north east of the Little Dotty (48/30-15z) well and about 1 km east of Della & Dellilah well cluster and the PLEM.

A 'Low Reef' classification was given to several areas. The 'Low' reefs closest to each of the wells were found approximately 532m south east of the Dawn well, 745m east of the Deborah well cluster, 800m east of the Della & Delilah well cluster and the PLEM, 245m south west of Little Dotty (48/30-15z) well, about 445 m south west of the MTM and 250m north west and north east of Little Dotty (48/30-9) well.

Table 6.10 provides an estimated coverage of *S. spinulosa* over each ground truthed transect (excluding transects where no *S. spinulosa* were present), with potential *S. spinulosa* categorised following the 'reefiness' structure matrix. *S. spinulosa* reef is listed as an Annex I habitat under the Habitats Directive (Council Directive 92/43/EEC) and a UK BAP priority marine habitat (JNCC, 2007).

Table 6.10: *S. spinulosa* identified at the Subsea Installation Survey Areas (Fugro, 2019b)

Transect	Percentage of transect (%)				
	No emergent *Sabellaria*	**Not Reef**	**Low Reef**	**Medium Reef**	**High Reef**
Dawn Survey Area					
HEW-DAWN-TR1	83.5	14.2	2.3	0	0
Deborah & 48/30-13 Survey Area					
HEW-DEB-TR2	53.2	45.6	1.2	0	0
Della & Delilah & PLEM Survey Area					
HEW-DEL-DD1	18.3	81.7	0	0	0
HEW-DEL-DD7	0	100	0	0	0
HEW-DEL-TR1	9.6	58.1	22.9	9.4	0
HEW-DEL-TR3	0	100	0	0	0
HEW-DEL-TR4	3.5	76.5	20.0	0	0
Little Dotty (48/30-9) Survey Area					
HEW-LDB-DD1	0	79.7	20.3	0	0
HEW-LDB-DD2	0	79.7	20.3	0	0
HEW-LDB-DD3	0	100	0	0	0
HEW-LDB-DD4	13.3	86.7	0	0	0
HEW-LDB-DD5	0	100	0	0	0
HEW-LDB-DD6	100	0	0	0	0
HEW-LDB-DD7	14.8	85.2	0	0	0

HEW-LDB-DD8	20.9	38.3	40.8	0	0
HEW-LDB-TR1	87.7	11.3	1	0	0
HEW-LDB-TR2	8.5	74.4	17.1	0	0
Little Dotty (48/30-15z) & MTM Survey Area					
HEW-LDT-DD1	0	100	0	0	0
HEW-LDT-DD2	4	29	0	67	0
HEW-LDT-DD2a	0	96	4	0	0
HEW-LDT-DD3	0	100	0	0	0
HEW-LDT-DD4	0	92	8	0	0
HEW-LDT-DD5	0	89	11	0	0
HEW-LDT-DD6	0	100	0	0	0
HEW-LDT-TR1	91	9	0	0	0
HEW-LDT-TR3	83	17	0	0	0

Further areas were identified as 'Not a Reef', however due to the mobile sands of the Hewett Field Area it was not possible to rule out the potential for *S. spinulosa* in locations where it was not observed during video photography. Certain patches were therefore reclassified from 'Not a Reef' to 'No Emergent *Sabellaria*'. No emergent areas of *S. spinulosa* have been delineated at transect HEW-DEL-TR1 approximately 1.1 km to the east and HEW-DEL-TR4 approximately 800 m to the south west of the Della & Delilah subsea well cluster and the PLEM.

An additional *S. spinulosa* assessment (using the same criteria for assessing reefiness as noted above) was undertaken by Fugro using visual footage obtained by Gardline during a borehole survey. The type of reef and percentages of *S. spinulosa* identified at each location during the borehole survey are provided in Table 6.11.

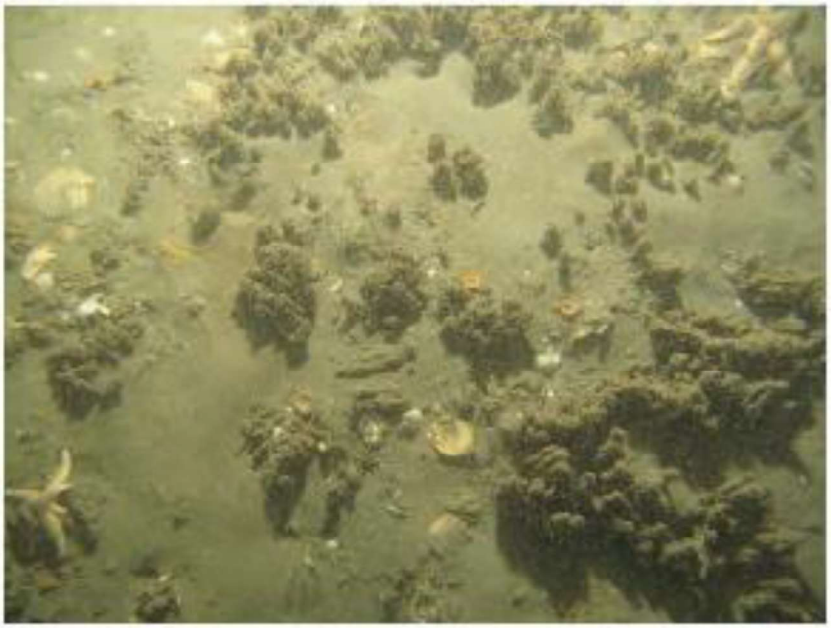
Table 6.11: *S. spinulosa* identified during the Borehole Survey (Fugro, 2019c)

Asset	Percentage of transect (%)				
	No emergent *Sabellaria*	Not Reef	Low Reef	Medium Reef	High Reef
Dawn Well 48/29-9	98.5	1.5	0	0	0
Deborah Well 48/30-10	82.6	17.4	0	0	0
Deborah Well 48/30-14	82.6	17.4	0	0	0
Della Well 48/30-11z	68.2	31.8	0	0	0
Delilah Well 48/30-18	0	92.0	8.0	0	0
Little Dotty 48/30-15z	0	37.4	48.5	14.1	0
Little Dotty 48/30-9	92.8	7.2	0	0	0

It can be seen that of the area surveyed at Dawn, Deborah, Della and Little Dotty (48/30-9), 68-98% were identified as having 'No emergent *Sabellaria*' with the remaining 2-32% classed as 'Not a Reef'. At the Delilah well 92% of areas were identified as 'Not a Reef' and 8% as 'Low Reef'. The most notable reefs were observed at Little Dotty (48/30-15z) where 14.1% were identified as 'Medium Reef' and 48.5% as 'Low Reef', both of these aggregations were identified approximately 50m south-west of the Little Dotty (48/30-15z) well, with the remaining 37.4% was classified as 'Not a Reef' (Fugro, 2019c). The areas of 'no emergent *Sabellaria*' closest to the subsea installations are located approximately 43m east of Little Dotty (48/30-9), 41m north east of Deborah (48/30-10), 53m south east of Deborah (48/30-14) and 44m east of Della (48/30-11).

Example photographs of observed 'Medium Reef', 'Low Reef' and 'Not a Reef' at the Little Dotty (48/30-15z) subsea well location are provided in Figure 6.15, Figure 6.16 and Figure 6.17 respectively.

Identified *S. spinulosa* at the subsea installation locations are shown in the figures provided in Section 6.1, namely Figure 6.1 (Dawn Subsea Well 48/29-9), Figure 6.2 (Deborah Subsea Wells 48/30-8, 48/30-10 and 48/30-14 and 48/30-13 E&A well), Figure 6.3 (Della Subsea Well 48/30-11z, Delilah Subsea Well 48/30-18 and PLEM), Figure 6.4 (Little Dotty Subsea Well 48/30-15z and MTM) and Figure 6.5 (Little Dotty Subsea Well 48/30-9).



DD2_09: Easting: 422643.1 Northing: 5878568.1
Sediment Type: Sand with shell fragments
Fauna: Ross worm (*Sabellaria spinulosa*), faunal turf, starfish (*Asterias rubens*)
Reef: 'Medium reef'

DD2_17: Easting: 422648.0 Northing: 5878560.4
Sediment Type: Sand with shell fragments
Fauna: Ross worm (*Sabellaria spinulosa*), faunal turf, crustacean
Reef: 'Medium reef'

Figure 6.15: Photographs of *S. spinulosa* identified as 'Medium Reef' at Little Dotty (48/30-15z) Subea Well (Fugro, 2019a)

DD5_09: Easting:422255.5 Northing: 5878707.9
Sediment Type: Sand with shell fragments
Fauna: Ross worm (*Sabellaria spinulosa*), faunal turf, crab (Brachyura)
Reef: 'Low reef'

DD5_10: Easting: 422256.5 Northing: 5878705.8
Sediment Type: Sand with shell fragments
Fauna: Ross worm (*Sabellaria spinulosa*), faunal turf
Reef: 'Low reef'

Figure 6.16: Photograph of *S. spinulosa* identified as 'Low Reef' at Little Dotty (48/30-15z) Subsea Well (Fugro, 2019a)

DD5_03: Easting: 422252.7 Northing: 5878715.2
Sediment Type: Sand with shell fragments
Fauna: Ross worm (*Sabellaria spinulosa*), faunal turf, hermit crab (Paguroidea)
Reef: 'Not a reef'

DD2_03: Easting: 422640.4 Northing: 5878573.4
Sediment Type: Sand and clay with shell fragments
Fauna: Ross worm (*Sabellaria spinulosa*), faunal turf, hermit crab (Paguroidea)
Reef: 'Not a reef'

Figure 6.17: Photograph of *S. spinulosa* identified as 'Not a Reef' at Little Dotty (48/30-15z) Subsea Well (Fugro, 2019a)

6.4.3 Fish and Shellfish

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.

Table 6.12 identifies the fish species which were observed in the vicinity of the Hewett subsea installations during the Pre-Decommissioning Survey (Fugro, 2019b).

Table 6.12: Fish species identified within the Hewett Field Area (Fugro, 2019b)

Fauna / Class	Species	Dawn	Deborah & 48/30-13	Della & Delilah & PLEM	Little Dotty (48/30-15z) & MTM	Little Dotty (48/30-9)
Actinopterygii	Common Dragonet (*Callionymus sp.*)	✓	-	✓	✓	✓
	Pogge (Agonus cataphractus)	✓	-	✓	✓	✓
	Dab (Limanda limanda)	✓	✓	-	✓	-
	Sole (Solea solea)	✓	-	✓	-	-
	Yellow Sole (Buglossidium luteum)		✓	-	-	-
	Juvenile Gadoid fish (Gadidae)	✓	-	-	-	-
	Gadoid (Gadidae including *Merlangius merlangus*)	✓	-	-	✓	-
	Sand Eels (*Ammodytidae*)	✓	✓	-	-	-
	Gobies (Pisces including Gobiidae and Cottidae)	✓	✓	✓	✓	✓
	Butterfish (Pholis gunnellus)	✓	-	✓	-	-
	Mackerel (Scomber scombrus)	✓	-	-	-	-
	Gadoid (Gadiformes)		✓	-	-	-
	Unidentified fish (Pisces including Gadiformes)	-	-	-	-	✓
	Unidentified flatfish (Pleuronectiformes)	-	-	✓	✓	✓

The North-East Atlantic and North Sea is split into statistical grids called International Council for the Exploration of the Sea (ICES) Rectangles in order to map statistical information about the area. All the Hewett subsea installations are located within ICES Rectangle 35F1. A number of spawning and nursery grounds for fish species are located within ICES Rectangles 35F as listed in Table 6.13 and illustrated in Figure 6.18 and Figure 6.19.

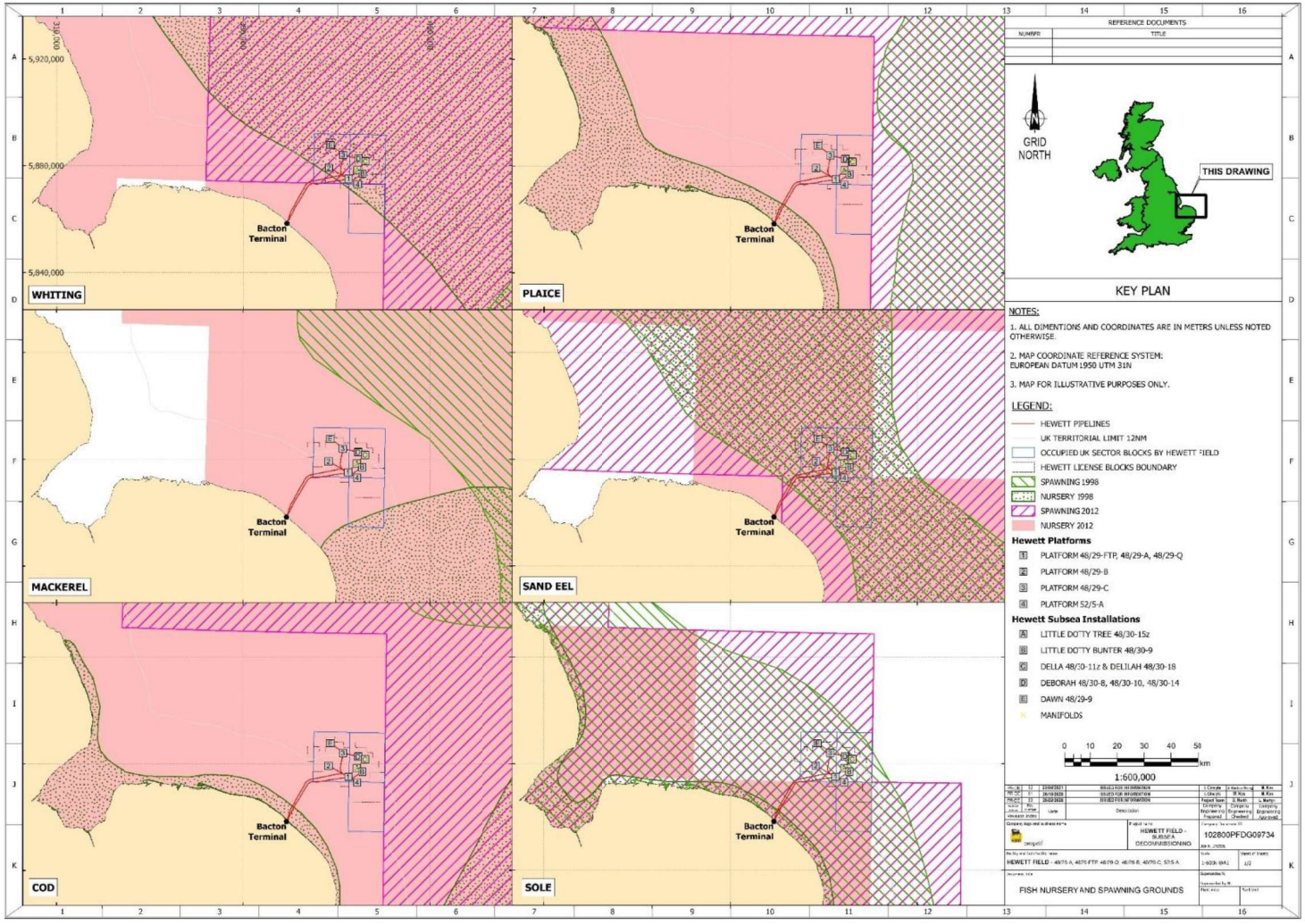


Figure 6.18: Fish Spawning and Nursery Grounds (1 of 2) in the vicinity of the Hewett Field Area

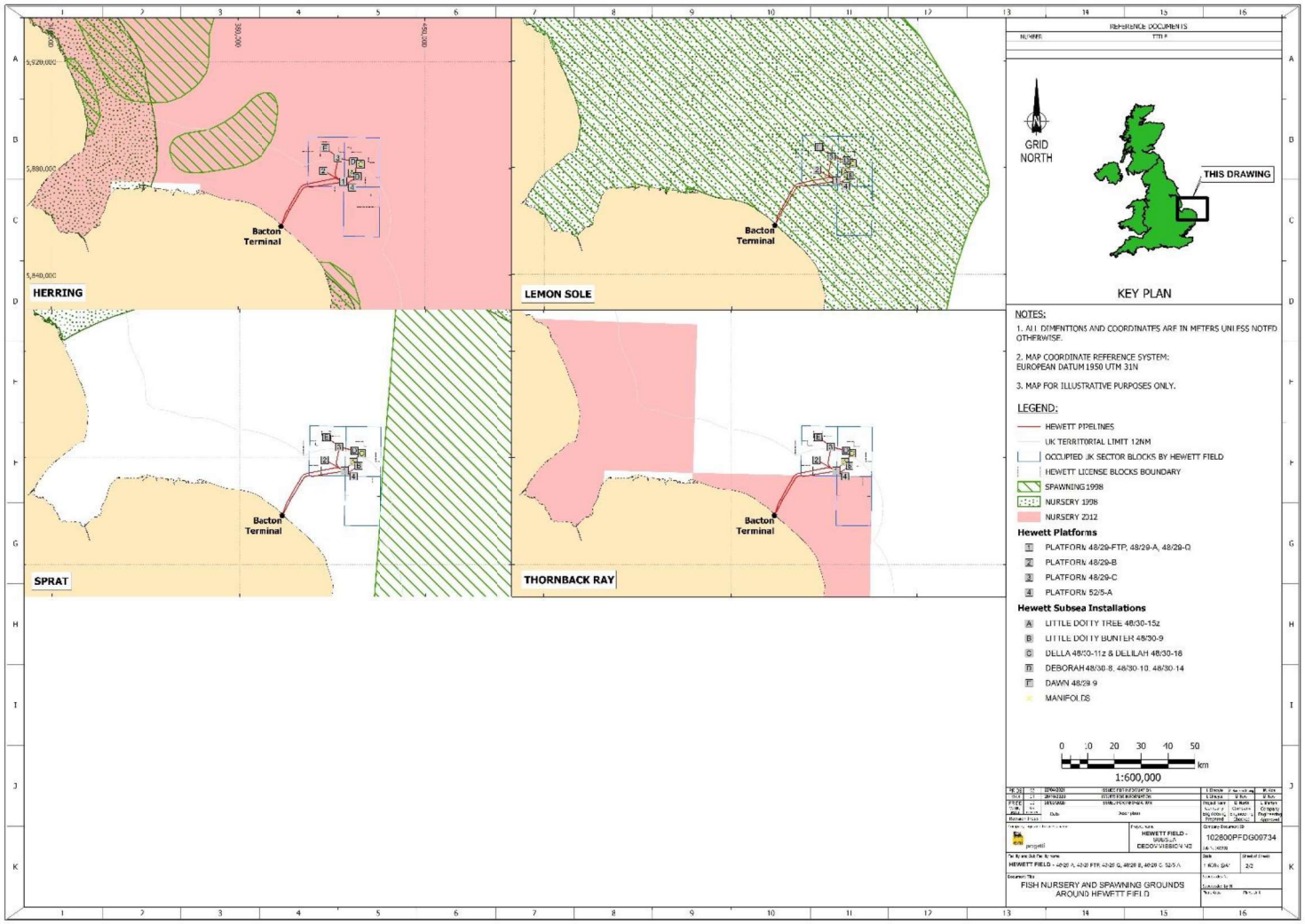


Figure 6.19: Fish Spawning and Nursery Grounds (2 of 2) in the vicinity of the Hewett Field Area

Table 6.13: Spawning and nursery grounds in the vicinity of the Hewett Field Area (Coull *et al*., 1998; Ellis *et al.*, 2012)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Herring (N)												
Mackerel (N)												
Sprat					*	*						
Whiting (N)												
Cod (N)												
Plaice (N)	*	*										
Sole				*								
Lemon sole (N)												
Sand eel (N)												
Thornback ray (N)				*	*	*	*	*				
Spawning	Peak spawning *						N = Nursery area					

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 Hewett subsea installations are in an area of low probability of 0 group fish for cod, blue whiting (*Micromesistius poutassou*), haddock (*Melanogrammus aeglefinus*), anglerfish (*Lophius piscatorius*), hake (*Merluccius merluccius*), Norway pout (*Trisopterus esmarkii*), mackerel, herring, sprat, plaice and sole and moderate probability for horse mackerel (*Trachurus trachurus*) and whiting (Aires *et al*., 2014).

All of the species mentioned above, with the exception of haddock, lemon sole and all the species identified during the Pre-Decommissioning Survey, 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, 2014b). In addition, cod and haddock are listed as 'Vulnerable' globally on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species and should therefore be considered as a priority for protection. All other species are listed as 'Least Concern' (including those identified during the Pre-Decommissioning Survey), aside from sole which is listed as 'Data Deficient' (IUCN, 2021).

6.4.4 Elasmobranchs

Elasmobranch species (sharks, skates and rays) are also an important component of the North Sea ecosystem. Elasmobranchs have a low fecundity and slow growth rate, leaving them vulnerable to over-fishing pressures and pollution events, and subsequent recovery of populations in response to disturbance events is low. Historically, many elasmobranch species have been fishery targets due to their fins and liver oils (Kunzlik, 1988). While many species are no longer subjects of targeted fisheries they are still under threat from commercial pelagic and demersal fishery by-catch. In a survey conducted by CEFAS, 26 elasmobranch species were recorded throughout the North Sea and surrounding waters (Ellis *et al*., 2004). 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 Hewett Field Area are listed in Table 6.14 (Ellis *et al*., 2004).

Table 6.14: Distribution, Abundance and Current Status on the IUCN Red List of the Elasmobranchs Species Likely to be found in the Hewett Field Area (Ellis *et al*., 2004; IUCN, 2021)

Common Name	Latin Name	Location	Depth range (metres)	Global IUCN Status[1]	European IUCN Status[1]
Spurdog	*Squalus acanthias*	widespread	15-528	Vulnerable	Endangered
Lesser-spotted dogfish	*Scyliorhinus canicula*	South and west British borders	6-308	Least Concern	Least Concern
Tope shark	*Galeorhinus galeus*	widespread	17-200	Critically Endangered	Vulnerable
Starry smooth hound	*Mustelus asterias*	widespread	10-199	Near Threatened	Near Threatened
Common smooth hound	*Mustelus mustelus*	South and west British borders	9-421	Vulnerable	Vulnerable
Starry ray	*Amblyraja radiata*	North Sea	32-209	Vulnerable	Least Concern
Cuckoo ray	*Leucoraja naevus*	Irish Sea, Celtic Sea & northern North Sea	12-290	Least Concern	Near Threatened
Blonde ray	*Raja brachyura*	South and west British borders	14-146	Near Threatened	Near Threatened
Thornback ray	*Raja clavata*	South and west British borders	7-192	Near Threatened	Near Threatened
Spotted ray	*Raja montagui*	South and west British borders	8-283	Least Concern	Least Concern
Undulate ray	*Raja undulata*	English Channel	0-72	Endangered	Near Threatened

[1]Status as of July 2021

Of these species, tope shark, undulate ray, blond ray, thornback ray, spurdog, common smooth hound, and starry ray are of most concern due to their unfavourable conservation status (IUCN, 2021). In addition, spotty ray and thornback ray are listed on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2014b).

6.4.5 Marine Mammals

6.4.5.1 Cetaceans

Cetacean abundance in the southern North Sea is relatively low compared to the northern and central North Sea, with the exception of the 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. Harbour porpoise feed mainly on species found on or near the seabed, in the southern North Sea their diet is mainly comprised of whiting, sandeels, European sprat, and herring (Ransijn *et al.,* 2019). White-beaked dolphins' diet is mainly comprised of pelagic species including herring, mackerel, horse mackerel, silvery pout and squid (DECC, 2016).

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. Modelled density for harbour porpoise provides results of more than 3 animals/km^2 for the winter months (October-March) and roughly 1.5 animal/km^2 for the summer months (April-September) (see Figure 6.20) (Heinänen and Skov, 2015).

The UK Statutory Nature Conservation Bodies (SNCBs) have defined Marine Mammal Management Units (MMMUs) 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 MMMUs within which the Hewett subsea installations are located, along with the corresponding abundance of animals within these units, are listed in Table 6.15.

Table 6.15: Estimates of Cetacean Abundance (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		23,528	13,989 – 39,572	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^2) was calculated using the total area of the MMMU and the abundance of animals within that MMMU.
[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.

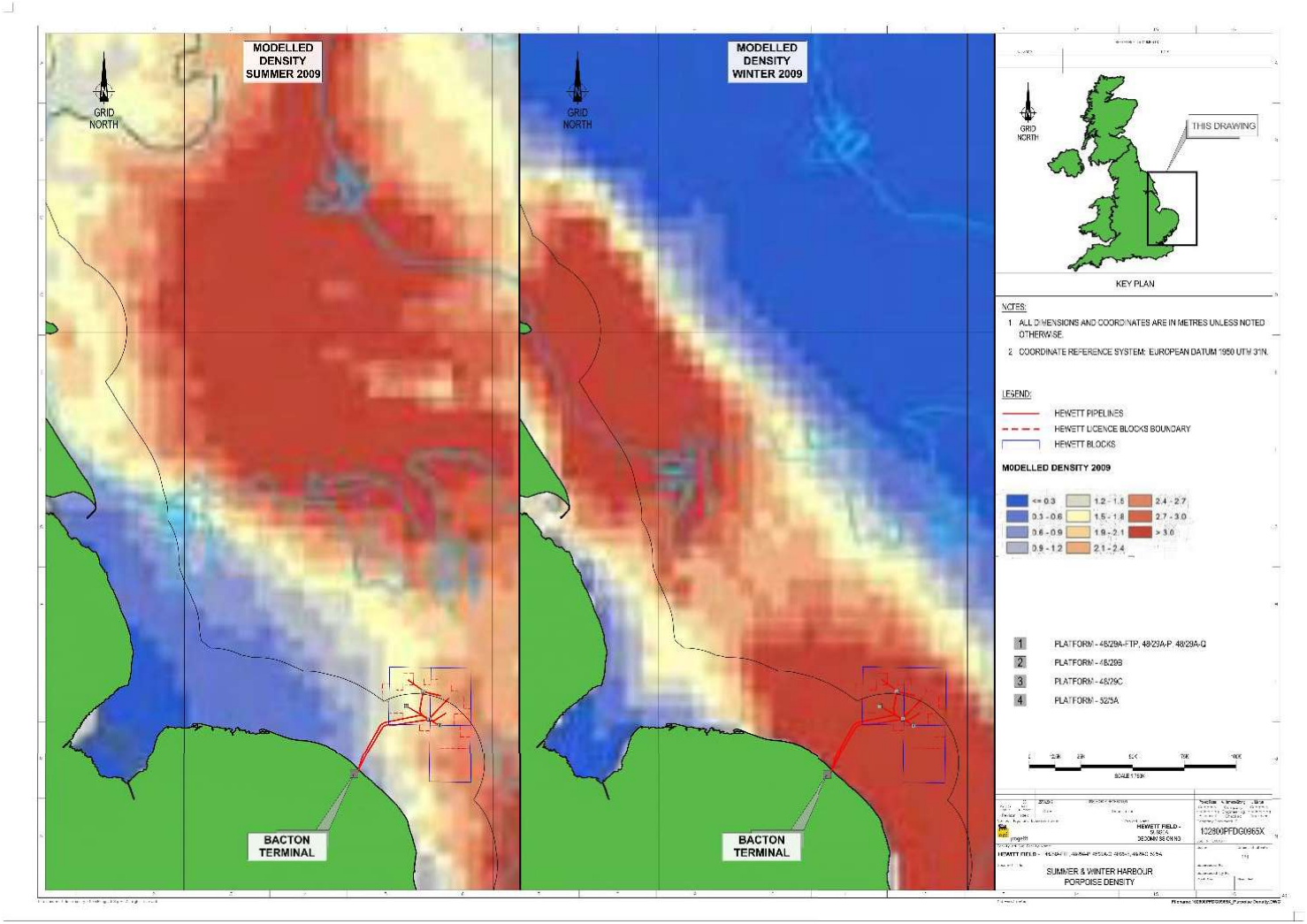


Figure 6.20: Persistently higher density area of harbour porpoise in winter and summer, based on modelled data (after Heinänen and Skov, 2015)

It is evident that harbour porpoises are the most abundant species in the North Sea, despite its MMMU being smaller in area (IAMMWG, 2015). White-sided dolphins are the next most abundant, however this species was not recorded in significant numbers in other surveys.

The relative abundance and density of cetaceans in the vicinity of the Hewett subsea installations can also 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 and density of cetacean species within predefined sectors of the North Sea and North-East Atlantic. The Hewett subsea installations are all situated within SCANS-III Block O in which harbour porpoise, minke whale and white-beaked dolphin have been recorded (see Table 6.16) (Hammond *et al*., 2017). It should be noted that although density estimates are shown in Table 6.16, 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 6.16: 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 animals per km^2.

The density of the harbour porpoise within the SCANS-III Block O is higher than the total surveyed area, again indicating that the area is important for this species. Densities for minke whale were similar to the total surveyed area, whereas densities for the white-beaked dolphin were a magnitude lower as illustrated in Figure 6.21, Figure 6.22 and Figure 6.23.

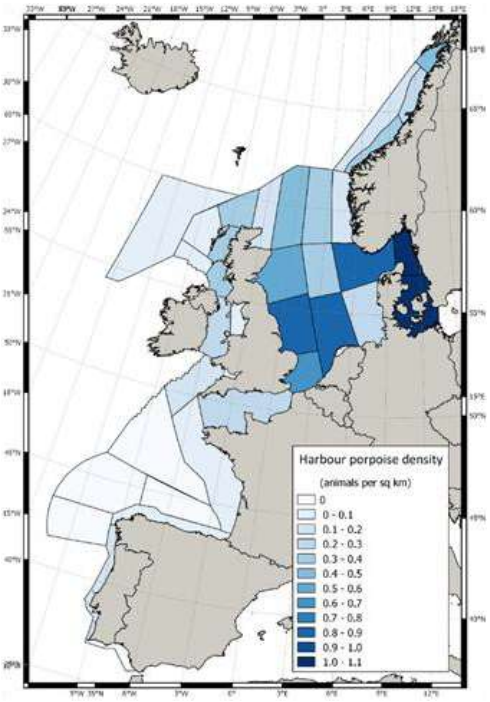


Figure 6.21: Harbour Porpoise sightings observed in SCANS III survey

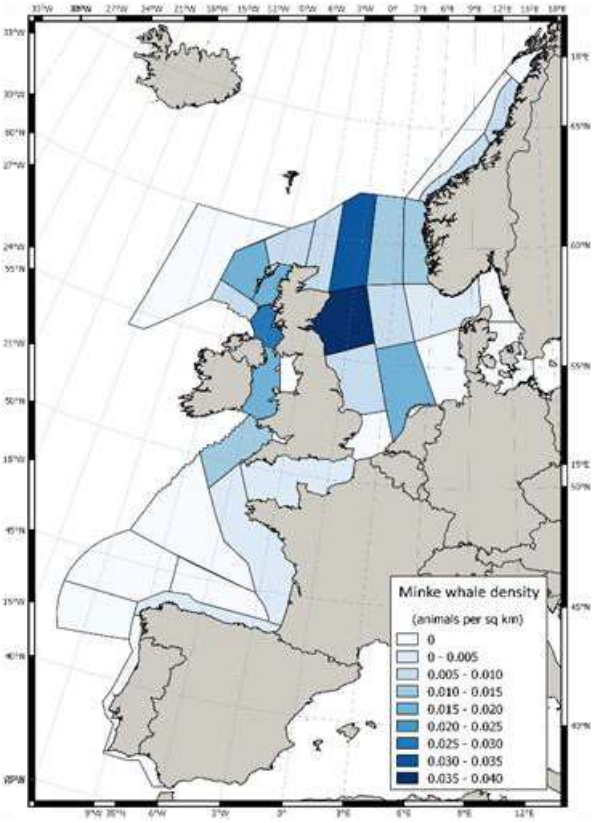


Figure 6.22: Minke whale sightings observed in SCANS III survey

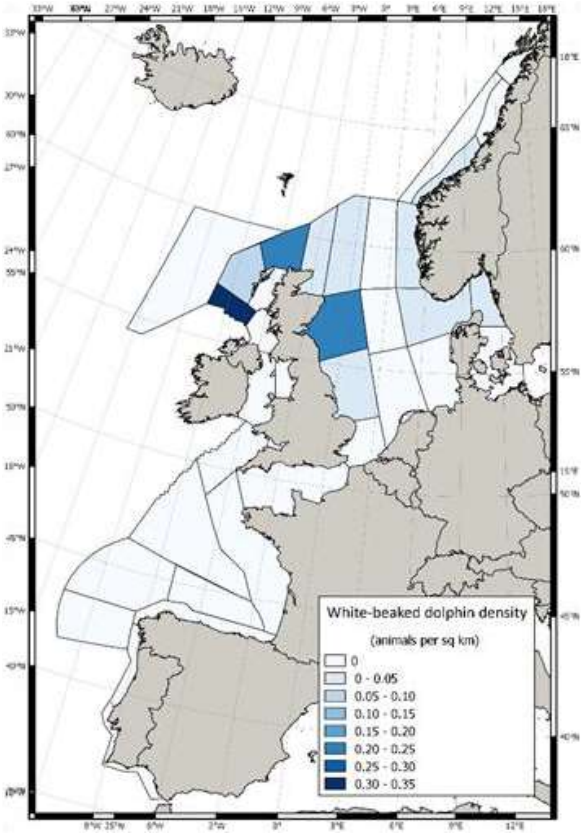


Figure 6.23: White beaked dolphin sightings observed in SCANS III survey

As the SCANS-III survey area encompasses a relatively large geographical area and is therefore unlikely to accurately reflect the abundance and densities of cetaceans which may be present within the vicinity of the Hewett subsea installations, data from the JNCC Atlas of Cetacean Distribution in north-west European Waters has been used to give a more localised indication of the season distribution of cetaceans. The seasonal sightings data for ICES Rectangle 35F1 indicates that low densities of harbour porpoise and the white-beaked dolphin have been recorded in the area (see Table 6.17) (Reid *et al*., 2003).

Table 6.17: Cetacean Sightings in ICES Rectangle 35F1 (Reid *et al*., 2003*)*

Species / Month	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise												
White-beaked dolphin												
Key (Number of individuals per hour of sightings effort)												
High (<100)	Medium (10-100)		Low (0.01-10)		Very low (< 0.01)		No Occurrence				

It is important to note that the lack of recorded sightings does not necessarily preclude the presence of a species at a certain time of year. In addition, the highly mobile nature of cetaceans means that species that are found within the area in general, such as the 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 porpoise is listed on the OSPAR List of Threatened and/or Declining Species (OSPAR, 2014b) and under Annex II of the EC Habitats Directive, which requires the designation of SACs for these species in order to facilitate their conservation. All of the species that may occur in the vicinity of the Hewett subsea wells and manifolds are listed as UK BAP priority species (JNCC, 2007), but are of least concern on the IUCN Red List (IUCN, 2021).

6.4.5.2 Pinnipeds

Two species of seals, the 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 EC 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 seals are incredibly rare globally, and the UK hosts around 40% of the world's 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 8,199 grey seals were counted between Donna Nook and Dover in August 2018 (DECC, 2016; SCOS, 2019).

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 Hewett subsea installations is low (<5 individuals per 25 km^2 in all areas except the Little Dotty (48/30-9) well where it ranges from 5 to 10 individuals per 25 km^2) as shown in Figure 6.24 (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 from February to March (SCOS, 2018). Of note is that during the pre-decommissioning EBS conducted in August and September 2018 only one grey seal was observed over the full duration of the survey (Fugro, 2019a).

Around 30% of EU harbour seals are found in the UK. Their distribution on the east coast of the UK is restricted, concentrated 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, with 5,199 individuals recorded in the region in 2016. The largest colony in the UK is The Wash, with an estimated 3,632 individuals counted in 2018 (SCOS, 2019).

In general, the harbour seal tends to forage within 40-50 km of its haul-out sites (SCOS, 2018), however tagging studies 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). The distribution of harbour seals in the vicinity of the Hewett subsea installations is low (<1 individual per 25 km^2) as shown in Figure 6.24 (Russel *et al*., 2017). Additionally, 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).

The UK SNCBs have defined management units 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 Hewett subsea installations are located within the South East England management unit for seals (IAMMWG, 2013). Table 6.18 shows the seal count and estimated population for this management.

Table 6.18: Population Sizes of Seals in the vicinity of Hewett Field Area (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.

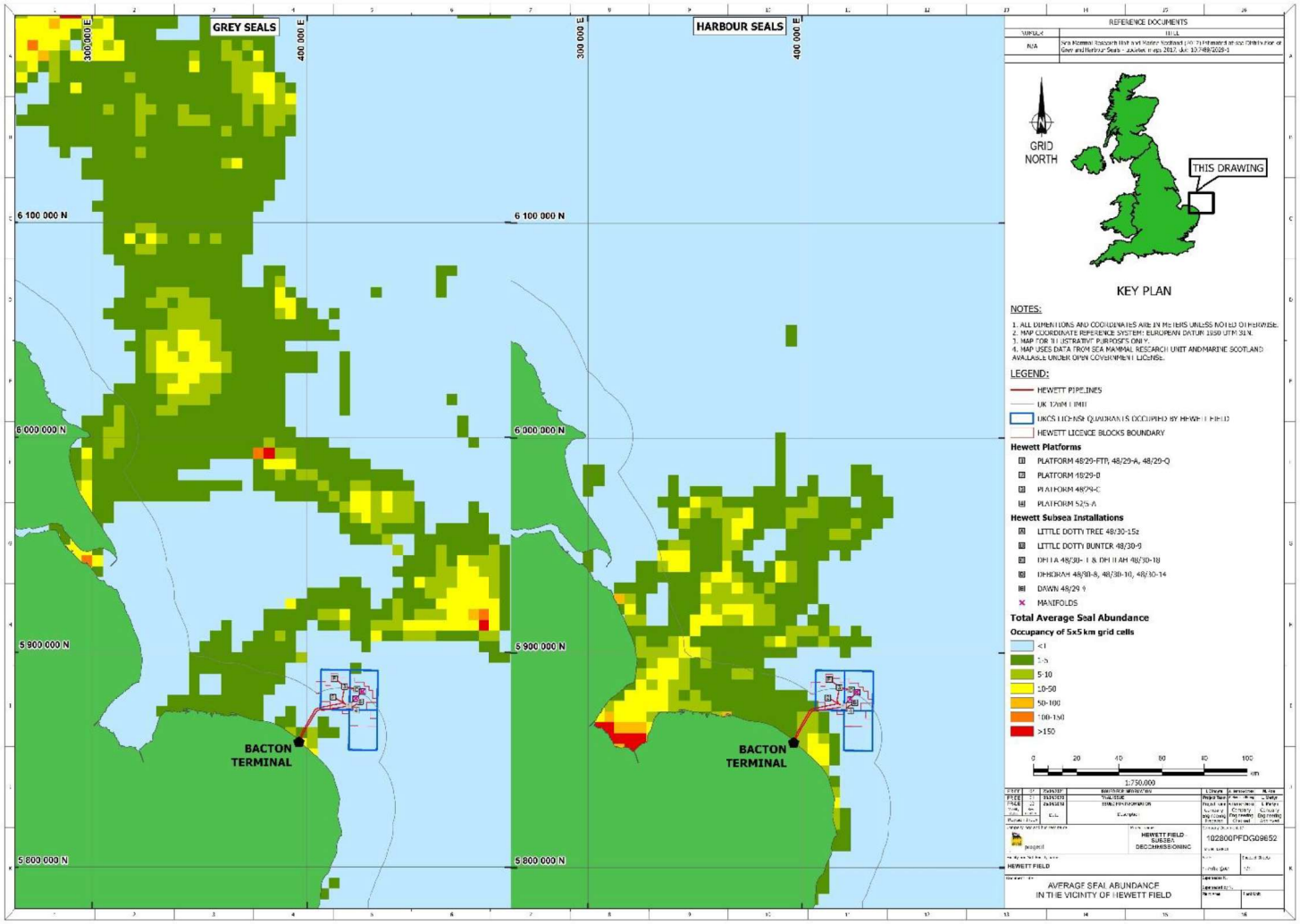


Figure 6.24: Seal Abundance in the vicinity of the Hewett Field Area (Russel *et al.*, 2017)

6.4.6 Seabirds

The offshore waters of the southern North Sea are visited by seabirds, mainly for feeding purposes in and around the shallow sandbanks. The adjacent coastline includes a number of areas suitable for cliff nesting seabirds, and some of the most important sites for wintering and passage waterbirds in a national and international context, including the Wash and Thames Estuary. Therefore, individuals found offshore in the vicinity of Hewett subsea installations may originate from onshore colonies, or be passing migrants (DECC, 2016). Of note is that the Hewett subsea installations lie adjacent to several Special Protection Areas (SPAs) on the Norfolk coastline, which have been designated for the protection of breeding colonies of seabirds. Given the proximity to the coastline (22 km), the Hewett subsea installations lie within the mean maximum breeding foraging ranges of most seabirds, including common eider, fulmar, Manx shearwater, storm petrel, gannet, cormorant, Arctic skua, great skua, common gull, herring gull, lesser black-backed gull, kittiwake, sandwich tern, common tern, Arctic tern, guillemot, razorbill and puffin (Thaxter *et al*., 2012; Woodward *et al*, 2019).

The closest SPA to the Hewett subsea installations is the Greater Wash SPA (see Section 6.2), located approximately 13.7km from the nearest installations; the Little Dotty (48/30-15z) subsea well and the MTM. The site is designated for the protection of red-throated diver (*Gavia stellata*), common scoter (*Melanitta nigra*) and little gull (*Hydrocoloeus minutus*) during the non-breeding season, and for breeding Sandwich tern (*Sterna sandvicencis*), common tern (*Sternula albifrons*) and little tern (*Sternula albifrons*). The SPA contains important foraging areas for the largest breeding populations of little tern in the UK marine SPA network (798 pairs), and important areas used by the second largest non-breeding populations of red-throated diver (1,407 individuals) and little gull (1,255 individuals) within the UK SPA network (JNCC, 2020a).

During the breeding season, the mean maximum foraging distance recorded by Woodward *et al*. 2019 for common terns is 18.0±8.9 km, whilst for the sandwich tern it is 34.3±23.2 km. Little terns do not regularly occupy the Greater Wash; however, studies have suggested the foraging range of little tern (related to its body size) is smaller than that of the larger tern species. This dictates that it nests close to shallow coastal waters with a supply of small shoaling fish such as sand eels and clupeids and invertebrates which comprise its diet. Mean maximum foraging range for little tern colony is less than 5 km from the colony. (Woodward *et al.,* 2019). All the identified tern species plunge-dive to seize fish from the top of water column (they usually dive to no more than 2m depth), often following spells of hovering.

Red-throated divers wintering in the North Sea are thought to feed predominantly on small fish such as herring, sprats, and sand eels. Little gull feed on small fish and aquatic invertebrates like zooplankton. The common scoter, wintering in the North Sea, forages over sandy substrates on mussels, cockles and other bivalve molluscs, with other molluscs, crustaceans and small fish forming a smaller part of their diet (Natural England, 2012). The common scoter has been recorded foraging 30 km from the shore and they have a maximum recorded diving depth of 20m (Kaiser *et al*, 2006; Natural England, 2012). Common scoter and red-throated diver are both vulnerable to disturbance by boats (Schwemmer *et al*., 2011), with common scoter flushing at distances of around 1,600 ± 777 m from approaching vessels and red-throated diver flushing at distances of about 750 ± 437 m (Fliessbach *et al.,* 2019). Large aggregations of these species are present within the Greater Wash SPA between November and March. In contrast, little gull are less sensitive to disturbance from shipping traffic (Leopold & Dijkman, 2010).

Of note, if project vessels are mobilised from Great Yarmouth, they would also have to traverse the Outer Thames Estuary SPA (see Section 6.2). This SPA is classified for the protection of the largest aggregation of wintering red-throated diver in the UK, an estimated population of 6,466 individuals (JNCC, 2020b). It also protects foraging areas for common tern and little tern during the breeding season.

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 ESAS data (Table 6.19) suggests that seabirds do not use the area in the vicinity of the Hewett subsea installations in high densities, predicting a maximum of 4 seabirds per km^2 during the breeding season (March

– September) and 6 seabirds per km^2 in winter (November – March). The most abundant species likely to be present in the vicinity of the subsea installations are fulmar, kittiwake and guillemot in the breeding season; kittiwake, great black-backed gull, guillemot and razorbill over winter and guillemot in the post-breeding dispersal period (JNCC, 2019a; Kober *et al*., 2010).

An ornithological boat based survey completed between 30th June and 6th July 2021 confirmed no birds were nesting on the Hewett field platforms (RSK Biocensus, 2021).

Table 6.19: Predicted Seabird Surface Density in the Vicinity of the Hewett Subsea Installations (Maximum number of individuals per km^2) (JNCC, 2019a; Kober *et al.,* 2010)

Species	Season	J	F	M	A	M	J	J	A	S	O	N	D
Fulmar	Breeding												
	Winter												
Sooty shearwater	Winter												
Manx shearwater	Breeding												
Gannet	Breeding												
	Winter												
Pomarine skua	Other – spring												
	Other – autumn												
Arctic skua	Breeding												
Great skua	Breeding												
Kittiwake	Breeding												
	Winter												
Black-headed gull	Breeding												
Little gull	Winter												
	Other												
Great black-backed gull	Breeding												
	Winter												
Common gull	Breeding												
	Winter												
Lesser black-backed gull	Breeding												
Sandwich tern	Breeding												
Arctic tern	Breeding												
Guillemot	Breeding												
	Winter												
	Other												
Razorbill	Breeding												
	Winter												
	Other												
Atlantic puffin	Breeding												
	Winter												
All species combined	Breeding												

Species	Season	J	F	M	A	M	J	J	A	S	O	N	D
	Winter												

Key (Number of individuals per hour of sightings effort)				
6.0 – >10.0	4.0 – 6.0	1.0 - < 4.0	< 1.0	No Occurrence

Seabird populations are particularly vulnerable to surface pollution. The sensitivity of bird species to oil pollution 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. Species considered most vulnerable to sea surface pollution are those which spend a great deal of time on the sea surface, for example puffin, guillemot and razorbill. Species considered to be at lower risk, due to spending less time on the sea surface, include gannet, cormorant and kittiwake.

The Seabird Oil Sensitivity Index (SOSI) (Webb *et al*., 2016) combines seabird data collected between 1995 and 2015 and individual seabird species sensitivity index values to create a single measure of seabird sensitivity index values to create a single measure of seabird sensitivity to oil pollution. The SOSI score for each UKCS Block can be ranked into sensitivity categories, from 1 (Extremely High Sensitivity) to 5 (Low Sensitivity). An assessment of the median SOSI scores indicates that the sensitivity of seabirds to oil pollution in Blocks 48/29 and 48/30 is consistent within both blocks during winter months, assessed as extremely high in January and February, very high in December, and high in March, April and October. In summer months the results also align between the two blocks, with all months assessed as medium or low from May to September (see Table 6.20 and Figure 6.25; Webb *et al.,* 2016).

Table 6.20: Seabird Oil Sensitivity Index for UKCS Blocks 48/29, 48/30 and adjoining blocks (Webb *et al*., 2016)

Quad / Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
48/23	2	2	3	3*	5	5	5	3	4	2*	2	2
48/24	1	2	2	2*	4	5	5	3	3	2*	2	2
48/25	1*	1	1	1*	3**	5**	4*	4	4*	2*	2	2
48/28	2	2	3	3*	5	5	5	3	4	2*	2	2
48/29	1	1	3	3*	4	5	5	4	5	3*	3	2
48/30	1*	1	3	3*	4**	5*	5	4	5	3*	3	2
49/21	1	1	4	4	5	5	5	5	5	5	3	2
49/26	1*	1	4	4*	5**	5**	5*	5	5	3*	3	2
52/03	2	2	3	3*	5	5	5	4	5	3*	3	2
52/04	2	1	2	2*	5	4	5	4	5	3*	3	2
52/05	1	1	3	3*	5	5	5	4	5	3*	3	2
53/01	1	2	3	3*	5**	3**	5*	5	5	3*	3	2

Quad / Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Key

1= Extremely High Sensitivity, 2=Very High Sensitivity, 3= High Sensitivity 4= Medium Sensitivity, 5=Low Sensitivity, N=No data;

	Indirect Assessment - Coverage gap populated with estimate based JNCC guidance (JNCC, 2016)
*1-5	Coverage gaps populated using data from the same block in adjacent month (Step 1)
**1-5	Coverage gaps populated using data from adjacent blocks within the same month (Step 2)

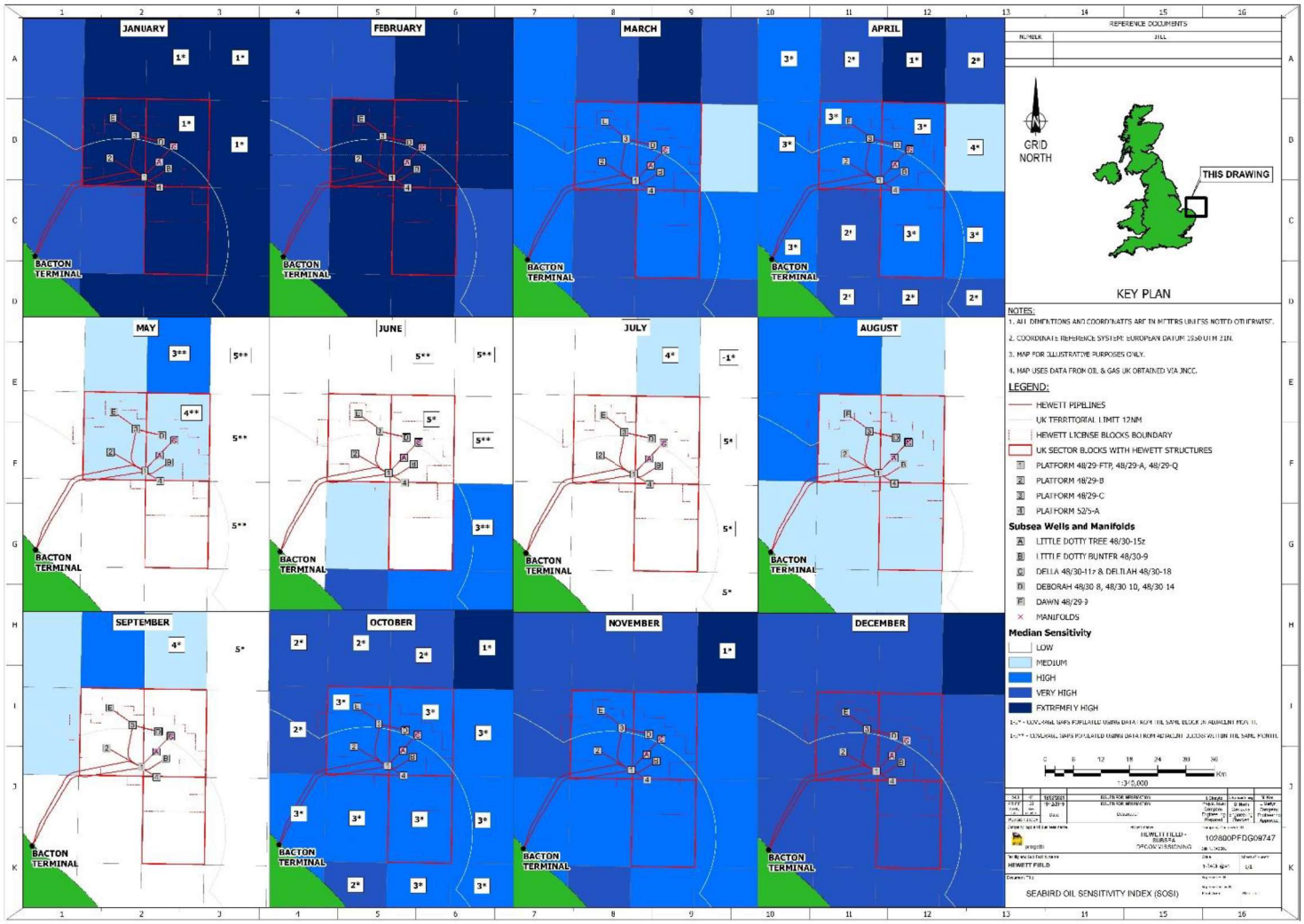


Figure 6.25: Seabird Oil Sensitivity Index for UKCS Blocks 48/29, 48/30 and adjoining blocks (after Webb *et al.*, 2016)

6.5 Socio-Economic Sensitivities

6.5.1 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). However, there is relatively limited fishing effort recorded near the Hewett field, with the majority of the effort concentrated in the north of the region, on the Dogger Bank, within the Wash and along the Suffolk coast (DECC, 2016).

Fishing effort and landings are recorded by ICES Rectangle on a monthly and annual basis. The Hewett subsea installations are located within ICES Rectangle 35F1. Figure 6.26 identifies the average landing values (2012-2016) by species and method in ICES Rectangle 35F1.

Fishing effort from 2010 to 2014 within ICES Rectangle 35F1 was generally low, with less than 100 days fished per year, with peak effort during the summer months. The dominant gear types within ICES Rectangle 35F1 were beam trawls targeting demersal or near demersal fish and shellfish. This is also reflected in the landings data, which demonstrate that demersal species make up the highest proportion of catch in terms of landings by weight and value. Landings data also shows a dominance of demersal flatfish species such as plaice, sole, turbot and dab (Marine Scotland, 2020). More up-to-date fisheries data is unavailable for ICES Rectangle 35F1 and the data from Marine Scotland only takes account of UK registered vessels; however, foreign vessels particularly those from Greece, Italy, Spain and Portugal are also known to undertake commercial fishing activities within UK waters (MMO, 2015).

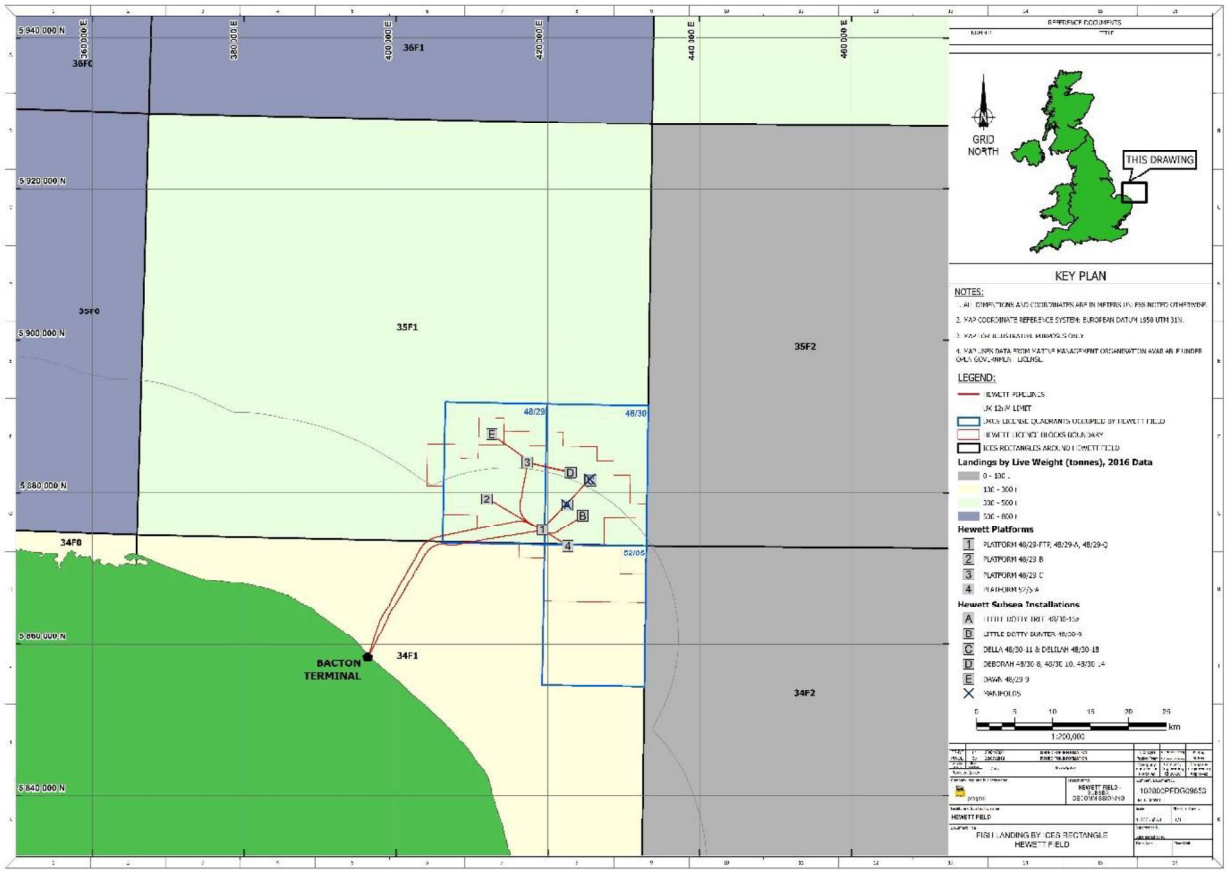


Figure 6.26: Fish Landings by ICES Rectangle in the proximity of the Hewett Field Area (MMO, 2015)

A fishing activity study has been undertaken within the Hewett Field Area which identifies the intensity of fishing within the vicinity of the subsea infrastructure. The study shows fishing pressure throughout the Hewett Field Area is generally low with an average of 0 to 73 hours of fishing per year between 2009 and 2017 (Xodus, 2021b).

6.5.2 Shipping

The Hewett Field Area is located in part of the North Sea which contains some of the world's busiest shipping routes and ports. Oil and gas fields generate moderate vessel traffic in the form of support vessels, principally operating from Great Yarmouth and Lowestoft. Shipping density is considered to be very high in Block 48/29 and high in Block 48/30 (MMO, 2014 and DECC, 2016).

A vessel traffic survey has been undertaken by Xodus Group on behalf of Eni for the project. The overall study area (within 10 nautical miles (nm); 18.5km), centred on seven wells; 48/29-9, 48/30-9, 48/30-10, 48/30-11z, 48/30-14, 48/30-15z and 48/30-18) contained a total of 13,135 routine vessel tracks associated with 1,533 different vessels, which corresponds to an estimated 36 vessel transits per day. The majority of routine vessel tracks in the study area are associated with shipping lane traffic, accounting for 90.3% of all routine traffic across the whole study area. Compared to shipping lane traffic, in-field traffic represents a much lower proportion of routine tracks (9.7% for the whole study area) (Xodus, 2021b).

In total 25 shipping lane were identified in the overall study area (see Figure 6.27). Across all shipping lanes that fell within the overall study area, the three most common port of origins were Immingham (2,043 tracks, 17.2%), Great Yarmouth (1,523 tracks, 12.8%) and Rotterdam (1,121 tracks, 8.4%). The most common destination ports were similar, with Immingham (2,483 tracks, 20%), Great Yarmouth (1,527 tracks, 12.9%) and Tees (1,185 tracks, 10.0%) being the most common (Xodus, 2021b).

For shipping lane traffic, cargo vessels accounted for the largest proportion of tracks across the overall study area, varying between a maximum of 70.0% of shipping lane traffic within 10 nm of 48/30-9, and a minimum of 62.1% within 10 nm of 48/29-9. Tanker vessel tracks were lower than cargo, representing between 22.1% (within the 10 nm study area of 48-30-9) and 19.7% (within the 10 nm study area of 48/29-9) of all shipping lane traffic (Xodus, 2021b).

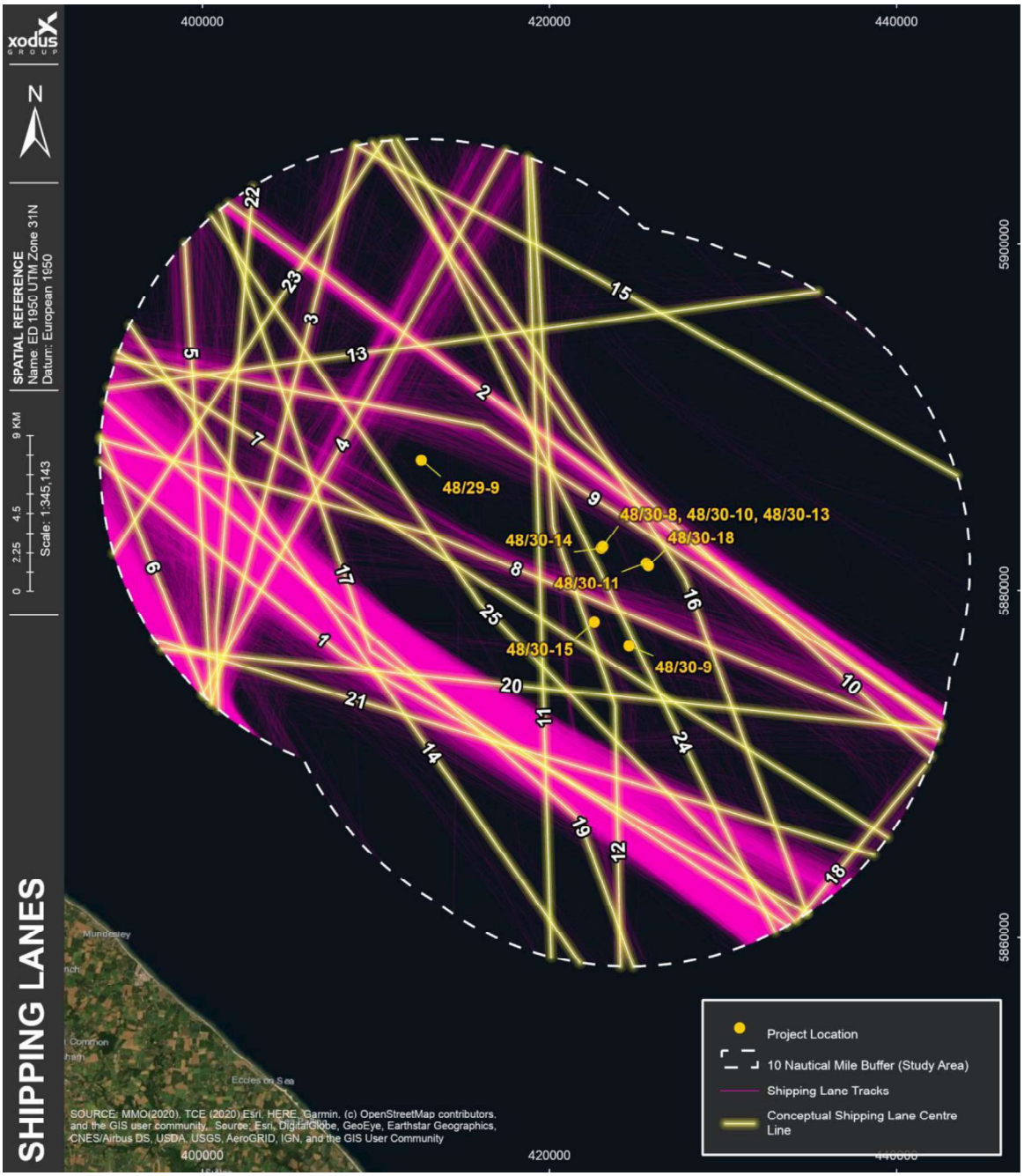


Figure 6.27: Shipping Lanes (Xodus, 2021b)

6.5.3 Oil and Gas Activities

The Hewett Field Area is located in a region well developed by the oil and gas industry. The only oil and gas facilities within approximately 26km of the Hewett Field Area are those associated with the Perenco operated Leman Field located north-west of Hewett, as illustrated in Figure 6.28 (OGA, 2021).

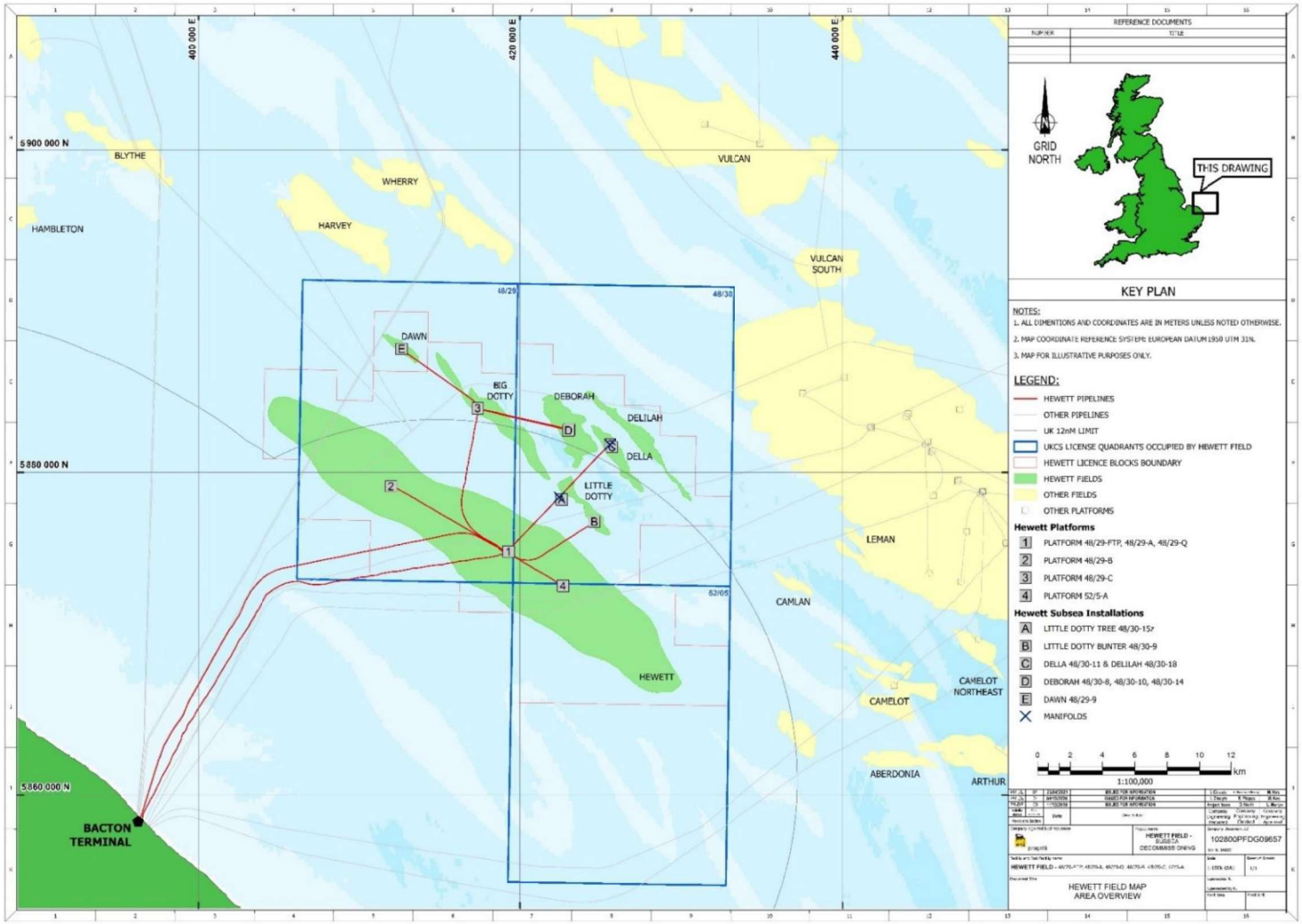


Figure 6.28: Oil and Gas Infrastructure in the vicinity of the Hewett Field Area

6.5.4 Offshore Renewable Activities

The nearest wind farm areas to the Hewett Field Area are the active Dudgeon and Sheringham Shoal wind farms located to the northwest, approximately 20 km and 32 km from Dawn subsea well 48/29-9 respectively, as illustrated in Figure 6.29. At the time of writing this document, Sheringham and Dudgeon extension project is expected to submit an application in Q2 2022 and could be in construction within the timescales of the Hewett subsea installations decommissioning work.

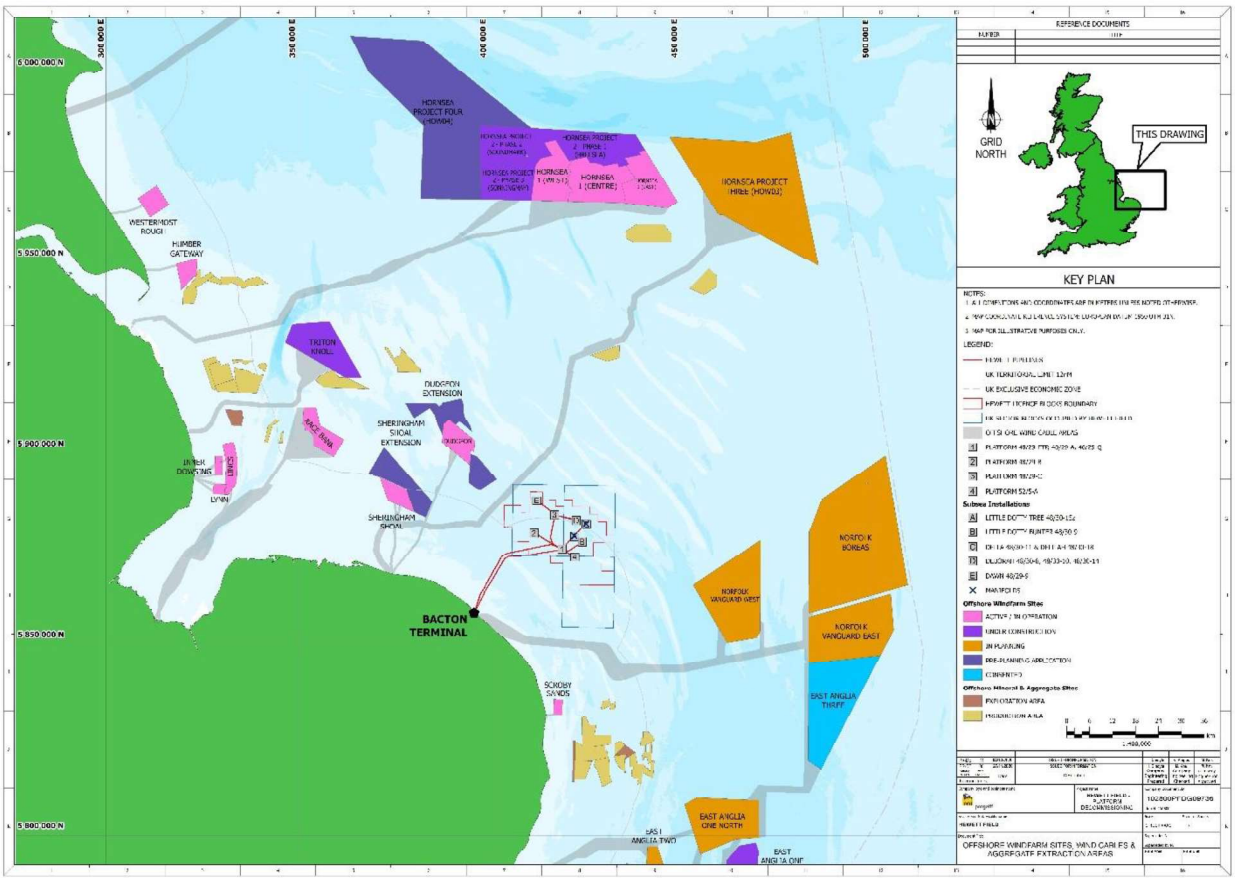


Figure 6.29: Windfarms in the vicinity of the Hewett Field Area

6.5.5 Other Subsea Infrastructure

The nearest non-oil and gas subsea infrastructure to the project area is the 'STRATOS 1' telecommunication cable situated approximately 9 km west of Dawn subsea well 48/29-9 which runs from north-east (offshore North Sea) to south-west (Weybourne). Current records show this cable to be disused (KIS ORCA, 2021).

6.5.6 Offshore Aggregate and Dredging Areas

There are no licensed offshore aggregate areas, dredging areas or known dumping areas in the vicinity of the Hewett subsea installations (MMO, 2021). The nearest site is the 'Humber 3' Aggregate Production Area, located approximately 50 km to the north east of the Hewett Field Area (Operator: DEME Building Materials Ltd). However, the Hewett field is surrounded by areas of high potential aggregate resource, sand and gravel (AGG 3) (DEFRA, 2019).

6.5.7 Military Activity

There is a military Practice and Exercise area (PEXA) situated approximately 60 km to the north of the Hewett Field Area. This area is used by the Royal Air Force (RAF) and is therefore an area of intense aerial activity (DECC, 2016).

6.5.8 Marine Archaeology

A total of eight known shipwrecks are located within the Hewett Field Area, but none are protected (Historic England, 2018). However, no shipwrecks were detected during the Hewett pre-decommissioning survey. The closest protected wreck is the Vortigern Destroyer, located approximately 22 km northwest of the Hewett Field Area (MMO, 2021). This wreck is protected by the Military Remains Act 19.

7.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

7.1 Environmental Impact Identification

Potential environmental and societal impacts arising from the proposed Hewett Area Subsea Installations DP were initially determined through an Environmental Impact Identification (ENVID) workshop held on 27th April 2021.

The objectives of the ENVID were to:

- Identify environmental and societal impacts and risks that may occur during the project;
- Determine the significance of the impact or risk using a simple scoring system;
- For potentially significant impacts or risks identify additional mitigation measures required to avoid or reduce adverse effects.

The activities (or aspects) identified during the ENVID workshop are summarised in the receptor based activity and events matrix in Table 7.1.

The significance of the potential impacts resulting from the identified aspects was assessed during the ENVID workshop using the criteria defined in Section 7.2. As a final decision on the subsea installation removal methodology will only be made following an engineering feasibility and commercial tendering process (refer to Section 5.3), the worst-case scenario in terms of the potential environmental impact was considered in all instances.

The ENVID identified that no planned activities or unplanned events have the potential to result in significant effects on the marine environment, with embedded mitigation measures in place. However, for completeness it was recommended that the following aspects be subject to further assessment as these are likely to have the greatest impact on the marine environment from a Project perspective:

- Seabed disturbance from:
  - Excavation of piles;
  - Abrasive cutting discharge (i.e. garnet);
  - Removal of subsea installations, including disturbance from wet storage.
- Underwater noise emissions from:
  - Use of propellers / DP thrusters on vessels;
  - Use of cutting tools;
  - Use of mass flow excavator (propeller noise).

A comprehensive assessment has been undertaken for these aspects, using the significance criteria defined in Section 7.2, the results of which are documented in Section 8. The potential for significant cumulative, in-combination and transboundary impacts to occur has also been assessed in Section 8.

A justification as to why the other aspects have been scoped out of detailed assessment is documented in Section 7.3.

In addition, as the majority of the Hewett subsea installations are located within the Southern North Sea SAC and are within 40km of five other MPAs (refer to Section 6.2), an assessment has been undertaken to determine whether there are likely to be any significant effects on the conservation objectives of these MPAs as a result of the proposed Hewett subsea installations decommissioning activities, either alone or in-combination with other plans or projects. This assessment is documented separately within Section 9.

Impacts to overwintering populations of red-throated diver and common scoter within the Greater Wash SPA and the Outer Thames Estuary SPA from the physical presence of vessels transiting through these MPAs has also been assessed within Section 9.

Additionally, Section 9 assesses the potential impacts to the supporting habitats and prey availability of grey seals, a qualifying feature of the Humber Estuary SAC, as although this SAC is located 100 km from the closest subsea structure (48/29-9), grey seals are known to forage within the Hewett field area.

Table 7.1: 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	Protected Marine 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
Planned Events																						
Physical Presence	- Presence of DSV / CSV											A	A									
	- Vessel movement (transit)								A		A											
	- Removal of subsea installations and associated 500m safety zones								A		P	P	P									
Seabed Disturbance	- Excavation of piles	A					A	A			A											
	- Abrasive cutting discharge (i.e. garnet)	A					A	A			A											
	- Removal of subsea installations, wellheads and xmas trees, including disturbance from wet storage	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											
	- Use of cutting tools							A		A	A											
	- Use of mass flow excavator (propeller noise)							A		A	A											
Energy Use & Atmospheric Emissions	- Fuel consumed by offshore vessels, diesel-powered equipment and generators			A	A																	
Marine Discharges	- Routine vessel discharges to sea		A			A		A	A	A	A											
	- Potential for introduction of alien species (from ballast water)					A		A														
Waste Management	- Removal and disposal of subsea structures (ferrous metal)			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
	- Disposal of NORM																					A
Unplanned Events																						
Accidental Events	- Vessel collision (loss of diesel inventory)		A			A		A	A	A	A	A	A									
	- Dropped objects	A				A							A									
	- Leak of hydraulic fluid from cutting equipment subsea		A			A		A														
	- Residual liquids (hydraulic fluid) released during lift or loss of load on-board vessel		A			A		A														
	- Loss of vessel power and use of mooring anchor	A					A	A			A											

Key:

	Negligible effect		Minor effect	A	Adverse effect	P	Positive effect		No interaction
	Low risk		Medium risk but ALARP						

7.2 Evaluation of Significance

7.2.1 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, having regard to the criteria detailed in Annex III of the EIA Directive, including:

- The magnitude and spatial extent of the impact;
- The nature of the impact;
- The transboundary nature of the impact;
- The intensity and complexity of the impact;
- The probability of the impact;
- The expected onset, duration, frequency and reversibility of the impact;
- The cumulative impact with the impact of other existing and / or approved projects and / or projects not yet approved, but that Eni is aware of;
- The possibility of effectively reducing the impact.

7.2.1.1 Sensitivity Criteria

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 7.2 has been used as a guide in this assessment to determine the sensitivity of receptors.

Table 7.2: 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.

7.2.1.2 Magnitude of Impact Criteria

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. Where it is not possible to quantify impacts, a qualitative assessment has been carried out, based on best available scientific evidence and professional judgement. The criteria presented in Table 7.3 has been used as a guide in this assessment to define the magnitude of impact.

Table 7.3: 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).

7.2.1.3 Significance of Effect

For planned activities, 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 7.4.

Table 7.4: 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 on 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" in EIA terms 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.

7.2.2 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 7.2.1 above. The likelihood of an unplanned event occurring has been determined using the criteria presented in Table 7.5 as a guide.

Table 7.5: 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 7.6.

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

Medium risk events are also considered to be "significant" in EIA terms, 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" in EIA terms, but should still be controlled through good industry practice.

Table 7.6: 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

[1] The consequence (significance of effect) has been determined using the methodology for planned events as described in Section 7.2.1 above.

7.3 Aspects Scoped Out from Detailed Assessment

7.3.1 Physical Presence

The DP vessels (DSV and CSV) required for the proposed removal options will be present on location within the 500m safety exclusion zones surrounding the Hewett subsea installations, which are clearly marked on navigation charts and have been in place for a number of years. Notifications will be made to regular users of the area via fisheries notices, Notices to Mariners and NAVTEX/NAVAREA warnings. Operations will be planned to minimise the number of boat movement, as far as reasonably practicable. Eni has therefore concluded that impacts arising from physical presence of the DSV and CSV do not warrant further assessment.

In addition, once the Hewett subsea installations have been removed, the 500 m safety exclusion zones surrounding the installations will be withdrawn. This will result in a minor positive impact as an area of circa 3.95 km^2 will be made available to other sea users.

Note, impacts to seabirds from the movement of vessels through SPAs are assessed in Section 9.

7.3.2 Energy Use and Atmospheric Emissions

Atmospheric emissions will be produced as a result of the fuel consumed by offshore vessels, 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, SOx, VOCs).

Estimated emissions from the proposed decommissioning activities are summarised in Table 7.7.

Table 7.7: Estimated Atmospheric Emissions from Removal Activities

Activity	Total Fuel Use [1]	Emissions (tonnes) [2]							
		CO_2	CO	NO_X	N_2O	SO_2	CH_4	VOC	CO_2e
DSV	396	1,267.20	6.22	23.52	0.09	1.58	0.07	0.79	1,295
CSV	220	704.00	3.45	13.07	0.05	0.88	0.04	0.44	719
Total:	616	1,971.20	9.67	36.59	0.14	2.46	0.11	1.23	2,014

[1] See assumptions relating to vessel timings and fuel consumption in Section 5.3.

[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 Hewett subsea installations decommissioning options equate to approximately 0.01% of the total UK offshore CO2e emissions in 2018 (14,630,000 tonnes; OGUK, 2019) and less than 0.0006% of the UK net total CO_2e emissions in 2019 (351,100,000; BEIS, 2021).

To minimise the emissions generated, Eni will look to reduce vessel time in the field as far as practicable. In addition, Eni'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.

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

7.3.3 Waste Management

Good housekeeping standards will be maintained on board all vessels in accordance with the contractor waste management strategy; any waste water discharged to sea from vessels will be treated to comply with the requirements of the MARPOL Convention.

A Materials Inventory has been developed for the Project to identify the types of waste generated and the management procedures for each waste stream will be included in the contractor's Waste Management Plan. Eni will ensure the principles of the Waste Management Hierarchy are followed during the decommissioning activities. Transfer notes will accompany all non-hazardous waste to shore and consignment notes will be in place for any hazardous waste.

Checks will be carried out on the selected waste yard to ensure all permits and licenses are in place for the handling and disposal of the waste types identified. Eni will ensure that waste is transferred by an appropriately-licensed carrier who should have a Waste Carrier Registration, Waste Management Licence or Exemption, as appropriate for the type of waste.

The amount of NORM Waste is unknown at this time, however there remains a possibility that it will be present during decommissioning activities.

Marine growth, if found, will be removed onshore at the waste yard, with appropriate odour control implemented through an odour management plan and disposal in accordance with the principles of the Waste Management Hierarchy.

In summary, the impacts of waste management are largely onshore and therefore outside the scope of this document. A large proportion of project waste consists of easily reprocessed scrap metal and no hazardous waste is anticipated. Implementation of a robust waste management plan will mitigate any expected impacts. On this basis, Eni has concluded that no further assessment of waste management is necessary.

7.3.4 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. The potential introduction of invasive species from ballast water is therefore considered unlikely to occur.

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

7.3.5 Accidental Events

7.3.5.1 Vessel Collision

Prior to the proposed subsea installations decommissioning activities commencing, the subsea wells will be plugged and abandoned. 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.

As vessels required for the decommissioning are yet to be confirmed, no specific modelling has been undertaken, however modelling has been conducted for other large vessels which have been routinely used in the Hewett Field Area. For example modelling of instantaneous release of 394.4m^3 of diesel for the Valaris 72 Rig at the Hewett 48/29-B Platform has demonstrated that the probability of the diesel release beaching on the UK coastline is highest in spring (40-50%), with the shortest arrival time after 9 hours. The maximum mass accumulated onshore across all beaching locations in any one season is 190 m^3 after 20 days. The probability of a release of diesel crossing into Dutch waters is 1-2% in winter, with the shortest arrival time after 2 days. A total of 17 marine protected areas may be subject to surface oiling (> 0.3 µm) or beaching.

The eastern coast of the UK contains extensive areas of sheltered mudflats and sandflats, saltmarsh, estuaries and wetlands, which are highly sensitive to oiling. Species most at risk include seabirds, especially during the breeding and moulting season where large rafts aggregate on the surface, and wildfowl utilising wetlands. 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 a vessel collision is, however, considered to be low as the DSV / CSV will be present on location within the existing 500m safety exclusion zones surrounding the Hewett subsea installations and any vessel operating inside the 500m zone will be on DP. The safety zones are 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 the DSV / CSV will be covered by their respective Shipboard Oil Pollution Emergency Plan (SOPEP).

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

7.3.5.2 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, Eni has concluded that impacts from unplanned loss of materials to the sea do not require further assessment.

7.3.5.3 Leak of Hydraulic Fluid from Cutting Equipment Subsea

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

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

7.3.5.4 Loss of Vessel Power and Use of Mooring Anchor

In the very unlikely event that the DP DSV or CSV loses power, the vessel may need to drop anchor to prevent it from drifting. Physical disturbance of the seabed from anchoring can cause displacement or mortality of benthic species, such as sessile organisms, that are unable to move out of the impacted area, but it is expected that recovery of affected areas of seabed will be relatively rapid once the anchor has been retrieved. Eni will ensure that the vessels selected to undertake the decommissioning activities have effective operational

systems and that on board control measures are in place. As the risk of loss of vessel power occurring is Low, Eni has concluded that no further assessment is necessary.

8.0 ENVIRONMENTAL ASSESSMENT

This section documents the assessment undertaken for those aspects identified during the ENVID as likely to have the greatest impact on the marine environment from a Project perspective. Impacts to marine protected areas are documented separately in Section 9.0.

8.1 Seabed Disturbance

8.1.1 Quantification of Seabed Disturbance

The following decommissioning activities which have the potential to result in seabed disturbance were identified during the ENVID workshop:

- Excavation of piles;
- Abrasive cutting discharge (i.e. garnet);
- Removal of subsea installations, wellheads and xmas trees, including disturbance from wet storage;
- Potential removal of mud mats.

Table 8.1 provides an estimate of the total area of seabed likely to be disturbed by the above listed decommissioning activities, which equates to 12,259 m^2 (0.012 km^2).

Table 8.1: Seabed Disturbance

Source of Disturbance	Area of Seabed Impacted (see Note 1)											
	48/29-9	48/30-8	48/30-10	48/30-14	48/30-9	48/30-15z	48/30-18	48/30-11z	MTM	PLEM	48/30-13	Total
• Excavation of piles; • Abrasive cutting discharge (i.e. garnet); • Removal of subsea installations, wellheads and xmas trees, including disturbance from wet storage; • Potential removal of mud mats.	1,225 m^2	1,225 m^2	1,225 m^2	1,225 m^2	1,225 m^2	1,225 m^2	1,225 m^2	1,225 m^2	1,225 m^2	1,225 m^2	9 m^2	12,259 m^2

Note 1

As a conservative estimated it is assumed that disturbance will occur within a 35m by 35m box centred on each subsea structure. Within this area the following activities will result in disturbance to the seabed:

- Excavation of piles (applicable to the piled structures, namely 48/29-9, 48/30-8, 48/30-10, 48/30-14, 48/30-9, 48/30-11z, MTM and PLEM). Eni's preference is for internal pile cutting, but if required excavation would be down to ca. 3.5m. The volume of seabed disturbance for each pile, if dredging is required, would be ca. 50 m^3, equating to 200m^3 per structure. Worst-case disturbance area per pile is ca. 14m^2 (3.75m x 3.75m), totalling 56m^2 per structure to account for the four piles.
- Any abrasive material (i.e. garnet) discharged to the seabed during external cutting activities.
- Potential removal of mud mats.
- Prior to lifting, the structures, wellheads and xmas trees may be temporarily wet stored. In this instance they would be placed on the seabed in a location immediately adjacent to their current position, although a separation distance of up to 1m has been assumed.

The exception to the above is at the 48/30-13 E&A well where only the wellhead is to be removed. Seabed disturbance at this location will therefore be in a much smaller area, assumed to be within a 3m by 3m box centred on the well. Note, there is no requirement to temporary wet store this wellhead.

8.1.2 Potential Impacts to Seabed Communities

The excavation of the seabed surrounding the subsea installations, physical removal of infrastructure (including the potential removal of mud mats) and the temporary placement of articles on the seabed is expected to result in mortality to benthic fauna, although mobile species should be able to avoid this impact. Of note is that aggregations of *S. spinulosa* biogenic reef were identified in the vicinity of all of the subsea installations, during the pre-decommissioning environmental survey. Research has shown that *S. spinulosa* has a limited tolerance to the direct physical impact, with recovery not expected for an extended period of time. However, *S. spinulosa* classified as 'Medium Reef' was only identified 50m south-west and 250m north-north east of the Little Dotty (48/30-15z) well and about 1km east of Della & Dellilah well cluster and the PLEM. At their closest points, 'Low' reefs were found approximately 50m south-west of Little Dotty (48/30-15z) well, 532m south east of the Dawn well, 745m east of the Deborah well cluster, 800m east of the Della & Delilah well cluster and the PLEM, 245m, 270 m south west of the MTM and 250m north west and north east of Little Dotty (48/30-9) well. Areas of 'no emergent *Sabellaria*' have also been identified, the closest of these to the subsea installations are located approximately 43m east of Little Dotty (48/30-9), 41m north east of Deborah (48/30-10), 53m south east of Deborah (48/30-14) and 44m east of Della (48/30-11). Therefore, due to the distance of the proposed operations from the identified *S. spinulosa* aggregations, direct physical impact as a result of the subsea installations decommissioning activities is not expected.

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 subsea installations are 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.

Given the above, the sensitivity of seabed communities to seabed disturbance in the vicinity of the subsea installation operations 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. 0.012 km^2; see total in Table 8.1). Therefore, physical effects on seabed communities due to seabed disturbance are predicted to be **Minor** and not significant.

8.1.3 Potential Impacts to Fish Spawning and Nursey Grounds

The proposed decommissioning operations may temporarily displace fish species from their spawning and nursery areas. Exposure to increased turbidity through sediment resuspension can also reduce the visual acuity of fish potentially affecting foraging behaviour. However, any disturbance will be highly localised (within an area of ca. 0.012 km^2) and of short duration and mobile species would be expected to return to the area shortly after the subsea installations have been removed.

Egg development and hatching success is also known to be vulnerable to the effects of smothering. A number of studies have been conducted on the effects of sedimentation on fish egg development of commercially valuable fish species, particularly in relation to dredging operations. Results are variable with some demonstrating mortality of fish eggs when smothered by even a thin veneer of sediment (DOER, 2000) and

many studies showing no significant effects on fish egg and larval development and mortality (Auld and Schubel, 1978; Kiørboe *et al*., 1981). Of note is that commercially and ecologically important fish species such as herring and sand eels have spawning grounds in the Hewett Field Area. Both these species lay their eggs only in clean sandy and gravelly sediments. However, the Hewett Field Area is not considered to be critical spawning habitat for these species, with the spawning grounds for these species occurring over a much larger area.

Given the above, the sensitivity of fish spawning and nursery grounds to seabed disturbance in the vicinity of the subsea installation decommissioning operations is considered to be **Low,** with a medium value and very high resistance and resilience. 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. 0.012 km^2). Therefore, physical effects on fish spawning and nursery grounds due to seabed disturbance are predicted to be **Minor** and not significant.

8.1.4 Mitigation Measures

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

- Piles will be cut internally, if possible, to avoid seabed disturbance.
- Tool use will be minimised where feasible whilst still achieving the desired result.
- Working areas will be minimised, as far as practicable.
- In advance of the removal operations commencing, Eni will survey (via MBES and GVI) any area where it is proposed to land an item on the seabed to confirm it is clear of debris or obvious surface features that could be damaged. If the area is deemed not to be suitbale, a new area would be selected accordingly.
- Eni intends to remove the subsea installations immediately following cutting, where appropriate, preventing the need for any items to be wet stored.

8.1.5 Residual Effects

Based on the nature of the seabed habitats and species present in the vicinity of the subsea structures, the comparatively small area of seabed that will be impacted by the proposed decommissioning activities (ca. 0.012 km^2) and the fact that no identified areas of potential *S. spinulosa* reef will be subject to direct physical impact, residual effects on seabed communities and fish spawning and nursery grounds are predicted to be **Minor** and not significant.

8.2 Underwater Noise

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

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 (OSPAR, 2009). Particularly loud sound can disturb marine animals, triggering avoidance response or, in extreme cases, has the potential to cause temporary, or even permanent, auditory threshold shifts (TTS and PTS respectively). In fish, the effects of "excessive" sound include avoidance reactions and changes in shoaling behaviour. Avoidance of an area may interfere with feeding or reproduction or cause stress-induced reduction in growth and reproductive output (Slabbekoorn *et al*., 2010).

A range of fish species use the area for nursery and/or spawning grounds at different times of the year including cod, herring, lemon sole, sand eel, plaice, mackerel, sprat and whiting (Coull *et al*. 1998 and Ellis *et al*. 2012). Harbour porpoise, white-beaked dolphin, minke whale, grey and harbour seals are marine mammals that have been observed or identified as most likely to be present in the Hewett Field Area.

8.2.1 Sources of Underwater Noise

The potential sources of underwater noise from the subsea installations decommissioning have been identified as:

- Use of propellers / DP thrusters on vessels;
- Use of cutting tools;
- Use of mass flow excavator (propeller noise).
-

All of the above are non-impulsive noise sources.

8.2.1.1 Vessel Operations

Two vessels will be mobilised to remove the Hewett subsea installations, a DSV and CSV. The peak sound pressure level associated with these vessels is identified in Table 8.2. 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).

Table 8.2: Source noise from decommissioning vessel (OSPAR, 2009)

Vessel	Description	Peak sound pressure level (dB re 1 µPa)	Frequency (Hz)	Total Duration (days)
DSV	Dive Support Vessel	180	20-10 000	22
CSV	Construction Support Vessel			11

8.2.1.2 Underwater Cutting Tools

Underwater cutting tools will be required to cut the wellheads and subsea structures. As discussed in Section 5.3, the piles may be cut internally using an abrasive cutting system or, if internal pile cutting is not possible, the structures may be dredged and cut using subsea diamond wire cutters. Additionally, the wellheads will be cut approximately 3m below the mudline using either an abrasive cutting system or a rotary cut system.

A paper reported that the noise from underwater diamond wire cutting, during the severance of a 30 inch diameter conductor at a platform in the North Sea, was barely discernible above background noise levels including the noise of associated vessel presence (Pangerc *et al*., 2016). In addition, Anthony *et al*. (2009) has reported peak source intensities of 148 to 180 dB re 1µ Pa for a range of underwater cuttings tools, including a high-pressure water jet lance, chainsaw, grinder and oxy-arc cutter, with most energy in the frequency range 200 to 1,000Hz.

Cutting activities will be short term and intermittent in nature and the underwater noise generated is likely to be masked by the noise generated from the supporting decommissioning vessel(s). Underwater noise emissions from cutting tools are therefore unlikely to result in sufficient levels of noise to cause significant disturbance to marine life (BEIS, 2022). This aspect has therefore been scoped out of detailed assessment.

8.2.2 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 be 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 Hewett Field Area. 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). Fish are therefore more likely to be disturbed by the continuous underwater noise emissions generated from the proposed subsea installation decommissioning operations, potentially leading to their displacement, albeit temporarily, from the area. There is a range of evidence; however, from underwater video inspections of North Sea drilling and production platform jackets that show fish species, especially gadoids such as cod and saithe, swimming calmly in the immediate vicinity of the installations (Fujii, *2015*).

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 in the vicinity of the subsea installations, 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 high volume of vessel traffic and, as such, it is anticipated that the additional underwater noise generated by the planned vessels and use of cutting tools 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 **Medium**, with a medium value and 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

8.2.3 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 8.3 presents the marine mammal species that have been sighted within the vicinity of the subsea installations by their functional hearing group and associated estimated hearing range, as classified by NOAA, 2018. It can be seen that odontocetes (toothed whales, dolphins and porpoises) have a wider hearing frequency range compared to mysticetes (baleen whales).

Table 8.3: Functional Marine Mammal Hearing Groups (NOAA, 2018)

Hearing Group	Generalised Hearing Range (Hz)	Species
Low-frequency cetaceans	7 – 35 000	Minke whale
Mid-frequency cetaceans	150 –160 000	Common dolphin, white-beaked dolphin, white-sided dolphin,
High-frequency cetaceans	275 – 160 000	Harbour porpoise
Phocid pinnipeds [1] (underwater)	50 – 86 000	Harbour seal, Grey seal

[1] Earless or true seals

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, applicable to non-impulsive noise sources such as those associated with the Hewett decommissioning activities, are provided in Table 8.4.

Table 8.4: Non-Impulsive PTS and TTS Onset Thresholds for Marine Mammals *(*NOAA, 2018*)*

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	191	179
Mid-frequency cetaceans	198	178
High-frequency cetaceans	173	153
Phocid pinnipeds [2] (underwater)	201	181

None of the activities associated with the proposed subsea installations decommissioning operations are considered to generate significant noise levels which may cause injury to marine mammal species.

Underwater noise propagation modelling undertaken for other EA reports (e.g. Chrysaor, 2020 and NEO Energy, 2020) indicate that injury is unlikely to occur for any marine mammals species within the vicinity of DP vessel operations as the PTS thresholds will not be exceeded.

Although it has been determined marine mammals will not be injury by the underwater noise generated during the proposed decommissioning operations, there is still a possibility of behavioural disturbance. Due to the complexity and variability of marine mammal behavioural responses, NOAA are continuing to work on developing additional guidance regarding the effects of anthropogenic sound on marine mammal behaviour. In the absence of detailed behavioural disturbance in NOAA, 2018, criteria of 120 dB re 1 µPa (unweighted SPL_{RMS}), which is applicable to all marine mammal hearing groups for behavioural disturbance of 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 8.5 presents the predicted impact range within which marine mammals may exhibit behavioural changes as a result of the proposed decommissioning operations.

Table 8.5: Maximum Behavioural Impact Range to Marine Mammals (NOOA, 2013)

Hearing Group	Behavioural Criteria - unweighted SPL_{RMS} (dB re 1 µPa)	Maximum Noise Source (dB re 1 µPa)	Maximum Predicted Impact Range
Marine Mammals	120	184	1,585 m

It can be seen from Table 8.5 that behavioural responses may be elicited within approximately 1.6km of the worst case decommissioning noise source, although for the reasons provided above the distance quoted is conservative. To determine the magnitude of impact in terms of the actual number of animals impacted, it is possible to calculate the number of animals likely to experience some sort of behavioural impact using the density and abundance estimates from the MMMUs (IAMMWG, 2015; see Table 6.15) as shown in Table 8.6. In addition, density data from Russel *et al*., 2017 has been used for harbour seal and grey seal.

Table 8.6: Estimated Number of Marine Mammals Potentially Experiencing Behavioural Disturbance During Decommissioning Operations

Species	Estimated Density in the Area (animals / km^2)	Estimated Number of Animals that May Experience Behavioural Disturbance [3]	% of Reference Population Disturbed [4]
Harbour porpoise [1]	0.335	< 3	0.0013
White-beaked dolphin [1]	0.010	< 1	0.006
Minke whale [1]	0.015	< 1	0.004
Common dolphin [1]	0.036	< 1	0.002
White-sided dolphin [1]	0.044	< 1	0.001
Harbour seal [2]	0.04	< 1	N/A
Grey seal [2]	0.4	< 4	0.04

[1] Source: IAMMWG, 2015
[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 8.6 that there will be a number of individual animals likely to exhibit some form of change in behaviour for the period in which they encounter noise from the decommissioning, however in all instances the percentage of reference population disturbed is very small. It should be noted that all species of cetaceans are classified as European Protected Species (EPS). EPS are listed on Annex IV of the EU Habitats Directive, which is transposed into UK law in the UK offshore area through The Conservation of Offshore Marine Habitats and Species Regulations 2017 (OMR). It is an offence under the OMR to deliberately disturb, injure or kill a species designated as an EPS. The likelihood of an offence being committed is highly dependent on the temporal characteristics of the activity (JNCC, 2010). A disturbance offence is more likely where an activity causes persistent (sustained and chronic) noise in an area for long periods of time. For most cetacean populations in the UK, disturbance in terms of OMR is unlikely to result from single, short-term operations (JNCC, 2010). Given the fact that only a low number of individuals are likely to experience behavioural disturbance and no cetaceans are predicted to be injured, it is therefore considered unlikely that the decommissioning project would constitute an offence under OMR.

Research has shown that marine mammals are typically more tolerant of fixed location noise sources, as opposed to moving sources (Southall *et al*., 2007), which may be perceived as an approaching threat.

However, the noise from the support vessels associated with the decommissioning will be stationary or slow moving in the area, meaning that marine mammals are less likely to be startled. In addition, as noted above, this area of the southern North Sea has a high volume of vessel traffic and, as such, it is anticipated that the additional underwater noise generated by the vessels and cutting activities is likely to be insignificant.

In conclusion, the sensitivity of marine mammals to underwater noise emissions from the proposed decommissioning activities is considered to be **Very High**, with a very high value as marine mammals are of international importance and high resistance and resilience. Reported responses of behavioural disturbance to marine mammals from vessel noise include avoidance, changes in swimming speed, direction and surfacing patterns, alteration of the intensity and frequency of calls (Erbe *et al*., 2019). Harbour porpoises and minke whales have been shown to respond to vessels by moving away from them, while some other species, such as common dolphins, have shown attraction (Palka & Hammond, 2001). The magnitude of impact is considered to be **Minor** as while there is potential for some behavioural disturbance, the area of potential disturbance will be localised and any impacts will be temporary. Effects on marine mammals from underwater noise emissions are therefore predicted to be **Minor** and not significant, particularly relative to the underwater noise generated by existing levels of vessel traffic in the wider 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 8.2.2, 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.

8.2.4 Mitigation Measures

The following measures will be implemented 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.
- Internal cutting techniques will be utilised where possible, which do not produce any significant noise emissions.
- Where internal cuts are not possible, the preference for external cuts will be mechanical methods because they produce significantly less noise than of abrasive methods.
- No use of explosives.

8.2.5 Residual Effects

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

8.3 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 Hewett subsea installations decommissioning activities.

Ongoing industrial activities located closest to the Hewett Field Area include the Perenco operated Leman Field located approximately 26km to the north-west, the ‘Humber 3’ Aggregate Production Area located approximately 50 km to the north east and the Dudgeon and Sherinham Shoal operational wind farms (both operated by Equinor) located approximately 20 km and 32 km north west of the Dawn 48/29-9 subsea well respectively. Additionally, the Norfolk Vanguard offshore windfarm (operated by Norfolk Vanguard Limited) and the Norfolk Boreas offshore windfarm (operated by Norfolk Boreas Limited) are located approximately 32

km and 58 km east of the Della 48/30-11z and Delilah 30-18 subsea wells, respectively. The Norfolk Vanguard windfarm is waiting determination and the Norfolk Boreas windfarm is recently consented. Both windfarms have the potential to be under construction during the proposed decommissioning window for the Hewett subsea installations. In addition, the Sheringham and Dudgeon extension project is expected to submit an application in Q2 2022 and could be in construction within the timescales of the Hewett subsea installations decommissioning work.

Discussions with IOG have identified that development activities associated with the Vulcan Satellites Hub Project, located 12km north west of the Hewett Field Area, are ongoing with first gas planned for late Q3 2021. Discussions with other Southern North Sea oil and gas operators (Perenco, Chrysaor and INEOS) have not identified any oil and gas projects which would result in a significant cumulative impact with the Hewett subsea installations decommissioning work.

However, the emissions and discharges from the above listed activities and projects in conjunction with the proposed Hewett decommissioning activities are not expected to result in any significant cumulative effects on marine receptors. Routine marine discharges and atmospheric emissions from the proposed Hewett activities are predicted to rapidly disperse and the underwater noise emissions which will be generated are predicted to be insignificant against the noise produced by existing vessel traffic in this area of the southern North Sea. As such, there is unlikely to be any significant overlap with emissions and discharges from other activities in the vicinity of the Hewett Field Area and therefore no significant cumulative effects on marine receptors are predicted. In addition, given the limited area of seabed disturbed by the proposed decommissioning activities, coupled with the distance between the Hewett subsea installations and the developments listed above, no significant cumulative effects on seabed habitats and species are predicted.

In-combination impacts may arise from different activities within the subsea installations 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 and temporary nature of impacts resulting from the proposed decommissioning operations, no significant environmental effects are predicted as a result of in-combination impacts.

8.4 Transboundary Impacts

The Hewett subsea installations are located approximately 82 km west of the UK/Dutch transboundary line at their closest point. 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.

At this stage in the Project there remains potential for Transfrontier Shipment for disposal. In the event any waste from the Hewett subsea installations decommissioning activities is disposed of outside of the UK, Eni will ensure regulations governing transfrontier shipment of waste are complied with.

9.0 POTENTIAL IMPACTS TO MARINE PROTECTED AREAS

There are six marine protected areas (MPAs) located within 40 km of the project area: Southern North Sea SAC, Haisborough, Hammond and Winterton SAC, North Norfolk Sandbanks and Saturn Reef SAC, Greater Wash SPA, Cromer Shoal Chalk Beds MCZ, and The Wash and North Norfolk Coast SAC. The following subsections assess the likely significant effect of decommissioning operations on the coherence of the identified protected site, to ensure the objectives of each of the sites are not compromised.

9.1 Southern North Sea SAC

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

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

The Southern North Sea SAC covers an area of 36,951 km^2 and supports an estimated 17.5% of the UK North Sea MU population of harbour porpoises. All the Hewett subsea installations are located within the southern part of the SAC, except for the Dawn 48/29-9 subsea well which lies outside of the SAC boundary. The southern part of the site supports persistently higher densities of harbour porpoise during the winter months (October – March) and covers an area of 12,687 km^2.

As noted in Section 8.2, the underwater noise emissions generated during the proposed 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. 1.6km from the noise source, equivalent to an area of ca. 8 km^2. This equates to ca. 0.02% of the Southern North Sea SAC total area and 0.06% of the southern (winter) area. It has been calculated that less than three individuals may be temporarily disturbed within this area, which is equivalent to 0.0013% 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.

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, 2020):

- 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.

Eni 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 and 2028), including:

- Hornsea Two offshore wind farm (status: consented) (summer area): construction could be ongoing during 2022, located 81 km north-north-west of the Hewett Field Area;
- Hornsea Four offshore wind farm (status: pre-application) (summer area): construction could be ongoing during 2023-2027, located 85 km north north-west of the Hewett Field Area;
- Dogger Bank Creyke Beck A and B Offshore Wind Farms (status: consented) (summer area) construction could be ongoing during 2022-2024, located 174 km north of the Hewett Field Area;
- Norfolk Vanguard offshore wind farms (status: consented but subject to re-determination) (summer area): construction could be ongoing during 2024-late 2020s, located 32 km south east of the Hewett Field Area;

- Norfolk Boreas offshore wind farm (status: in-planning) (summer area): construction could be ongoing during 2024-late 2020s, located 61 km east of the Hewett Field Area;
- East Anglia Three offshore wind farm (summer and winter area): construction could be ongoing during 2022-2024, located 67km south east of the Hewett Field Area.
- East Anglia One North offshore wind farm (winter area): construction could be ongoing during 2027-2030, located 71 km south east of the Hewett Field Area;
- East Anglia Two offshore wind farm (winter area): construction could be ongoing during 2026-2029, located 78 km south-south-east of the Hewett Field Area.

However, as any disturbance caused by the proposed Hewett 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 and therefore it is anticipated that the additional underwater noise generated by the proposed decommissioning activities is likely to be insignificant compared to the ambient noise level.

In addition to impacts from noise, there is the potential for impacts to supporting habitats and processes relevant to harbour porpoises and their prey within the SAC. As detailed in Section 8.1.1, removal of the Hewett subsea installations will disturb an area of seabed totalling ca. 0.012 km^2. This equates to 0.00003% of the Southern North Sea SAC total area. 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 underwater noise 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 and processes relevant to the prey of the harbour porpoise, fish species such as sand eels, herring, mackerel, cod and whiting that form part of the harbour porpoise diet are present in the vicinity of the subsea installations. However, fish are not predicted to be significantly impacted by the proposed decommissioning activities. Given the flexibility of the harbour porpoise diet (SWF, 2012), there should be no adverse long-term changes regarding availability of prey.

In view of the conservation objectives of the SAC, no LSE on the Southern North Sea SAC are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

9.2 Haisborough, Hammond and Winterton SAC

The site's conservation objectives apply to the site and the individual species and/or assemblage of species for which the site has been classified (refer to the qualifying features listed in Table 6.1). The objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the FCS of its qualifying features, by maintaining or restoring:

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

The Haisborough, Hammond and Winterton SAC is located approximately 0.9km from the nearest subsea installation, the Little Dotty (48/30-9) subsea well. As such, none of the site will be physically disturbed by the proposed decommissioning operations. In addition, any impacts arising from the emissions and discharges

generated by the proposed decommissioning operations are predicted to be highly localised and are therefore not expected to result in significant impacts to the qualifying features of the SAC.

It is acknowledged that one of the sites qualifying features, biogenic reef constructed by *S. spinulosa*, is present in the vicinity of the Hewett subsea installations. *S. spinulosa* classified as 'Medium Reef' was identified 50m south-west and 250m north-north east of the Little Dotty (48/30-15z) well and about 1km east of Della & Dellilah well cluster and the PLEM. At their closest points, 'Low' reefs were found approximately 50m south-west of Little Dotty (48/30-15z) well, 532m south east of the Dawn well, 745m east of the Deborah well cluster, 800m east of the Della & Delilah well cluster and the PLEM, 245m, 270 m south west of the MTM and 250m north west and north east of Little Dotty (48/30-9) well. Areas of 'no emergent *Sabellaria*' have also been identified, the closest of these to the subsea installations are located approximately 43m east of Little Dotty (48/30-9), 41m north east of Deborah (48/30-10), 53m south east of Deborah (48/30-14) and 44m east of Della (48/30-11). However, as noted in Section 8.1.2, *S. spinulosa* is considered to be tolerant to smothering and high levels of turbidity and no identified areas of potential *S. spinulosa* will be subject to direct physical impact from the proposed decommissioning operations.

The site's other qualifying feature, Annex I sandbanks slightly covered by seawater all the time, are not present at the location of the Hewett subsea installations. This feature will therefore not be impacted by the proposed decommissioning operations.

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

9.3 North Norfolk Sandbanks and Saturn Reef SAC

The conservation objectives for the North Norfolk Sandbanks and Saturn Reef SAC are for the features to be in favourable condition thus ensuring site integrity in the long term and contribution to 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.

The North Norfolk Sandbanks and Saturn Reef SAC is located approximately 3.5km from the nearest subsea installation, the Della (48/30-11z) subsea well. As such, none of the site will be physically disturbed by the proposed decommissioning operations. In addition, any impacts arising from the emissions and discharges generated by the proposed decommissioning operations are predicted to be highly localised and are therefore not expected to result in significant impacts to the qualifying features of the SAC.

As noted above, one of the sites qualifying features, biogenic reef constructed by *S. spinulosa*, is present in the vicinity of the Hewett subsea installations. *S. spinulosa* classified as 'Medium Reef' was identified 50m south-west and 250m north-north east of the Little Dotty (48/30-15z) well and about 1km east of Della & Dellilah well cluster and the PLEM. At their closest points, 'Low' reefs were found approximately 50m south-west of Little Dotty (48/30-15z) well, 532m south east of the Dawn well, 745m east of the Deborah well cluster, 800m east of the Della & Delilah well cluster and the PLEM, 245m, 270 m south west of the MTM and 250m north west and north east of Little Dotty (48/30-9) well. Areas of 'no emergent *Sabellaria*' have also been identified, the closest of these to the subsea installations are located approximately 43m east of Little Dotty (48/30-9), 41m north east of Deborah (48/30-10), 53m south east of Deborah (48/30-14) and 44m east of Della (48/30-11). However, as noted in Section 8.1.2, *S. spinulosa* is considered to be tolerant to smothering and high levels of turbidity and no identified areas of potential *S. spinulosa* will be subject to direct physical impact from the proposed decommissioning operations.

The site's other qualifying feature, Annex I sandbanks slightly covered by seawater all the time, are not present at the location of the Hewett subsea installations. This feature will therefore not be impacted by the proposed decommissioning operations.

Therefore, in view of the conservation objectives of the SAC, no LSE on the North Norfolk Sandbanks and Saturn Reef SAC are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

9.4 Greater Wash SPA

The site's conservation objectives apply to the site and the individual species and/or assemblage of species for which the site has been classified (refer to the qualifying features listed in Table 6.1). The objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

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

The Greater Wash SPA covers an area of 3,536 km^2 and is located approximately 13.7km from the nearest Hewett subsea installations, Little Dotty (48/30-15z) subsea well and the MTM.

Of the bird species present within the SPA, common scoter and red-throated diver are vulnerable to disturbance by boats (Schwemmer *et al*., 2011), with common scoter flushing at distances of around 1,600 ± 777 m from approaching vessels and red-throated diver flushing at distances of about 750 ± 437 m (Fliessbach *et al.,* 2019). Large aggregations of these species are present within the SPA between November and March. In contrast, little gull are less sensitive to disturbance from shipping traffic (Leopold & Dijkman, 2010) and tern species, present during the breeding season, are generally tolerant of vessel activity (Cook & Burton, 2010).

In the event that the decommissioning vessels transit through the SPA during the overwintering period, based on evidence of vessel displacement, it is assumed that all red-throated diver within 2 km of a vessel could be displaced (Burt et *al*., 2017; Burger *et al.,* 2019) and all common scoter within 2.5 km of a vessel could be displaced (Fliessbach *et al.,* 2019). The total number of birds that could be displaced by a vessel transiting through the SPA, assuming the vessel mob / demob from Great Yarmouth, are summarised in Table 9.1.

It can be seen from Table 9.1 that red-throated diver are most at risk of disturbance from vessels transiting to the Hewett Field Area from Great Yarmouth. Therefore to minimise disturbance, Eni proposes to implement the following mitigation measures:

- The timing of the removal works is targeted to occur between April and September, which avoids the period when large aggregations of overwintering red-throated diver and common scoter are present within the SPA;
- Restricting, to the extent possible, vessel movements within the SPA to existing navigation routes when transiting to / from the Hewett Field Area;
- Following marine best practices, such as avoiding over-revving of engines;
- Briefing vessel crew on the purpose and implications of vessel management practices within the Greater Wash SPA.

Given the above, removal of the Hewett subsea installations will not have a likely significant effect on the distribution and population of red-throated diver and common scoter within the Greater Wash SPA.

Table 9.1: Estimated Numbers of Red-Throated Diver and Common Scoter Potentially Disturbed Within the Greater Wash SPA during the Overwintering Period

Mob / Demob Port	Distance Through SPA[1]	Displacement Area[2]	Density of Birds Within SPA[3]	No. of Birds Disturbed	% Population of SPA Disturbed[4]
Red-throated Diver					
Great Yarmouth	16 km	32 km^2	1.35 – 3.38 per km^2	43 – 108	3 – 8
Common Scoter					
Great Yarmouth	16 km	40 km^2	0 – 0.7 per km^2	0 - 28	0 – 0.8

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

Disturbance of the seabed may also have indirect impacts on seabirds due to the potential for adverse effects on their prey. The diet of red-throated diver consists primarily of fish, although sometimes feeds on molluscs, crustaceans, insects and fish spawn. Common scoter feeds on benthic bivalve molluscs, and little gull feeds mostly on insects but also eats brine shrimp and other crustaceans, small molluscs, marine worms and small fish (RSPB, 2019). Disturbance to the seabed, may thus reduce the availability of the benthic prey on which these species feed; however, only a small area of seabed will be disturbed by the proposed decommissioning activities (ca. 0.012 km^2). Additionally, the proposed decommissioning activities are not expected to have a significant impact on fish populations. Thus any effect on seabird prey is considered to be Negligible.

Seabird populations are also particularly vulnerable to surface pollution, however, there is insufficient liquid hydrocarbon inventory associated with the Hewett Field to result in significant damage to the environment. Spill prevention measures will also be in place as detailed in Section 7.3.5.

Given the reasons outlined above, the proposed decommissioning activities will not significantly alter the extent, distribution, structure and function of the habitats of the qualifying bird species, the supporting processes on which these habitats rely, nor the population or distribution of the qualifying bird species. It is recognised that this region of the southern North Sea is already subject to high densities of vessel traffic, which could result in adverse impacts to red-throated diver and common scoter within the SPA in-combination with the vessel traffic generated during the Hewett subsea installations decommissioning project. However, given the temporary nature of the project and the relatively short duration of the proposed operations, coupled with mitigation measures Eni propose to implement, significant in-combination effects are not predicted. Therefore, in view of the conservation objectives of the SPA, no LSE on the Greater Wash SPA are predicted, as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

9.5 Cromer Shoal Chalk Beds MCZ

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

- High energy circalittoral rock – maintain in favourable condition;
- High energy infralittoral rock – maintain in favourable condition;
- Moderate energy circalittoral rock – maintain in favourable condition;

- Moderate energy infralittoral rock – maintain in favourable condition;
- North Norfolk coast (Subtidal) – maintain in favourable condition;
- Peat and clay exposures – maintain in favourable condition;
- Subtidal chalk – maintain in favourable condition;
- Subtidal coarse sediment – maintain in favourable condition;
- Subtidal mixed sediments – maintain in favourable condition; and
- Subtidal sand – maintain in favourable condition.

The Cromer Shoal Chalk Beds MCZ is located approximately 23 km from the nearest subsea installation, the Dawn (48/29-9) well. Given the distance to the site and the fact that any impacts arising from the emissions and discharges generated by the proposed decommissioning operations are predicted to be highly localised and temporary, it is not predicted that the site's qualifying features will be significantly impacted. Therefore, in view of the conservation objectives of the MCZ, no LSE on the Cromer Shoal Chalk Beds MCZ are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

9.6 The Wash and North Norfolk Coast SAC

The conservation objectives for The Wash and North Norfolk Coast SAC are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the FCS of its Qualifying Annex I habitats and Annex II species, by maintaining or restoring;

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

The Wash and North Norfolk Coast SAC is located approximately 37.1 km from the nearest subsea installation, the Dawn (48/29-9) well. All other Hewett subsea installations are greater than 40km away. Given the distance to the SAC and the fact that any impacts arising from the emissions and discharges generated by the proposed decommissioning operations are predicted to be highly localised, it is not predicted that the site's qualifying features will be significantly impacted.

It is acknowledged that one of the SAC's qualifying features, the common seal (an Annex II species), can forage out to distances of 50 km from its haul-out sites (refer to Section 6.4.5), although the distribution of common seals in the vicinity of the Hewett subsea installations is low (<1 individual per 25 km^2) (Russel *et al.,* 2017). Common seals are known to eat a wide variety of fish, including herring, sand eels, whiting and flatfish. Although the distribution of common seals within the SAC will not be impacted, they have the potential to be disturbed by underwater noise emissions generated the proposed decommissioning operations whilst foraging within the Hewett Field Area. However, as discussed in Section 8.2, effects on seals from underwater noise emissions are 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. Additionally, 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 seals due to changes in prey resources are considered to be Negligible.

Therefore, in view of the conservation objectives of the SAC, no LSE on The Wash and North Norfolk Coast SAC are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

9.7 Humber Estuary SAC

The conservation objectives for the Humber Estuary SAC are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the FCS of its Qualifying Annex I habitats and Annex II species, by maintaining or restoring;

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

The Humber Estuary SAC is located approximately 100 km north west from the nearest subsea installation, the Dawn (48/29-9) well. Given the distance to the SAC and the fact that any impacts arising from the emissions and discharges generated by the proposed decommissioning operations will be highly localised, it is not predicted that the site's qualifying Annex I habitat features or Annex II species features (sea lamprey and river lamprey) will be significantly impacted.

The SAC is also designated for the protection of grey seals (an Annex II species). As noted in Section 6.4.5, grey seals are known to forage up to 100 km offshore, with the distribution of grey seals in the Hewett Field Area ranging from 5 to 10 individuals per 25 km^2 at the Little Dotty (48/30-9) well to less than 5 individuals per 25 km^2 in the vicinity of the other subsea installations (Russel *et al.,* 2017). Grey seals are opportunistic feeders and eat a wide variety of fish, squid, octopus and crustaceans such as shrimp. Although the distribution of grey seals within the SAC will not be impacted, they have the potential to be disturbed by underwater noise emissions generated the proposed decommissioning operations whilst foraging within the area. However, as discussed in Section 8.2, effects on seals from underwater noise emissions are 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. Additionally, 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 seals due to changes in prey resources are considered to be Negligible.

Therefore, in view of the conservation objectives of the SAC, no LSE on The Humber Estuary SAC are predicted as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

9.8 Outer Thames Estuary SPA

The site's conservation objectives apply to the site and the individual species and/or assemblage of species for which the site has been classified (refer to the qualifying features listed in Table 6.1). The objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

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

The Outer Thames Estuary covers an area of ca. 3,924 km^2 and is classified for the protection of wintering red-throated diver and breeding little terns and common terns. The SPA is located approximately 41 km from the nearest Hewett subsea installation, Little Dotty (48/30-9).

Of the bird species protected by the SPA, red-throated diver are vulnerable to disturbance by boats, flushing at distances of about 750 ± 437 m (Fliessbach *et al.,* 2019), with large aggregations present within the SPA between November and March. In contrast, little tern and common tern, which forage in the SPA during the breeding season, are generally tolerant of vessel activity (Cook & Burton, 2010).

In the event that the vessels used to decommission the Hewett subsea installations transit through the SPA during the overwintering period, based on evidence of vessel displacement, it is assumed that all red-throated diver within 2 km of a vessel could be displaced (Burt et *al*., 2017; Burger *et al.,* 2019). The total number of birds that could be displaced by a vessel transiting through the SPA, assuming vessel mob / demob from Great Yarmouth, is summarised in Table 9.2.

Table 9.2: Estimated Numbers of Red-Throated Diver Potentially Disturbed Within the Outer Thames Estuary SPA during the Overwintering Period

Mob / Demob Port	Distance Through SPA[1]	Displacement Area[2]	Density of Birds Within SPA[3]	No. of Birds Disturbed	% Population of SPA Disturbed[4]
Great Yarmouth	6 km	12 km^2	2.58 per km^2	31	0.5

[1] Assumes a direct transit route through the SPA to the Hewett Field Area.
[2] Based on displacement distance of 2km for red-throated diver along the entire route within the SPA.
[3] Based on maximum predicted density of red-throated diver within the SPA (Irwin *et. al,* 2019).
[4] Based on an estimated population of 6,466 individuals, the peak mean over the period 1989-2006/07 (JNCC, 2020b). Note, more recent surveys in February 2018 indicate the peak abundance of red-throated diver within the SPA to be 22,280 individuals (Irwin *et. al,* 2019)

To minimise disturbance to red-throated diver, Eni proposes to implement the following mitigation measures:

- The timing of the removal works is targeted to occur between April and September, which avoids the period when large aggregations of overwintering red-throated diver are present within the SPA;
- Restricting, to the extent possible, vessel movements within the SPA to existing navigation routes when transiting to / from the Hewett Field Area;
- Following marine best practices, such as avoiding over-revving of engines;
- Briefing vessel crew on the purpose and implications of vessel management practices within the Outer Thames Estuary SPA.

Given the above, removal of the Hewett subsea installations will not have a likely significant effect on the distribution and population of red-throated diver within the Outer Thames Estuary SPA.

It is recognised that this region of the southern North Sea is already subject to high densities of vessel traffic, which could result in adverse impacts to red-throated diver within the SPA in-combination with the vessel traffic generated during the Hewett subsea installations decommissioning project. Red-throated divers have also been displaced by the wind farm areas within the SPA. However, given the temporary nature of the project and the relatively short duration of the proposed operations, coupled with mitigation measures Eni propose to implement, significant in-combination effects are not predicted.

Therefore, in view of the conservation objectives of the SPA, no LSE on the Outer Thames Estuary SPA are predicted, as a result of the proposed decommissioning activities either alone or in-combination with other plans or projects.

10.0 CONCLUSION

The Hewett Subsea Installations DP involves the removal of eight wellheads, xmas trees and wellhead protection structures and two subsea manifold protection structures (PLEM and MTM). This EA confirms that the Hewett Area Subsea Installations DP can be executed with minimal impact on the environment.

The baseline environment in the affected area is well understood and the potential for impacts to arise from the proposed decommissioning activities are known. Comprehensive identification of potential impacts from the Hewett Area Subsea Installations DP to environmental and societal receptors was achieved through an ENVID workshop. The ENVID identified that no planned activities or unplanned events have the potential to result in significant effects on the marine environment, with embedded mitigation measures in place. However, for completeness, it was recommended that activities resulting in seabed disturbance and underwater noise emissions be subject to further assessment as these are likely to have the greatest impact on the marine environment from a Project perspective, which could be reduced via further mitigation. Following further assessment and upon implementation of the identified mitigation measures, it is has been concluded that all residual effects from these aspects are Minor and not significant, with the majority of impacts being localised and temporary in nature.

Of note is that all the Hewett subsea installations, with the exception of the Dawn (48/29-9) subsea well are located within the boundary of the Southern North Sea SAC designated for the protection of harbour porpoise. A further five MPAs are located within 40km of the installations, namely Haisborough, Hammond and Winterton SAC, North Norfolk Sandbanks and Saturn Reef SAC, Greater Wash SPA, Cromer Shoal Chalk Beds MCZ and The Wash and North Norfolk Coast SAC. Two additional MPAs, Humber Estuary SAC and Outer Thames Estuary SPA, have also been screened into the assessment as one or more of the qualifying features of these sites has the potential to be impacted by the proposed decommissioning activities. However, the EA has concluded that there will not be any likely significant effects on the conservation objectives of these MPAs as a result of the proposed Hewett decommissioning activities, either alone or in-combination with other plans or projects.

The mitigation measures identified to reduce any adverse environmental effects arising from removal of the Hewett subsea installations are summarised in Table 10.1. Eni operates under a HSE IMS, certified to ISO14001:2015 and has established contractor selection and management procedures. When the project contractors are appointed, Eni will communicate the measures listed in Table 10.1 to the contractors via action and technical qualification sessions and, where relevant, will document the measures in bridging documents or in the opening statements of the working procedures. This will help ensure the mitigation measures are successfully implemented during the proposed decommissioning activities.

Table 10.1: Mitigation Measures

Mitigation Measures
Physical Presence
• Notifications will be made to regular users of the area via fisheries notices, Notices to Mariners and NAVTEX/NAVAREA warnings. • Operations will be planned to minimise the number of boat movement, as far as reasonably practicable. • The timing of the removal works is targeted to occur between April and September, which avoids the period when large aggregations of overwintering red-throated diver and common scoter are present within the Greater Wash SPA and Outer Thames Estuary SPA; • Restricting, to the extent possible, vessel movements within the Greater Wash SPA and Outer Thames Estuary SPA to existing navigation routes when transiting to / from the Hewett Field Area; • Following marine best practices, such as avoiding over-revving of engines;

- Briefing vessel crew on the purpose and implications of vessel management practices within the Greater Wash SPA and Outer Thames Estuary SPA.

Seabed Disturbance

- Piles will be cut internally, if possible, to avoid seabed disturbance.
- Tool use will be minimised where feasible whilst still achieving the desired result.
- Working areas will be minimised, as far as practicable.
- In advance of the removal operations commencing, Eni will survey (via MBES and GVI) any area where it is proposed to land an item on the seabed to confirm it is clear of debris or obvious surface features that could be damaged. If the area is deemed not to be suitbale, a new area would be selected accordingly.
- Eni intends to remove the subsea installations immediately following cutting, where appropriate, preventing the need for any items to be wet stored.

Underwater Noise Emissions

- Operations will be planned to reduce vessel movements and minimise the overall duration of the project.
- Internal cutting techniques will be utilised where possible, which do not produce any significant noise emissions.
- Where internal cuts are not possible, the preference for external cuts will be mechanical methods because they produce significantly less noise than of abrasive methods.
- No use of explosives.

Energy Use and Atmospheric Emissions

- Vessel time in the field will be reduced, as far as practicable.
- Eni'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

- Any waste water discharged to sea from vessels will be treated to comply with the requirements of the MARPOL Convention.
- Vessels will operate in compliance with the International Maritime Organisation Ballast Water Management Convention.

Waste Management

- A Materials Inventory has been developed for the Project to identify the types of waste generated and the management procedures for each waste stream will be included in the contractor's Waste Management Plan. The principles of the Waste Management Hierarchy will be followed.
- Good housekeeping standards will be maintained on board all vessels in accordance with the contractor waste management strategy.
- Transfer notes will accompany all non-hazardous waste to shore and consignment notes will be in place for any hazardous waste.
- Checks will be carried out on the selected waste yard to ensure all permits and licenses are in place for the handling and disposal of the waste types identified. Eni will ensure that waste is transferred by an appropriately-licensed carrier who should have a Waste Carrier Registration, Waste Management Licence or Exemption, as appropriate for the type of waste.

- The amount of NORM Waste is unknown at this time, however there remains a possibility that it will be present during decommissioning activities. Eni will ensure appropriate RSR permits are in place and conditions that dictate the management and control of radioactive waste are met.
- Marine growth, if found, will be removed onshore at the waste yard and will be done with appropriate odour control implemented through an odour management plan and will be disposed of in accordance with the principles of the Waste Management Hierarchy.

Accidental Events

- Shipping and fishing bodies will be kept informed of the project and appropriate notifications made in a timely manner.
- Vessels selected to undertake the decommissioning activities will have effective operational systems and on board control measures.
- Dropped object procedures 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.
- Appropriate maintenance and pre-use checks on hydraulic equipment 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.
- All vessels undertaking decommissioning activities will have an approved SOPEP.

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12.0 APPENDIX A: MARINE PLANNING

Table 12.1: Marine Planning Objectives and Policies Relevant to the Proposed Hewett Area Subsea Installations Decommissioning Operations

Relevant Objectives	Associated Policies	Project Compliance
Economic Productivity - To promote the sustainable development of economically productive activities, taking account of spatial requirements of other activities of importance to the East marine plan areas.	EC1 - Proposals that provide economic productivity benefits which are additional to Gross Value Added currently generated by existing activities should be supported.	The Hewett Gas Field is coming to the end of its productive time and is in the process of being decommissioned. CoP applications have been approved for each of the eight subsea wells where the subsea installations are being removed. The possibility for in situ re-use or redevelopment is not viable.
Employment and Skill Levels - To support activities that create employment at all skill levels, taking account of the spatial and other requirements of activities in the East marine plan areas.	EC2 - Proposals that provide additional employment benefits should be supported, particularly where these benefits have the potential to meet employment needs in localities close to the marine plan areas.	Where possible the proposed decommissioning work will utilise local contractors.
Heritage Assets - To conserve heritage assets, nationally protected landscapes and ensure that decisions consider the seascape of the local area.	SOC2 - Proposals that may affect heritage assets should demonstrate, in order of preference: a) that they will not compromise or harm elements which contribute to the significance of the heritage asset; b) how, if there is compromise or harm to a heritage asset, this will be minimised; c) how, where compromise or harm to a heritage asset cannot be minimised it will be mitigated against, or;	The proposed decommissioning operations are not anticipated to have an impact on any heritage assets. As the infrastructure which is being removed is subsea, any impact to the seascape of the local area will be temporary as a result of vessels on location during the removal activities.

Relevant Objectives	Associated Policies	Project Compliance
	d) the public benefits for proceeding with the proposal if it is not possible to minimise or mitigate compromise or harm to the heritage asset. SOC3 - Proposals that may affect the terrestrial and marine character of an area should demonstrate, in order of preference: a) that they will not adversely impact the terrestrial and marine character of an area; b) how, if there are adverse impacts on the terrestrial and marine character of an area, they will minimise them; c) how, where these adverse impacts on the terrestrial and marine character of an area cannot be minimised they will be mitigated against; d) the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.	
Healthy Ecosystem - To have a healthy, resilient and adaptable marine ecosystem in the East marine plan areas.	ECO1 - Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be addressed in decision-making and plan implementation.	No significant cumulative impacts are predicted to occur. Refer to Section 8.3.
	ECO2 - The risk of release of hazardous substances as a secondary effect due to any increased collision risk should be taken account of in proposals that require an authorisation.	In the unlikely event of an accidental release of hydrocarbons or chemicals the impact to the marine environment is not anticipated to be significant. Refer to Section 7.3.5.1.
Biodiversity - To protect, conserve and, where appropriate, recover biodiversity that is in or dependent upon the East marine plan areas.	BIO1 - Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence including on habitats and species that are protected or of conservation concern in the East marine plans and adjacent areas (marine, terrestrial).	The proposed decommissioning operations will not significantly impact biodiversity. Refer to Sections 7 and 8.

Relevant Objectives	Associated Policies	Project Compliance
Marine Protected Areas (MPAs) - To support the objectives of MPAs (and other designated sites around the coast that overlap, or are adjacent to the East marine plan areas), individually and as part of an ecologically coherent network.	MPA1 - Any impacts on the overall MPA network must be taken account of in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network	The proposed decommissioning operations will not pose a risk of adversely affecting (either directly or indirectly) the integrity of any MPA, either alone or in combination with other plans or projects. Refer to Section 9.
Governance - To ensure integration with other plans, and in the regulation and management of key activities and issues, in the East marine plans, and adjacent areas.	GOV2 - Opportunities for co-existence should be maximised wherever possible.	Residual effects on other sea users resulting from the physical presence of vessels on location in the Hewett Area during the proposed decommissioning operations are predicted to be Negligible and not significant. In addition, removal of the WHPSs and associated 500 m safety exclusion zones will result in positive effects as the area will become available to other sea users again. Refer to Section 7.3.1.
	GOV3 - Proposals should demonstrate in order of preference: a) that they will avoid displacement of other existing or authorised (but yet to be implemented) activities; b) how, if there are adverse impacts resulting in displacement by the proposal, they will minimise them; c) how, if the adverse impacts resulting in displacement by the proposal, cannot be minimised, they will be mitigated against or; d) the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts of displacement.	