PremierOil

COMPARATIVE ASSESSMENT SERVICES

CONTRACTOR DOCUMENT COVER SHEET

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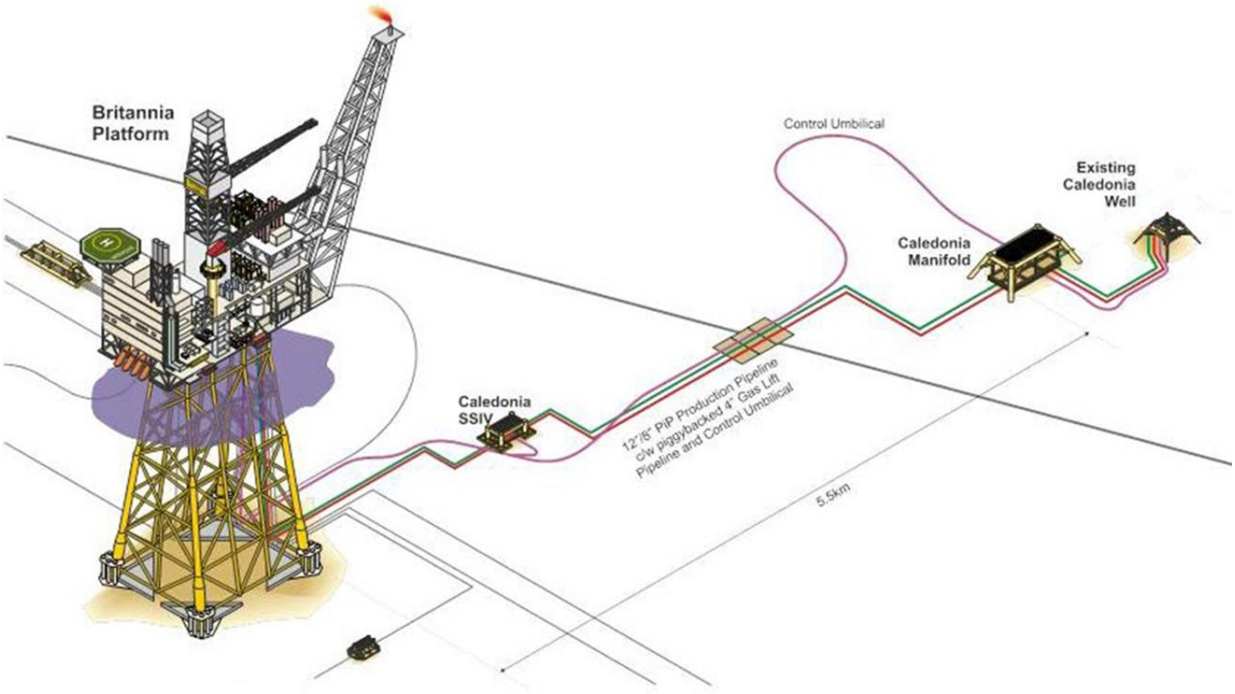

Caledonia Decommissioning

Environmental Appraisal

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B02	AB-CA-XGL-LL-SU-RP-0003	Comments Addressed	17/06/2020
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B04	AB-CA-XGL-LL-SU-RP-0003	Minor Amendments	07/05/2021
B05	AB-CA-XGL-LL-SU-RP-0003	OPRED comments addressed	03/06/2021

Distribution List

Name	Company/Organisation	No of Copies

Contents

Terms and Abbreviations

Abbreviation	Text in Full
ALARP	As Low As Reasonably Practicable
AIS	Automatic Identification System
AWMP	Active Waste Management Plan
BEIS	Business, Energy and Industrial Strategy
BP	British Petroleum plc
CA	Comparative Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CNS	Central North Sea
CoP	Cessation of Production
CSV	Construction Support Vessel
DECC	Department of Energy and Climate Change
DoB	Depth of Burial
DP	Decommissioning Programme
DFPV	Drained, Flushed, Purged and Vented
DSV	Diving Support Vessel
DTI	Department fort Transport and Industry
EA	Environmental Appraisal
EMT	Environmental Management Team
EPS	European Protected Species
ESE	East-Southeast
EU	European Union
EUNIS	European Nature Information System
FPSO	Floating Production Storage & Offloading

Abbreviation	Text in Full
HSE	Health & Safety Executive
HSES	Health, Safety, Environment and Security
ICES	International Council for the Exploration of the Seas
IEMA	Institute of Environmental Management and Assessment
in	Inch
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kg	Kilogrammes
km	Kilometre
KPI	Key Performance Indicator
m	Metre
MAIB	Marine Accident Investigation Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MCDA	Multi Criteria Decision Analysis
MCZ	Marine Conservation Zone
MDAC	Methane Derived Authigenic Carbonate
µg/g	Micrograms per gram
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
mg/l	Milligrams per litre
mm	Millimetre
MMO	Marine Management Organisation
MPA	Marine Protected Area
MS	Marine Scotland

Abbreviation	Text in Full
N/A	Not Applicable
N	North
Navaids	Navigational Aids
NCMPA	Nature Conservation Marine Protected Area
NE	Northeast
NMP	National Marine Plan
NNW	North-Northwest
NORM	Naturally Occurring Radioactive Material
NW	Northwest
OD	Outer Diameter
ODU	Offshore Decommissioning Unit
OGA	Oil & Gas Authority
OGUK	Oil & Gas UK
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
OPEP	Oil Pollution Emergency Plan
OSPAR	Oslo Paris Convention – Convention for the Protection of the Marine Environment of the North East Atlantic
P&A	Plug and Abandon (Wells)
PL	Pipeline
PMF	Priority Marine Features
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SBM	Synthetic based mud
SE	Southeast

Abbreviation	Text in Full
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermens Federation
SNH	Scottish National Heritage
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Areas
SSE	South-Southeast
SSS	Side-Scan Sonar
SSW	South-Southwest
Te	Tonne
THC	Total Hydrocarbon Concentration
TFSW	Trans Frontier Shipment of Waste
UKBAP	United Kingdom Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VMS	Vessel Monitoring System
WBM	Water based mud

EXECUTIVE SUMMARY

1 Introduction and Background

This section provides a non-technical summary of the findings of the Environmental Appraisal (EA) conducted by Premier Oil UK Limited (Premier) for the proposed decommissioning activities associated with the Caledonia Field. The Caledonia Field is located in Block 16/26 in the Central North Sea (CNS), approximately 186 km northeast of Peterhead, Scotland and 34 km southwest of the UK/Norway median line (Figure 1-1).

On the 31st March 2021, Premier Oil plc and Chrysaor Holdings Limited merged to form Harbour Energy plc. At this point in time, the Premier Oil plc and Chrysaor Holdings Limited companies, including Premier Oil UK Limited as Caledonia Operator and 100% equity holder, are not affected by the completion of the merger, and there are no changes to the company registration details.

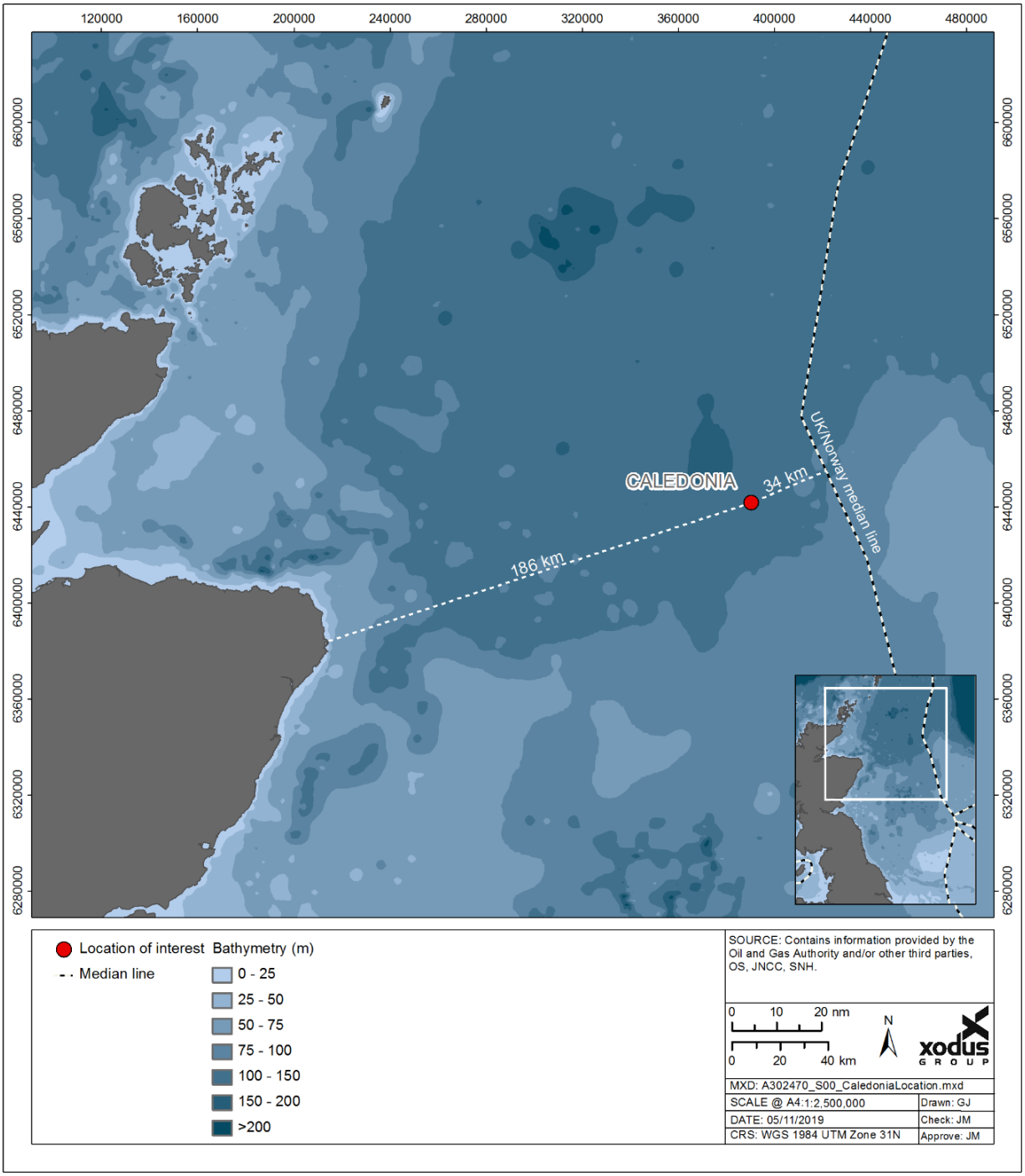

Figure 1-1 Location of Caledonia

2 Decommissioning Overview

As part of the planning for decommissioning and to obtain regulatory approval for the proposed activities, a Decommissioning Programme (DP) has been prepared for the Caledonia Field, which is supported by this EA (Premier, 2020). This EA report will assess the potential environmental impact associated the decommissioning of the Caledonia Field's flowlines and substructures.

The DP for the decommissioning of this infrastructure (Premier, 2020) and this supporting EA do not cover well plugging and abandonment (P&A). These activities will be carried out under Field operational permits. The Caledonia subsea infrastructure was flushed and disconnected in 2018. However, the removal of the subsea infrastructure is covered by the scope of this EA.

Further detail about the activities and infrastructure to be decommissioned is provided in Section 4 of this non-technical summary.

3 Proposed Schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability of cost-effective removal services and contractual agreements. The high-level Gantt chart featured in Figure 1-2 provides the overall schedule for the programme of decommissioning activities for the Caledonia Field operated by Premier Oil.

Premier Oil have already flushed and disconnected the subsea pipelines associated with the Caledonia Field in 2018.

Due to the relatively close proximity of the Caledonia Field to the Premier-operated Balmoral Area Fields, Caledonia will be decommissioned alongside the Balmoral Area decommissioning activities, hereby maximising efficiency and minimising costs. Also, due to subsea infrastructure intricacies, it is likely that the Caledonia workscopes inside the Britannia 500 m zone will have to be deferred until the Chrysaor-operated Britannia platform is decommissioned. This is reflected in the high-level project plan provided in Figure 1-2 below.

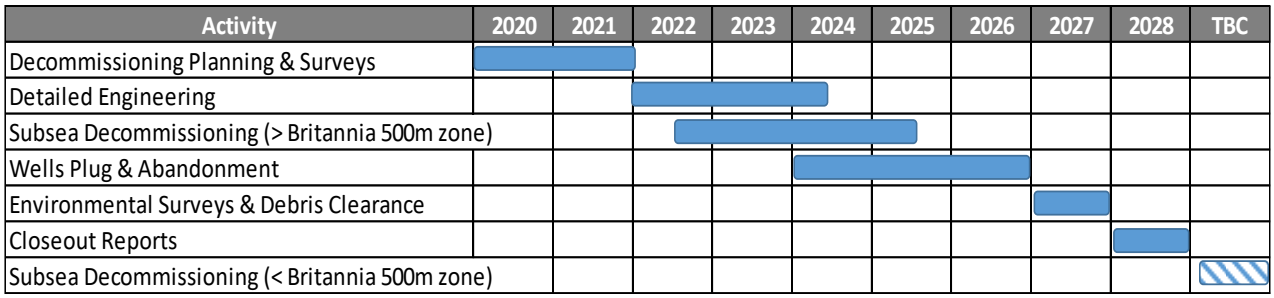

Figure 1-2 Gantt Chart of Project Plan

4 Options for Decommissioning

All of the Caledonia subsea infrastructure was assessed against the Guidance Notes: *Decommissioning of Offshore Oil and Gas Installations and Pipelines* (BEIS, 2018). The recommended Comparative Assessment (CA) process was applied. Infrastructure was organised into groups of items with similar characteristics allowing for greater efficiency in dealing with the large inventory. The guidance identifies infrastructure which may be fully removed and some categories of pipelines which may be decommissioned *in situ,* subject to CA.

Once the infrastructure groups designated for full removal were identified the remaining groups were assessed further. All possible decommissioning options for the remaining groups were screened. This involves consideration of each option against the primary criteria as specified within the BEIS (2018) Guidance: Safety; Environment; Technical; Societal and Economic. The options were scored against each criterion as either green, amber or red, pertaining to attractive, acceptable or unattractive respectively. This process eliminated the least favourable options from each infrastructure group in preparation for detailed evaluation of the remaining options. The remaining options were then investigated in detail to develop quantitative and qualitative data for each of the primary criteria and sub-criteria categories (e.g.

safety data, environmental impact data, technical considerations, societal impacts and costs). Once this data was prepared in the form of published studies, a detailed evaluation was conducted to determine the final recommended decommissioning option for infrastructure item. This was facilitated by comparing the data for each sub-criterion across the options using a pair-wise analysis to produce a relative score for each sub-criterion. This score was summed to produce an overall relative score for each option, thereby identify the emerging recommendation for the group.

The decision-making process underpinning the proposed DP is described in Section 2 and the selected decommissioning options, including those carried forward to CA, are summarised in Table 1-1 below. Section 2 contains further details about the process and outcomes of the CA.

Table 1-1 Decommissioning Activities for Caledonia infrastructure

Decommissioning Option	Subsea and surface installations / infrastructure
Full Removal	• Spools and Jumpers • Subsea Installations • Protection and Stabilisation • Dynamic Umbilicals
Carried forward to CA	• Buried Rigid Flowlines • Buried Flexible Flowlines & Umbilicals

Table 1-2 CA Decommissioning Options Considered

CA Group No.	Subsea Infrastructure Description	Decommissioning Options Considered
1 Note 1	Trenched and Buried Rigid Flowlines	• Full removal via de-burial, cut and lift pipeline sections using a construction support vessel (CSV). • Cut and remove pipeline ends (trench transitions) and remediate any remaining snag hazard with localised gravel or rock placement.
3 Note 1	Trenched and Buried Flexible Flowlines / Umbilicals	• Full removal via reverse reel without de-burying the line first. • Cut and remove pipeline ends (trench transitions) and remediate any remaining snag hazard with localised gravel or rock placement.

Notes:

1. 11 CA groups were identified in total, only groups 1 and 3 were carried through to the Caledonia CA evaluation. Groups 6, 7, 8, 9 and 10 were identified for full removal.

5 Environmental and Societal Baseline

The key environmental and societal sensitivities relating to the Caledonia Field are summarised in Table 1-3. As the Caledonia Field sits within the Greater Balmoral Area, survey data from Balmoral transects have been referred to throughout. Balmoral surveys have been used as there are no surveys for Caledonia. The results are thought to be analogous of conditions at Caledonia.

Table 1-3 Key Environmental and Societal Sensitivities for Caledonia Field

Environmental Receptor	Description
Key Conservation interests	
Oslo Paris Convention (OSPAR) (2008) List of Threatened and/or Declining Habitats and Species	
Ocean quahog (*Arctica islandica)*	No evidence of ocean quahog (*Arctica islandica)* siphons or aggregations were observed from surveys within the Balmoral Field, within which Caledonia is located closest to. Though this does not definitively rule out the presence of this species either on the investigated transects or at the Caledonia Field. Juvenile ocean quahog were identified in the majority of grab samples collected across the Greater Balmoral Area (Fugro, 2018b).
Seapens and burrowing megafauna communities	During the Fugro (2018a) habitat assessment survey, observations across the Greater Balmoral Area revealed the presence of the 'Seapens and burrowing megafauna communities' habitat. The Balmoral camera transects is close to Caledonia and it is therefore reasonable to assume this habitat is also present at the Caledonia Field. The 'Burrowed mud' Scottish Primary Marine Feature (PMF) habitat is a key component of the OSPAR habitat; this PMF is also present in the Greater Balmoral Area and therefore is likely to be found within the Caledonia area.
Conservation sites	
Special Areas of Conservation (SACs)	The nearest SAC to the Caledonia decommissioning project is the Scanner Pockmark SAC, which is situated 21 km north of the project area. This SAC is designated for the presence of submarine structures formed by leaking gases, which are found within seabed depressions referred to as "pockmarks" and support reef-like communities distinct from the surrounding soft sediments. Depressions have been observed in Caledonia, within 20 m of the pipeline between the Caledonia manifold and Britannia platform; however, it is unclear how they were formed (UTEC, 2008; SNH, 2014).
Nature Conservation Marine Protected Area (NCMPAs) and Marine Protected Areas	The nearest NCMPA to Caledonia is the Norwegian Boundary Sediment Plain MPA located 30 km north east of the project area. The site is designated for the conservation of ocean quahog aggregations, including sands and gravels as their supporting habitat (JNCC, 2014). The East Gannet and Montrose Fields NCMPA is located 60 km to the south of the project area. The site is also designated for the conservation of ocean quahog aggregations and contains supporting sands and gravel habitats. The Central Fladen MPA is located 103 km to the north west of the project area. The site is designated for features such as burrowed mud (seapens and burrowing megafauna and tall seapen components), and sub-glacial tunnel valley representative of the Fladen Deeps Key Geodiversity area (JNCC, 2018b).
Special Protected Areas (SPAs)	There are no SPAs in the vicinity of the project area. The closest SPA is the Buchan Ness to Collieston Coast SPA located approximately 174 km to the south west of the project area. The site is of importance as a nesting area for a number of seabird species (gulls and auks). These birds feed outside the SPA in the nearby waters as well as further offshore. In particular the Northern fulmar (*Fulmarus glacialis*), known to utilise the SPA, has a maximum foraging range of 580 km (Thaxter *et al.*, 2012). However, the likelihood of these birds being within the project area in great numbers is minimal.

Environmental Receptor	Description
Annex I Habitats	Caledonia has been characterised as an "area likely to produce Annex I submarine structures" (Figure 3-7). Seabed depressions were recorded within 20 m of the pipeline route between the Caledonia manifold and the Britannia platform, and within the Greater Balmoral Area (Fugro, 2001; Fugro, 2018a). However, there was no sign of MDAC and associated communities which would constitute these depressions being labelled as Annex I pockmarks.
Conservation Species	
Coastal and Offshore Annex II species most likely to be present in the project area	
Pinnipeds – Harbour and Grey Seals	Due to the distance from Caledonia to shore (185 km), pinnipeds are not expected in significant numbers across the project area, with densities estimated to be 0-1 individuals per 25 km^2 for both harbour and grey seals (Russell *et al*., 2017).
European Protected Species most likely to be present in the project area	
Harbour porpoise	The harbour porpoise (*Phocoena phocoena*) is a small, highly mobile species that is the most commonly occurring cetacean in UK waters. It can be found in the vicinity of the proposed decommissioning area in relative abundance. Particularly large numbers occur in the project area during the summer months, with a peak in numbers in July and August (Reid *et al*., 2003; Hammond *et al*., 2017). The relative density of harbour porpoise is estimated at 0.6 - 0.7 animals/km^2 in the vicinity of the Caledonia decommissioning activities (Hammond *et al*., 2017).
Minke whale	Minke whales (*Balaenoptera acutorostrata*) are usually sighted as individuals or in pairs; however, pods of up to 15 individuals have been seen feeding. It is suggested that animals return to the same seasonal feeding grounds. The relative density of minke whale is estimated at 0.037 animals/km^2 in the vicinity of the Caledonia decommissioning activities (Hammond *et al*., 2017).
White-beaked dolphin	White-beaked dolphins (*Lagenorhynchus albirostris*) are usually found in pods of around 10 individuals, although large pods of up to 500 animals have been seen. They are present in the UK waters throughout the year, however more sightings have been made between June and October. The relative density of white-beaked dolphin is estimated at 0.032 animals/km^2 in the vicinity of the Caledonia decommissioning activities (Hammond *et al*., 2017).
Benthic environment	
Seabed type	The water depth in the vicinity of the Caledonia manifold is approximately 140 m, and sediments comprise soft to very soft clay (Fugro, 2001). Habitat assessment camera transects conducted during the Balmoral Area pre-decommissioning survey (Fugro, 2018a) indicate the seabed habitat comprises 'circalittoral fine mud' (EUNIS code A5.36), which is comparable to the Fugro (2001) findings. Five seabed depressions were recorded within 20 m of the pipeline route between the Caledonia manifold and the Britannia platform (Fugro, 2001). Seabed depressions with shell accumulations inside were also evident in the Balmoral camera transects (Fugro, 2018a). Forty-one seabed depressions were investigated in Fugro (2018a), and the camera transects closest to Caledonia were conducted specifically to investigate depressions. Of the 41

Environmental Receptor	Description
	depressions investigated, no sign of MDAC or associated communities were found that would constitute these depressions being labelled as pockmarks.
Benthic Fauna	Fugro (2018a) recorded sea pens and faunal burrows across the Balmoral Field, and as such an assessment was conducted on the seabed camera data for the presence of the OSPAR threatened or declining habitat 'Sea pen and burrowing megafauna communities. At the camera transect stations closest to Caledonia, *Virgularia mirabilis* was 'common' (0.1 to 0.9 individuals/m^2) on one transect and 'frequent' (0.1 to 0.9 individuals/m^2) on the other five. Based on this assessment, the Balmoral camera transects close to Caledonia are expected to qualify as an example of 'Sea pen and burrowing megafauna communities', and it is therefore reasonable to assume this habitat is also present at the Caledonia Field. Visible fauna recorded in Fugro (2018a) included: sea pen (*Pennatula phosphorea* and *Virgularia mirabilis*), starfish (*Asteroidea*), sea anemone (*Actiniaria*), hermit crab (*Paguridae sp*.), sea urchin (Echinodermata) and faunal turf comprising hydrozoans and bryozoans. An unidentified fish and a hagfish (*Myxine sp*.) were also seen near the seabed. There were abundant faunal tracks and burrows. No evidence of ocean quahog siphons or aggregations were observed from the Balmoral transects (Fugro, 2018b), although this does not definitively rule out the presence of this species either on the investigated transects or at the Caledonia Field.
Fish – spawning and nursery grounds	
Spawning grounds	Caledonia is located within the spawning grounds of cod (*Gadus morhua)*, mackerel (*Scomber scombrus)*, Norway lobster (*Nephrops norvegicus)* and Norway pout (*Trisopterus esmarkii)* (Coull *et al*., 1998; Ellis *et al*., 2012).
Nursery grounds	The following species have nursery grounds in the vicinity of the project: anglerfish (*Lophius piscatorius)*, blue whiting (*Micromesistius poutassou)*, cod, European hake (*Merluccius merluccius)*, haddock (*Melanogrammus aeglefinus)*, herring (*Clupea harengus)*, ling (*Molva molva)*, mackerel, Norway lobster, Norway pout, sandeel (*Ammodytidae spp.)*, spotted ray (*Raja montagui)*, spurdog (*Squalus acanthias)*, and whiting (*Merlangius merlangus)* (Coull *et al*., 1998; Ellis *et al*., 2012).
Probability of age 0 group fish aggregations	Data from Aires *et al*. (2014) show the probability of the presence of aggregations of age 0 group fish species. The probability of age 0 group fish species occurring at Caledonia is estimated as <0.15 for all species listed (anglerfish, blue whiting, European hake, haddock, herring, mackerel, horse mackerel (*Trachurus trachurus*), Norway pout, plaice (*Pleuronectes platessa*), sprat (*Sprattus sprattus*) and whiting).
Seabirds	
According to the density maps provided in Kober *et al.* (2010), the following species could be found within the Caledonia decommissioning area: northern fulmar (*Fulmarus glacialis)*, European storm-petrel (*Hydrobates pelagicus),* northern gannet (*Morus bassanus)*, Arctic skua (*Stercorarius parasiticus)*, great skua (*Stercorarius skua)*, black-legged kittiwake (*Rissa tridactyla)*, common guillemot (*Uria aalge)*, razorbill (*Alca torda)*, common gull (*Larus canus*) and Atlantic puffin (*Fratercula arctica)*. Seabird Oil Sensitivity Index (SOSI) identifies areas at sea where seabirds are likely to be most sensitive to surface pollution (Webb *et al*., 2016). Seabird vulnerability in Block 16/26 is low throughout the year with no data for November and December (Webb *et al*., 2016).	

Environmental Receptor	Description

Seabird Oil Sensitivity Index (SOSI)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
15/25	5*	5	5*	5*	5	4	5	5	5	5*	5*	5*
16/21	5*	5	5*	5*	5	5	5	5	5	5*	N	N
16/22	5*	5	5	5*	5	5	5	5	5	5*	5*	5*
15/30	1*	1	4	4*	5	5	5	4*	4	5*	5	5
16/26	**5***	**5**	**5***	**5***	**5**	**5**	**5**	**5**	**5**	**5***	**5***	**5***
16/27	5*	3*	3	5	5	5	5	5	5	5*	5	5
21/5	5*	5	5*	5*	5	5	5	5	5	5*	5*	5*
22/1	5	5	5*	5*	5	5	5	5	5	5*	N	N
22/2	5	5	5*	5*	5*	5	5	5	5	5*	5*	5*

Key						
	1 = Extremely high	2 = Very high	3 = High	4 = Medium	5 = Low	N = No data
	* in light of coverage gaps, an indirect assessment of SOSI has been made					

Societal Receptor	Description

Commercial fishing

Caledonia is located in International Council for the Exploration of the Seas (ICES) Rectangle 45F1 (Scottish Government, 2020). Amalgamated VMS data from 2007 – 2015 shows demersal trawling activity associated with oil and gas pipelines in this region from *Nephrops* and demersal trawling. The fishing intensity is generally low and increases slightly from west to east and from north to south. ICES Rectangle 45F1 experiences low/low-moderate levels of trawling (i.e. between 5 – 20 tracks) on the majority of its pipelines, when compared to the rest of the UKCS (Rouse *et al.*, 2017). In 2019, fishing effort in ICES Rectangle 45F1 was highest in February, April and July, which accounted for 72% of the total number of days fished, whilst January, May, November and December experiencing either no or very low (i.e. disclosive) levels of fishing effort (Scottish Government, 2020). Trawls were the most utilised gear in Rectangle 45F1 (Scottish Government, 2020).

Fishing Landings in ICES Rectangle 45F1

Species type	2019		2018		2017		2016		2015	
	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weigh t (Te)	Value (£)	Live weight (Te)	Value (£)
Demersal	663	1,072,806	365	643,789	536	1,007,325	627	1,034,037	482	620,334
Pelagic	1	796	1	674	0	5	421	189,494	1,892	676,413
Shellfish	1,030	3,166,226	293	988,946	323	1,236,543	218	1,045,948	241	1,012,362
Total	**1,694**	**4,239,828**	**659**	**1,633,409**	**859**	**2,243,873**	**1,266**	**2,269,479**	**2,615**	**2,309,109**

<table>
<tr><th>Societal Receptor</th><th>Description</th></tr>
<tr><td colspan="2">Other sea users</td></tr>
<tr><td>Shipping activity</td><td>Caledonia is located in an area that experiences low shipping intensity (OGA, 2016).</td></tr>
<tr><td>Oil and Gas</td><td>Caledonia is located in the CNS in an area of extensive oil development with a number of fields located nearby. Oil and gas surface and subsea infrastructure within 30 km of the project area is described below:
<table>
<tr><th>Installation</th><th>Installation Type</th><th>Operator</th><th>Distance & direction</th></tr>
<tr><td>Britannia</td><td>Platform</td><td>Chrysaor</td><td>6.0 km SSE</td></tr>
<tr><td>Alba North</td><td>Platform</td><td>Ithaca</td><td>6.1 km SSW</td></tr>
<tr><td>Alba</td><td>Platform</td><td>Ithaca</td><td>8.9 km SSW</td></tr>
<tr><td>Beauly</td><td>Subsea</td><td>Repsol Sinopec</td><td>9.1 km N</td></tr>
<tr><td>Glamis</td><td>Subsea</td><td>Premier</td><td>10.0 km NW</td></tr>
<tr><td>Balmoral</td><td>Platform</td><td>Premier</td><td>14.3 km NNW</td></tr>
<tr><td>Brenda</td><td>Subsea</td><td>Premier</td><td>14.5 km WNW</td></tr>
<tr><td>Hummingbird</td><td>FPSO</td><td>Altera (formerly Teekay)</td><td>15.1 km SSE</td></tr>
<tr><td>Andrew</td><td>Platform</td><td>BP</td><td>16.5 km ESE</td></tr>
<tr><td>Cyrus</td><td>Subsea</td><td>BP</td><td>17.7 km E</td></tr>
<tr><td>Nicol</td><td>Subsea</td><td>Premier</td><td>23.8 km WNW</td></tr>
<tr><td>Alder</td><td>Subsea</td><td>Ithaca</td><td>26.3 km W</td></tr>
</table></td></tr>
<tr><td>Telecommuni-cation</td><td>A historic powerline is located approximately 9 km north of Caledonia. Some sections of the cable may remain on the seabed (NMPi, 2021). The closest submarine cable to Caledonia is the CNS Fibre Optic cable, which is located 34 km to the south (KIS-ORCA, 2019). The TAMPNET CNSFTC telecom cable is located roughly the same distance due south of Caledonia (NMPi, 2021).</td></tr>
<tr><td>Military activities</td><td>There are no military restrictions on Blocks 16/26 (OGA, 2018) and there are no known military activities within the area (Scottish Government, 2019a).</td></tr>
<tr><td>Renewables</td><td>There are no renewable energy activities in the immediate vicinity of Caledonia (The Crown Estate, 2016). The closest renewables site is the Hywind 2 Demonstration approximately 150 km away.</td></tr>
<tr><td>Wrecks</td><td>There are two wrecks, Palmyra (confirmed) and another wreck which is thought to form part of Palmyra, located in the vicinity of the project area, approximately 6 km south east and 9 km south west of the project area (Scottish Government, 2019b).
There are no protected wrecks in the project area (Scottish Government, 2019b).</td></tr>
</table>

6 Impact Assessment Process

This EA Report has been prepared in line with the OPRED Decommissioning Guidelines (BEIS, 2018) and also with Decom North Sea's (2017) *EA Guidelines for Offshore Oil and Gas Decommissioning.* The BEIS Decommissioning Guidance states that an EA in support of a DP should be focused on the key issues related to the specific activities proposed; and that the impact assessment write-up should be proportionate to the scale of the project and to the environmental sensitivities of the project area.

The environmental impact assessment has been informed by a number of different processes, including identification of potential environmental issues through project engineer and marine environmental specialist review in a screening workshop, and consultation with key stakeholders (as detailed in Section 4.1).

The impact assessment screening workshop discussed the proposed decommissioning activities and any potential impacts these may pose. This discussion identified ten potential impact areas based on the proposed removal and decommissioning *in situ* activities. Two of the ten potential impacts were screened in for further assessment based on the potential severity and/or likelihood of their respective environmental impact. The ten potential impacts are detailed in Table 1-4 below, together with justification statements for the screening decisions.

Table 1-4 Environmental impact screening summary for Caledonia decommissioning

Potential impact	Further assessment?	Rationale
Emissions to air	No	Emissions during decommissioning activities, (largely comprising fuel combustion gases) will occur in the context of the CoP. As such, emissions generated by maintenance vessels associated with the Caledonia Field will be replaced by those from vessels and equipment required for decommissioning activities, as well as the recycling of decommissioned materials. Reviewing historical EU Emissions Trading Scheme data and comparison with the likely emissions from the proposed workscope suggests that emissions relating to decommissioning will be minor relative to those generated during production. Review of available decommissioning EAs shows conclusively that atmospheric emissions in highly dispersive offshore environments do not present significant impacts and are extremely small in the context of UKCS and global emissions. Most submissions also note that emissions from short-term decommissioning activities are small compared to those previously arising from the asset over its operational life. The majority of atmospheric emissions for the Caledonia Decommissioning Project relate to vessel time, or are associated with the recycling of material returned to shore. As the decommissioning activities proposed are of short duration, this aspect is not anticipated to result in significant impacts. The vessels under consideration for emissions to air are limited to decommissioning vessels associated with the Caledonia Field (e.g. CSV, DSV, pipehaul vessel, supply vessel, etc.).

Potential impact	Further assessment?	Rationale
		The estimated CO_2 emissions to be generated by the selected decommissioning options is 8,644 Te, this equates to 0.11% of the total UKCS vessel emissions (excluding fishing vessels) in 2017 (7,800,000 Te; BEIS, 2019). In addition to emissions associated with production of new required materials and recycling of recovered materials, this CO_2 total has been calculated assuming an anticipated 52 days of vessel activity for the duration of the project, split across three vessel types (including but not limited to a DSV, trawler and survey vessel). This is a worst-case estimate of vessel days based on extensive overtrawling (which, as detailed in Section 2.4.6, will not be required). Considering the above, atmospheric emissions do not warrant further assessment.
Seabed impacts	Yes	There is potential for decommissioning activities to generate disturbance to the seabed; these include activities associated with the removal of Caledonia's subsea installations, pipelines and umbilicals, and any associated remediation post-decommissioning, including potential overtrawling. Seabed impacts may range in duration from short-term impacts, such as temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. Additionally, seabed disturbance from the removal of infrastructure has the potential to modify the habitat in a way which might impact upon other sea users which utilise the seabed. While not a confirmed activity, the reverse reeling of trenched and buried flexible flowlines has the potential to generate clay berms in the muddy benthic habitat which defines the Caledonia Field Area. Clay berms may pose a potential snagging hazard to commercial fishing gears which make contact with the seabed. However, Premier is committed to leaving a clear seabed following decommissioning and will include any clay berms identified in the Clear Seabed Verification Survey, following the decommissioning of the infrastructure listed above. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. The methods used will be discussed and finalised with OPRED. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF, seabed clearance is likely to require conventional overtrawl survey methods.

Potential impact	Further assessment?	Rationale
		Impacts to the seabed from project activities have been assessed further in Section 6.1, whilst impacts to commercial fisheries generated by seabed disturbance are assessed fully in Section 6.2
Physical presence of vessels in relation to other sea users	Yes	The presence of a small number of vessels for decommissioning activities will be short-term in the context of the life of the Caledonia Field. A collective 177 days of total vessel time is anticipated for the project area, split across three vessel types (possibly including, but not limited to, a DSV/CSV, trawler and survey vessel). Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities. The small number of vessels required will also generally be within the existing 500 m safety zone and the decommissioning of the Caledonia manifold will reduce the number of vessels in the area on the long-term. Other sea users will be notified in advance of planned activities through the appropriate mechanisms, meaning those stakeholders will have time to make any necessary alternative arrangements during the finite period of operations. Although the Caledonia decommissioning project is estimated to require various vessels depending on the selected method of removal, these would not all be on location at the same time. Despite these management measures and the short-term nature of the proposed decommissioning activities, there exists the potential for residual impacts to commercial fisheries to result from the temporary limitation on access to fishing grounds. Assessment of potential impacts to commercial fisheries associated with changes in access to fishing grounds during decommissioning activities is addressed in Section 6.2
Physical presence of infrastructure decommissioned *in situ* in relation to other sea users	Yes	The physical presence of infrastructure decommissioned *in situ* has limited potential of impacting other sea users and is limited to potential snagging risks to commercial fisheries. All substructures will be fully removed. All jumpers and spool pieces will be fully removed. The dynamic surface laid section of umbilical will be fully removed at the time of the Britannia platform decommissioning. Trenched and/or buried flexible flowlines will be decommissioned *in situ* but the ends will be cut and lifted, with remediation. Depth of Burial (DoB) surveys have confirmed the position of these flowlines within the seabed, they are suitably buried and therefore do not pose any risk of interaction with other sea users (see Appendix C). Future monitoring work will ensure the integrity of the DoB of these

Potential impact	Further assessment?	Rationale
		flowlines, but further consideration of the proposed decommissioning activities are necessary, and therefore will be discussed in this EA. Mattresses and grout bags will be fully removed and be cleaned of marine growth if required, and either reused, recovered as aggregate for infrastructure projects or disposed of in landfill sites. In the instance that some mattresses are unable to be recovered OPRED will be consulted. The clear seabed will be validated by an independent verification trawl over the installation sites and pipeline corridors, non-over-trawl techniques such as Side Scan Sonar (SSS)/ROV or by the post decommissioning survey. The methods used will be discussed and finalised with OPRED. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF, seabed clearance is likely to require conventional overtrawl survey methods. The risk associated with the decommissioning activities generating snagging hazards is negligible. However, further assessment related to potential snagging risks associated with the decommissioning of infrastructure *in situ* is provided.
Water quality	No	All Caledonia subsea infrastructures was flushed and disconnected in 2018 under MAT PLA/518. Vessel discharges are managed through existing, International Convention for the Prevention of Pollution from Ships (MARPOL) compliant controls, including bilge management procedures and good operating practices. Any residual liquids present during the decommissioning of pipelines and substructures have been treated before being discharged to sea, such that the discharge comprised of treated water. Any residual remaining material was in trace levels/volumes following the DFPV regime and did not pose any significant risk to water quality. All residual solids were shipped to shore for disposal.
Underwater noise emissions	No	Vessel presence will be limited in scale (i.e. the size and number of vessels) and duration and, therefore, does not constitute a significant or prolonged increase in noise emissions across the project area. To remove the subsea installations, the cutting of flowlines will likely be done with shears, thereby minimising produced underwater noise during this activity. There is potential that external cuttings using diamond wire may be required; however, noise associated with this

Potential impact	Further assessment?	Rationale
		activity will be temporary and generated very close to the seabed, where absorption rates are highest. All other noise generating activities associated with the decommissioning of the Caledonia Field are considered negligible in the context of ambient noise levels, and are likely to be masked by project related vessel activities. Geophysical surveys undertaken for post-decommissioned infrastructure left *in situ* will be assessed in future, through the process of permit application. Multibeam echosounder survey equipment is likely to be used for imaging and identification of pipeline exposures. The JNCC (2017) Guidelines will be employed for mitigation of noise impacts to marine mammals for future survey work involving seismic survey equipment. The project is not located within an area protected for marine mammals and none of the activities associated with the decommissioning of the Caledonia Field are considered to generate significant noise levels which may cause injury or significant disturbance to marine species or other users. On this basis, underwater noise does not require further assessment.
Resource use	No	Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Any opportunities for increasing fuel efficiency and reducing use of resources will be identified and implemented by Premier during the decommissioning programme. The estimated total energy usage for the project is 155,965 GJ. This figure accounts for all operations, materials recycling, and the loss associated with decommissioning items *in situ*. This is considered very low, compared to the resources generated during the production phase of the project. Considering the above, resource use does not warrant further assessment.
Onshore activities	No	The OPRED Guidance states that onshore activities are not in scope of Decommissioning EAs, and this topic does not require further assessment. It should be noted that, only licenced contractors which can demonstrate they are capable of handling and processing the material to be brought ashore (e.g. permitted capacity to accept the relevant waste streams) will be used. This will form part of the commercial tendering process, including duty of care audits and due diligence on the successful contractor. Approval is determined through due-diligence assessment comprising site visits, review of

Potential impact	Further assessment?	Rationale
		permits and consideration of the facilities design and construction has been developed to minimise environmental impact. Premier understands that dismantling sites will also require consents and approvals from onshore regulators such as the Scottish Environment Protection Agency (SEPA), who apply conditions relating to mitigation, management and who are responsible for the provision of permits for such work.
Waste	No	The recycling and disposal of wastes are covered by Premier's Waste Management Strategy, which is compliant with relevant regulations relating to the handling of waste offshore, transfer of controlled, hazardous and special waste, and TFSW. The Waste Management Strategy is guided by Premier's HSES Policy and commitments to best practice in waste management. This includes the mapping and documenting of waste management arrangements for each phase of the Caledonia Field's end of life in individual Active Waste Management Plans (AWMPs), and ongoing monitoring of waste procedures and performance review against target Key Performance Indicators (KPIs). Waste will be treated using the principles of the waste hierarchy, focusing on the reuse and recycling of wastes where possible. Raw materials will be returned to shore with the expectation to recycle the majority of the returned material. There may be instances where infrastructure returned to shore is contaminated (e.g. by Naturally Occurring Radioactive Material (NORM), hazardous, and/or special wastes) and cannot be recycled. In these instances, the materials will require disposal. However, the weight and/or volume of such material is not expected to result in substantial landfill use. On this basis, no further assessment of waste is necessary.
Unplanned events	No	There will be a variety of vessel types and sizes on-site during the decommissioning process. However, of the volume of vessel diesel inventory lost would be less than the worst-case crude oil spill from loss of well containment. The decommissioning activities detailed in this EA will occur after well P&A, therefore the fuel inventory of a vessel likely to be present during decommissioning has been used as a worst-case unplanned event scenario. A vessel's fuel inventory is likely to be split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of the full inventory. Any spills from vessels in transit and outside the 500 m safety zone are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). Premier will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP. Consequently, any impact from vessel-based fuel inventory release will be less than that already

Potential impact	Further assessment?	Rationale
		assessed and mitigated against within the OPEP for the operational phase of the Caledonia Field. The worst-case unplanned event during decommissioning activities would be the release of fuel inventory from the largest vessel on site. This is thought to be a CSV or DSV type vessel. The Seven Falcon, a vessel which is comparable to one which may be used during decommissioning has a fuel capacity of 1,335 m^3. As stated previously, the nature of the fuel tank layout is such that this is unlikely to be released all at once. In addition to the mitigation measures outlined in the individual vessel SOPEPs, Premier maintains manned bridges, navigational aids and monitoring of safety zones. Considering the above, the potential impacts from accidental chemical/ hydrocarbon releases during decommissioning activities do not warrant further assessment. As the methodology for the substructure and pipeline removal and return to shore has not been defined in detail, there exists the remote possibility that during transport of those materials, elements may dislodge and drop from the transport vessel. Premier will cut and lift the unburied sections of the pipeline; however, these sections are short therefore the likelihood of accidental loss of pipeline materials to the seabed is low. Moreover, all substructures are considered sound and no issues regarding their integrity have been identified. Dropped object procedures are industry-standard. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Any dropped objects will be reported to OPRED via PON2 notifications and addressed during the debris clearance survey. These will be removed or remediated in agreement with OPRED. In line with the mitigation measures in place, unplanned loss of materials to the sea do not require further assessment.

The initial screening identified two potential environmental and societal impacts which require further assessment within the EA against the proposed decommissioning activities; they include: seabed disturbance and the physical presence of infrastructure decommissioned *in situ* in relation to other sea users, specifically, commercial fisheries.

7 Environmental Management

The project has limited activity associated with it beyond the main period of preparation for decommissioning and removal of the Caledonia infrastructure. The focus of environmental performance management for the project is therefore to ensure that the activities that will take place during the limited period of preparation and decommissioning happen in a safe, compliant and acceptable manner. The

primary mechanism by which this will occur is through Premier's accredited Environmental Management System (EMS) and Health, Safety, Environment and Security (HSES) Policy.

To support this, a project Health, Safety and Environment (HSE) Plan will be developed which outlines how HSE issues will be managed and how the policies will be implemented effectively throughout the project. The plan will apply to all work carried out, whether onshore or offshore. Performance will be measured to satisfy both regulatory requirements including compliance with environmental consents, as well as to identify progress on fulfilment of project objectives and commitments.

Premier also operates a Waste Management Strategy specific to Caledonia and will develop an Active Waste Management Plan (AWMP) for the decommissioning project to detail the types of materials identified as decommissioning waste and to outline the processes and procedures necessary to support the Decommissioning Programme. The AWMP will detail the measures in place to ensure that the principles of the waste management hierarchy are followed during the decommissioning.

In terms of activities in the central North Sea, the National Marine Plan has been adopted by the Scottish Government to help ensure sustainable development of the marine area. This Plan has been developed in line with UK, European Union (EU) and OSPAR legislation, directives and guidance. With regards to decommissioning, the Plan states that 'where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations'. As part of the conclusions to this assessment (Section 7), Premier has given due consideration to the Scottish National Marine Plan during project decision making and the interactions between the project and Plan.

8 Conclusion

Given the remote offshore location of Caledonia and the highly localised impacts of the proposed decommissioning activities, there is no potential for decommissioning to impact any European or nationally designated protected sites.

This EA has considered the Scottish National Marine Plan, adopted by the Scottish Government to help ensure sustainable development of the marine area. Premier considers that the proposed decommissioning activities are in alignment with its objectives and policies.

Based on the findings of this EA, including the identification and subsequent application of appropriate mitigation measures, and Project management according to Premier's HSES Policy and EMS, it is considered that the proposed Caledonia decommissioning activities do not pose any significant threat to environmental or societal receptors within the UKCS.

1 INTRODUCTION

In accordance with the Petroleum Act 1998, Premier Oil E&P UK Limited (Premier), an established United Kingdom Continental Shelf (UKCS) operator, and on behalf of the Section 29 notice holders, is applying to the Department for Business, Energy and Industrial Strategy (BEIS) to obtain approval for decommissioning of the Caledonia infrastructure. Caledonia is currently in a non-producing state, and Cessation of Production (CoP) was approved on 4th March 2021.

The ownership and operation of the Field associated with Caledonia is 100% owned and operated by Premier. On the 31st March 2021, Premier Oil plc and Chrysaor Holdings Limited merged to form Harbour Energy plc. At this point in time, the Premier Oil plc and Chrysaor Holdings Limited companies, including Premier Oil UK Limited as Caledonia Operator and 100% equity holder, are not affected by the completion of the merger, and there are no changes to the company registration details.

This Environmental Appraisal (EA) has been conducted to assess the potential environmental impacts that may result from activities intrinsic to the staged decommissioning of Caledonia Field and facilities. This EA supports the Decommissioning Programme (DP) associated with the Caledonia Field being submitted to the Offshore Petroleum Regulator for Environment (OPRED), the offshore decommissioning regulator under BEIS, which covers the decommissioning of the Caledonia Field (Premier, 2020).

1.1 Project Overview

The Caledonia Field is located in the Central North Sea (CNS), approximately 186 km northeast of Peterhead, Scotland and approximately 34 km south west of the UK/Norway median line (Figure 1-1).

The Caledonia Field came onto production in February 2003 within in Block 16/26 of the OGA Lease Area on the UKCS. It consists of a single production well tied back, via a subsea manifold, to the Chrysaor-operated Britannia Platform. The production well is connected to the Britannia platform by a production pipeline, a gas lift pipeline and a controls umbilical. The production well was shut in October 2010 due to water handling issues on the Britannia platform. The subsea infrastructure was then flushed and disconnected in 2018.

Decommissioning of the Caledonia Field will be limited to the installations and pipelines; there is no surface infrastructure associated with the Caledonia Field. The Caledonia Field layout is depicted in Figure 1-2. Activities associated with the decommissioning of the Caledonia subsea infrastructure which are assessed in this EA are detailed in the Caledonia Field DP (Premier, 2020).

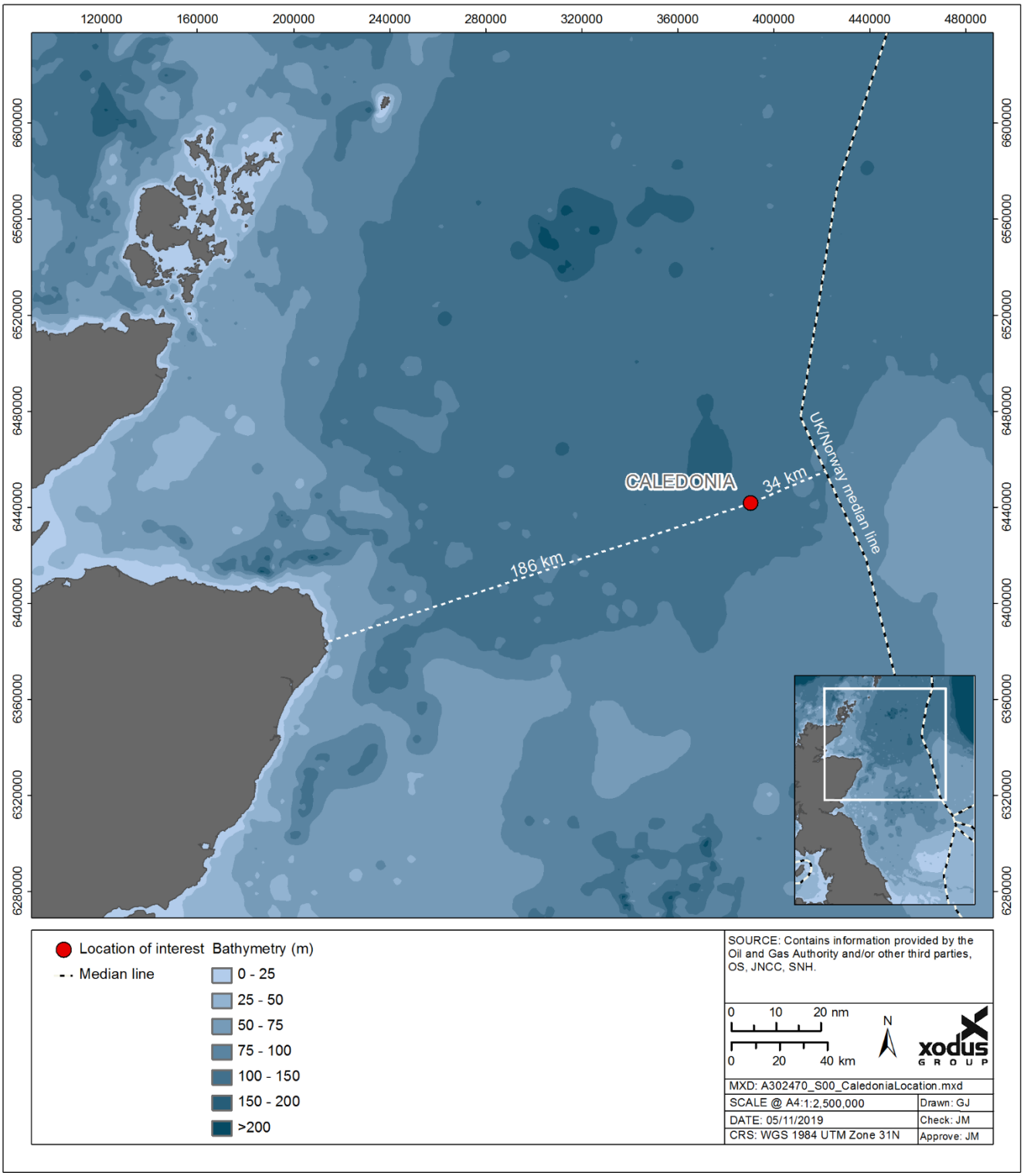

Figure 1-1 Location of Caledonia

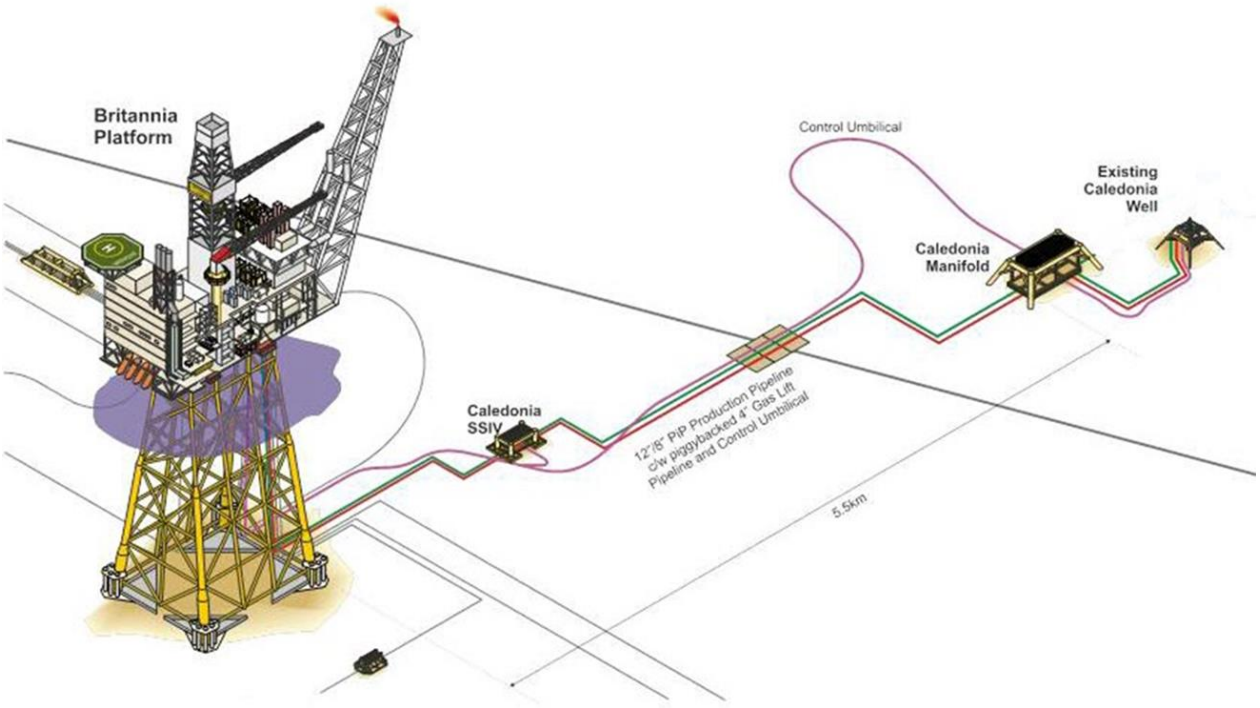

Figure 1-2 Caledonia Field Layout

Decommissioning activities associated with Caledonia are due to begin in 2022, when detailed engineering will commence, and will be carried out through the end of 2028, after the post-decommissioning environmental and debris clearance surveys are completed.

Well plugging and abandonment (P&A) will be permitted as a standalone activity by Premier. This means that the well will be permanently closed in accordance with well decommissioning best practice. Subsea Flowlines have already been flushed prior to disconnection at each end. Similarly, flushing and cleaning operations for subsea substructures have been completed under existing operational permits (i.e. MAT PLA/518) prior to commencement of decommissioning activities.

1.2 Purpose of the Environmental Appraisal Report

This EA Report has been prepared in line with the BEIS (2018) Decommissioning Guidelines and also with Decom North Sea's (2017) *EA Guidelines for Offshore Oil and Gas Decommissioning*. The BEIS Decommissioning Guidance states that an EA in support of a DP should be focused on the key issues related to the specific activities proposed; and that the impact assessment write-up should be proportionate to the scale of the project and to the environmental sensitivities of the project area.

The impact identification and assessment process take into account stakeholder engagement, comparison of similar decommissioning projects undertaken in the UKCS, expert judgement, and the results of supporting studies which aim to refine the scope of the DP. This EA Report documents this process and details, in proportionate terms, the extent of any potential impacts and any necessary mitigation/control measures proposed.

1.3 Regulatory Context

The decommissioning of offshore oil and gas installations and pipelines on the UKCS is controlled through the Petroleum Act 1998 (as amended). Decommissioning is also regulated under the Marine and Coastal Act 2009 and Marine (Scotland) Act 2010. 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). The responsibility for ensuring compliance with the Petroleum Act 1998 rests with OPRED.

The Petroleum Act 1998 (as amended) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the UKCS. The Act requires the operator of an offshore installation or pipeline to submit a draft DP for statutory and public consultation, and to obtain approval of the DP from OPRED, part of BEIS, before initiating decommissioning work. The DP must outline in detail the infrastructure being decommissioned and the method by which the decommissioning will take place.

The primary guidance for offshore decommissioning from the regulator (BEIS, 2018), details the need for an EA to be submitted in support of the DP. The guidance sets out a framework for the required environmental inputs and deliverables throughout the approval process. It now describes a proportionate EA process that culminates in a streamlined EA report rather than a lengthy Environmental Statement (ES). The OPRED guidance is supported by Decom North Sea's (Decom North Sea, 2017) Environmental Appraisal Guidelines for Offshore Oil and Gas Decommissioning, which provide further definition on the requirements of the EA report.

In terms of activities in the CNS, the Scottish National Marine Plan has been adopted by the Scottish Government to help ensure sustainable development of the marine area. This Plan has been developed in line with UK, EU and OSPAR legislation, directives and guidance. The relevant oil & gas policies with regards to decommissioning include Policy Oil & Gas 2 which states that 'where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process'. As part of the conclusions to this assessment (Section 7), Premier has given due consideration to the National Marine Plan during project decision making and the interactions between the project and Plan.

1.4 Scope and Structure of this Environmental Appraisal Report

This EA report sets out to describe, in a proportionate manner, the potential environmental impacts of the proposed activities associated with decommissioning of the Caledonia Field and to demonstrate the extent to which these can be mitigated and controlled to an acceptable level. This is achieved in the following Sections, which cover:

- The process by which Premier has arrived at the selected decommissioning strategy (Section 2);
- A description of the proposed decommissioning activities (Section 2);
- A review of the potential impacts from the proposed decommissioning activities and justification for the assessments that support this EA (Section 5);
- A summary of the baseline sensitivities and receptors relevant to the assessment area that support this EA (Section 3);
- Assessment of key issues (Section 6); and
- Conclusions (Section 7).

This EA report has been prepared in line with Premier's environmental assessment requirements (Standard: Environmental Baseline Data Gathering and Environmental and Social Impact Assessment (Document No. CP-CP-PMO-HS-ZZ-ST-0020)) and has given due consideration to the regulatory guidelines (BEIS, 2018) and to Decom North Sea's *Environmental Appraisal Guidelines for Offshore Oil and Gas Decommissioning* (Decom North Sea, 2017).

2 PROJECT SCOPE

2.1 Consideration of Alternatives and Selected Approach

2.1.1 Decision Making Context

The latest guidance (BEIS, 2018) states that subsea installations (e.g. wellheads, production manifold and spools) must, where practicable, be completely removed for reuse or recycling or final disposal on land. Any piles used to secure such installations in place should be cut below natural seabed level at such a depth as to ensure that any remains are unlikely to become uncovered. Should an Operator wish to make an application to leave in place a subsea installation because of the difficulty of removing it, justification in terms of the environmental, technical or safety reasons would be required. With regards to pipelines (including flowlines and umbilicals), these should be considered on a case-by-case basis. The guidance does provide general advice regarding removal for two categories of pipelines:

- For small diameter pipelines (including flexible flowlines and umbilicals) which are neither trenched nor buried, the guidance states that they should normally be entirely removed; and
- For pipelines covered with rock protection, the guidance states that these are expected to remain in place unless there are special circumstances warranting removal.

The guidance also highlights instances where pipelines could be decommissioned *in situ*. For example, pipelines that are adequately buried or trenched or which are expected to self-bury could be considered as candidates for *in situ* decommissioning. Where an Operator is considering decommissioning pipelines *in situ*, the decision-making process must be informed by 'Comparative Assessment' (CA) of the feasible decommissioning options. This CA takes account of safety, environmental, technical, societal and economic factors to arrive at a preferred decommissioning solution.

Finally, the guidance states that mattresses and grout bags installed to protect pipelines should be removed for disposal onshore, if their condition allows. If the condition of the mattresses or grout bags is such that they cannot be removed safely or efficiently, any proposal to leave them in place must be supported by an appropriate Comparative Assessment of the options.

2.1.2 Alternatives to Decommissioning

Options to re-use the Caledonia Field infrastructure *in situ* for future hydrocarbon developments have been considered, but to date none have yielded a viable commercial opportunity. The primary reason for this is the absence of remaining hydrocarbon reserves in the vicinity of the infrastructure. No reason to delay decommissioning of the infrastructure in a way that is safe and environmentally and socially acceptable has therefore been identified.

All of the Caledonia Field subsea infrastructure was assessed for decommissioning against the Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines (BEIS, 2018). The recommended CA process was applied. For efficiency purposes the Caledonia infrastructure was considered together with infrastructure from the Huntington, Hunter, Rita and Johnston Fields. In accordance with normal practice for the Scoping phase of the CA, infrastructure was organised into groups of items with similar characteristics, facilitating greater efficiency in processing the latter phases of the CA. The guidance identifies certain infrastructure which must be fully removed and some categories of pipelines which may be left decommissioned *in situ* subject to CA. Once the infrastructure groups designated for full removal were identified the remaining groups were assessed further.

All possible decommissioning options for the remaining groups were coarsely screened against the primary criteria as specified within the BEIS (2018) Guidance: Safety; Environment; Technical; Societal; and

Economic. The options were scored against each criterion either green, amber or red, pertaining to attractive, acceptable or unattractive respectively. This process eliminated the least favourable options from each infrastructure group in preparation for detailed evaluation of the remaining options. Those remaining options were then investigated in detail to develop quantitative and qualitative data for each option pertaining to the primary criteria and sub-criteria (e.g. safety data; environmental impact data; technical considerations; societal impacts; and costs). Once this data had been prepared in the form of published studies, a detailed evaluation was conducted to determine the final recommended decommissioning option for each item of infrastructure. This was facilitated by comparing the data for each sub-criterion across the options using a Multi Criteria Decision Analysis (MCDA) tool which employs pairwise comparisons of quantitative and qualitative data to produce a relative score for each sub-criterion that can be summed to produce an overall relative score for each option, enabling identification of the emerging recommendation for the group.

2.1.3 Subsea Comparative Assessment

Prior to the eventual recommended decommissioning options being identified, Premier followed the CA evaluation process in which the decommissioning options are assessed against the five main criteria defined in the Guidance (BEIS, 2018), these were equally weighted.

The CA options which have been considered for decommissioning of the Caledonia Field are outlined in Table 2-1 below and further details are provided in the Caledonia Field Comparative Assessment Report (Premier, 2020). The selected options are in bold and covered in greater detail in Section 2.2. Only Groups 1 and 3 were carried through the CA process as all other groups were identified for full removal.

Table 2-1 CA Decommissioning Options Considered

CA Group No. Note 1	Subsea Infrastructure Description	Decommissioning Options Considered
1	Trenched and Buried Rigid Flowlines	• Full removal via de-burial and cut and lift pipeline sections using a construction support vessel (CSV). • **Cut and remove pipeline ends (trench transitions) and remediate any remaining snag hazard with local gravel or rock placement.**
3	Trenched and Buried Flexible Flowlines / Umbilicals	• Full removal via reverse reel without de-burying the line first. • **Cut and remove umbilical ends (trench transitions) and remediate any remaining snag hazard with local gravel or rock placement.**

Notes:

1. 11 CA groups were identified in total, only groups 1 and 3 were carried through to the Caledonia CA evaluation. Groups 6, 7, 8, and 10 were applicable to Caledonia and were identified for full removal.

2.2 Scope of Proposed Decommissioning Operations

2.2.1 Description of the Infrastructure being Decommissioned

The Caledonia Field in the Central North Sea consists of a single production well tied back with spools to a subsea manifold and then via an 8/12-in diameter pipe in pipe, 5.88 km pipeline and the Caledonia SSIV to the Chrysaor-operated Britannia Platform. The well is supported by gas lift via a 4-in diameter pipeline piggy-backed to the production pipeline. Both the production pipeline and gas lift pipeline are trenched and buried. The well is controlled from Britannia via a multi-core electro-chemical-hydraulic control umbilical, routed through a termination assembly adjacent to the SSIV and on to the subsea manifold within the Caledonia Field. The control umbilical is also trenched and buried. A local controls jumper connects the manifold to the well. The well has been shut in since 2010 and is fully disconnected and positively isolated, the production and gas lift pipelines are disconnected outboard of the SSIV installation.

The pipelines and umbilical cross over the Braes-Forties 30-in diameter pipeline at KP 5.456. The crossing is formed from rock berm. There are also several crossings over the riser to SSIV tie-in spools and control umbilical within the 500m zone of the Britannia Platform.

As the Caledonia subsea infrastructure within the Britannia 500 m zone is in close proximity to live infrastructure the associated decommissioning work scopes will have to be deferred until the Chrysaor-operated Britannia platform is decommissioned. Approximately 330 m of the Caledonia production pipeline (PL1919), 330 m of the gas lift pipeline (PL1920), 357 m of the umbilical (PLU1921), the SSIV installation, 95 concrete mattresses and approximately 800 grout bags are located within the Britannia 500 m zone. As such, these items will be decommissioned at a later date, together with Britannia area infrastructure. However, in the interest of assessing the full impact associated with the Caledonia decommissioning, all of these items and activities are assessed together within this EA.

Table 2-2 provides a summary of the infrastructure within the Caledonia Field which will be decommissioned. Detailed infrastructure descriptions are provided in the subsequent sections within Section 2.4. A full inventory is provided in Appendix B.

Table 2-2 Summary of the infrastructure to be decommissioned in the Caledonia Field

CA Group No.	Subsea Infrastructure Description	Quantity within the Caledonia Field
1	Trenched and Buried Rigid Flowlines	2
3	Trenched and Buried Flexible Flowlines / Umbilicals	1
6	Spools and Jumpers	9
7	Subsea Installations	3
8	Protection / Stabilisation	156 Mattresses and 1,400 Grout Bags
10	Dynamic Umbilicals	1

2.2.2 Description of Proposed Decommissioning Activities

To enable the CA process to be as efficient as possible, the infrastructure to be decommissioned was organised into groups. Thereafter, groups of infrastructure required to be fully removed, in accordance with current guidance, were identified and the remaining groups were assessed against the required criteria; safety, environmental, technical, societal and economic. Through evidence-based evaluation of those remaining groups, final decommissioning recommendations were determined and presented to statutory stakeholders.

The recommended decommissioning approach for the groups of infrastructure located in the Caledonia Field are shown below in Table 2-3.

Table 2-3 Recommended Decommissioning Options for Each Group

Group	Infrastructure Description	Decommissioning Approach
1 Note 1	Trenched and Buried Rigid Flowlines	Removal of surface laid sections using DSV or CSV. Remediation of cut ends with spot rock or gravel cover. Remaining buried pipeline decommissioned *in situ*.
3 Note 1	Trenched and Buried Flexible Flowlines / Umbilicals	Removal of surface laid sections using DSV or CSV. Remediation of cut ends with spot rock or gravel cover. Remaining buried pipeline decommissioned *in situ*.
6	Spools and Jumpers	Full removal using DSV or CSV. Sections are to be cut into manageable lengths and recovered to the vessel for return onshore and recycling / disposal.
7	Subsea Installations	Full removal using a DSV or CSV with a suitable crane. Where possible piles shall be internally cut.
8 Note 2	Protection / Stabilisation	Full removal using a DSV or CSV. Returned onshore for recycling / disposal.
10	Dynamic Umbilicals	Disconnect the subsea end from the termination assembly and recover to vessel deck. Disconnect topsides end from the Britannia TUTU and lower through the J-tube. Recover the umbilical onto a suitable vessel-based reel.

Notes:

1. The Decommissioning approach is the recommended option as a result of the CA process. As the controls umbilical is laid in the same trench as the rigid pipelines the recommendation is to decommission the buried section *in situ*, removing the surface and transition sections.
2. The base position is full removal of all mattresses. If difficulties arise during the removal of mattresses, then Premier shall open a dialogue with OPRED to agree an alternative decommissioning approach.

2.3 General Assumptions

All pipework will have been flushed to an acceptable level of cleanliness prior to decommissioning activities commencing reflecting current guidance from OPRED and the HSE. Wells are out of scope and will be plugged and abandoned, covered by their own permitting regime.

2.4 Method Statements

An appropriately licensed waste management company (or companies, as required) will be identified through a selection process which ensures that the selected facility demonstrates a proven record of: (1) waste stream management throughout the deconstruction process; (2) the ability to deliver innovative re-use/recycling options; and (3) ensures the aims of the waste hierarchy are achieved. Geographic locations of potential disposal yard options may require the consideration of Trans-Frontier Shipment of Waste (TFSW), including hazardous materials. TFSWs will be reviewed by Premier as part of due diligence. Early engagement with the relevant waste regulatory authorities will ensure that any issues with TFSW are addressed. Premier will engage with other companies and industries to identify potential reuse opportunities. Premier believes that such opportunities are best achieved through the tendering and selection of a waste management contractor with the expert knowledge and experience in this area.

2.4.1 Pipelines and Umbilicals

The Trenched and Buried Rigid Flowlines (Group 1 in the CA; PL1919 and PL1920) are to be decommissioned by removing the ends and remediating any snag risk. The flowlines will be disconnected and then the transition and surface laid sections will be cut into manageable lengths before being recovered using a DSV or CSV. The proposed method of cutting is using hydraulic shears. The cut ends within the base of the trench shall be remediated with local rock or gravel placement and the profile left flush with the surrounding seabed.

In the Caledonia Field there are two trenched and buried rigid flowlines: (1) PL1919, which is a pipe-in-pipe production pipeline (12-in outer pipe, 8-in inner pipe) 5.88 km in length running from the Caledonia Field to the Britannia Platform; and (2) PL1920, a 4-in gas lift pipeline which is piggy-backed to the production pipeline. These pipelines are trenched and buried with no exposures along their length except for at the Brae-Forties crossing, where the lines surface and are rock covered. They are buried to an average of 1.46 m. There are no spans (i.e. an area of seabed loss below the pipeline which is > 0.8 m in height from the top of the pipeline and > 10 m long) along their length.

For the Trenched and Buried Flexible Flowlines / Umbilicals (Group 3 in the CA; PLU1921) the emerging recommended option, as a result of the CA process, was option 2B, Full Removal – Reverse Reel without de-burial. However, the single umbilical running between the Britannia Platform and the Caledonia Field is static, and trenched and buried, with the exception of a dynamic section (~375 m long) located entirely within the Britannia platform 500 m safety zone. The static section of the umbilical is laid within the same trench as the rigid pipelines. For this reason, the decision is to remove the ends of the umbilical only, as per the rigid pipelines, decommissioning the buried section of the umbilical *in situ*. The dynamic section of the PLU1921 umbilical is addressed in Section 2.4.3 and will be decommissioned with the Britannia infrastructure.

The details of the pipelines and the static section of the PLU1921umbilical are summarised in Table 2-4 below.

Table 2-4 Pipelines and Umbilicals

ID	Description	OD (mm)	Length (m)
PL1919	8”/12” Production Pipeline (Pipe-in-pipe)	323.9	5,880
PL1920	4” Gas Lift Pipeline (piggybacked to PL1919)	114.3	5,880
PLU1921	Static Umbilical, trenched & buried	172.0	6,092

2.4.2 Spools and Jumpers

Spools and jumpers will be fully removed using a CSV or DSV where sections of spools and jumpers are cut into lengths that are manageable for transportation. The preferred method of cutting is by using hydraulic shears. Spools and jumpers associated with the Caledonia Field installations are provided below in Table 2-5.

Table 2-5 Spools and Jumpers

ID	Description	OD (mm)	Length (m)
PL1919	Manifold – Production Pipeline Tie-In Spool	203.2	70
PL1919	Production Pipeline – SSIV Tie-In Spool	203.2	60
PL1919	SSIV – Production Riser Tie-In Spool	304.8	170
PL1919	Caledonia Well – Manifold Tie-In Spool	152.4	35
PL1920	Gas Lift Riser Base – SSIV Tie-In Spool	203.2	170
PL1920	SSIV – Gas Lift Pipeline Tie-in Spool	101.6	60
PL1920	Gas Lift Pipeline – Manifold Tie-In Spool	101.6	70
PL1920	Manifold – Caledonia Well Tie-In Spool	50.8	35
PLU1921	Manifold – Caledonia Well Controls Jumper	152	50

2.4.3 Dynamic Umbilicals

The dynamic section of the controls umbilical (PLU1921) is surface laid and located entirely within the Britannia platform 500 m safety zone. It will be fully removed at a later date by either reverse reeling or cut and recovery. The method of decommissioning will depend on vessel availability and details of likely synergies with other future Britannia area removal scopes. The dimensions of the dynamic umbilical are shown in Table 2-6.

Table 2-6 Dynamic Umbilical

ID	Description	OD (mm)	Length (m)
PLU1921	Dynamic Controls Umbilical Britannia TUTU – Termination Assembly	172	357

2.4.4 Subsea Installations

Subsea installations shall be fully removed from the seabed. Internal pile cutting is assumed for the piled Caledonia Manifold. The target cut depth of the piles will be 3 m. Premier will aim to use a cutting tool which is able to provide feedback in order to verify the success of the cut.

Where installations are gravity based a 1 m 'buffer' zone is assumed from the outside perimeter to account for the potential requirement for seabed intervention to mitigate suction effects. Installations will be lifted from the seabed using a CSV or DSV with a suitably rated subsea crane.

Additionally, there is a wellhead protection structure (WHPS) which is integrated with the Caledonia subsea tree at the wellhead. It is currently shut in and disconnected and will be removed by the rig as a part of the well abandonment campaign. Environmental impacts associated with the removal of the well will be considered as a part of the Well Intervention and Marine License applications, which will be submitted to OPRED, and therefore activities associated with its removal are considered outwith the scope of this EA. However, this structure has been included as a part of the subsea decommissioning inventory for the Caledonia Field.

A summary of the Caledonia Field installations is provided below in Table 2-7.

Table 2-7 Subsea Installations

Infrastructure	Description	Dimensions (m)	Weight (Te)
SSIV	Steel Framed Gravity Based Installation	6.5 x 4.4 x 3.75	30.4
Manifold	Steel Framed Piled Installation	10.6 x 8.4 x 3.7	67.2
Caledonia WHPS	Subsea Xmas tree with integrated wellhead protection	6.4 x 6.4 x 4	55.9

2.4.5 Protection / Stabilisation

All protection / stabilisation is to be fully recovered using a DSV or a CSV. Concrete mattresses and grout bags which are recovered will be cleaned and either recycled as aggregate for infrastructure projects or disposed of in landfill sites. For items which are unable to be recovered due to accessibility or integrity issues, Premier will open a dialogue with OPRED about alternative decommissioning methodologies.

- 65 off 6 x 2 x 0.15 m bi-flex concrete protection mattress
- 91 off 6 x 3 x 0.15 m bi-flex concrete protection mattress
- 1,400 off 25 kg grout bags (estimated)

Both grout bags and mattresses are usually used in conjunction with other installations to provide support. As such, they are typically stacked on top of one another. However, it has been assumed for the purposes of assessing the impact associated with the removal of these installations, that they are all laid out in a single layer on the seabed. This is an unlikely and worst case scenario with respect to the area of impact.

2.4.6 Clear Seabed Verification Survey

Following the decommissioning of the Caledonia Field infrastructure, it is necessary to identify any potential snagging hazards associated with any changes to the seabed. A clear seabed will be validated by an independent verification survey of all of the installation sites and pipeline corridors. The aim of these clean seabed verification actions is to ensure the seabed is left in a safe condition for future fishing effort, in line with the current Decommissioning Guidance (BEIS, 2018).

Survey techniques which do not make contact with the seabed, such as Side Scan Sonar (SSS) and Remotely Operated Vehicle (ROV), will be implemented to verify the condition of the seabed during the post

decommissioning survey. The survey methods will be discussed and finalised with OPRED prior to survey commencement to ensure the survey meets the requirements for clear seabed verification.

Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the Scottish Fishermen's Federation (SFF), seabed clearance is likely to require conventional overtrawl survey methods. Where there is evidence of snagging hazards requiring intervention (e.g. any spans, berms, dropped objects, etc.), then overtrawling will be undertaken to ensure no residual risk of snagging remains post-decommissioning. Should overtrawling be required, it will be conducted by fishing vessel(s) using trawl gear that is appropriate for the area. As a worst-case the overtrawl surveys shall cover each of the pipeline corridors to a width of 100 m centred on the pipeline route. This practice is highly unlikely; however, this EA aims to address the worse-case scenario. The methods used will be discussed and finalised with OPRED. Results of this survey will be available once the work is complete, with a copy forwarded to OPRED.

The latest survey data available for the Caledonia Field pre-dates development drilling in the Field and as such the current debris status is unknown. Pre- and post-decommissioning surveys shall be conducted, and any debris identified shall be recovered and recycled / disposed of accordingly.

2.5 Summary of Material Inventory

This section summarises the inventory of materials associated with the subsea infrastructure to be decommissioned. Comprehensive information about the materials present within the Caledonia Field is provided.

The Caledonia Field consists of a single subsea production well tied back to the Britannia Platform via a 5.88 km long 8/ 12-in pipe in pipe pipeline. The production well is supported by lift gas supplied via a 4-in gas lift pipeline which is piggy-backed to the production pipeline. Both pipelines are routed through a production manifold within the Caledonia Field and an SSIV within the Britannia 500m zone. The pipelines are tied in at each end via rigid steel spools.

An electro-chemical-hydraulic controls umbilical is used to control the well from Britannia. The dynamic section of umbilical is routed from a TUTU on Britannia through a J-tube within the Britannia jacket and to a seabed termination assembly within the Britannia 500 m zone. The static section of the umbilical is routed to the Caledonia Field within the same trench as the pipelines. The umbilical ties into the production manifold within the Caledonia Field. The manifold is tied into the subsea tree via individual rigid steel spools and control jumpers.

The Caledonia well has been shut in since 2010 and the spools are disconnected at the well and at the Britannia platform riser tie-ins.

All pipelines are trenched and buried with concrete mattresses and grout bags used to support and protect surface sections as required. The pipelines cross the Braes-Forties 30-in pipeline. The crossing is formed from rock berm.

Table 2-8, Figure 2-1 and Figure 2-2 summarise the total and proportional weight of each component's constituent materials for the Caledonia Field.

Table 2-8 Component Materials of Infrastructure to be Decommissioned

Component Type	Weight (Te)				
	Ferrous – all grades	Non-ferrous	Plastics & Misc.	Concrete	Total
Pipelines	1,432.1	27	80.4	633.5	2,173
Installations	135.7	2.3	0	0	138
Total	1,568	29	80	634	2,311

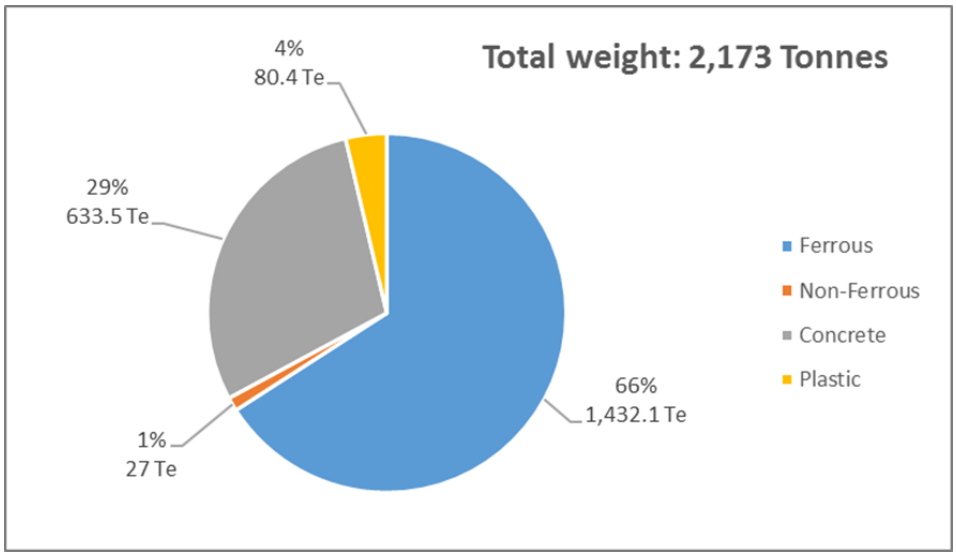

Figure 2-1 Proportion of Constituents for Pipelines in the Caledonia Field.

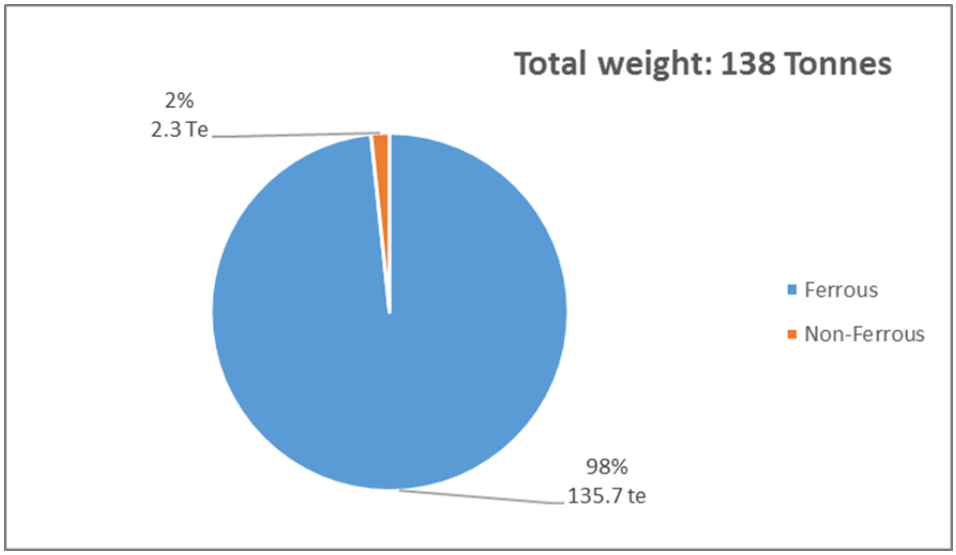

Figure 2-2 Proportion of Constituents for Installations in the Caledonia Field.

2.6 Waste Management

The management of waste during decommissioning is a highly regulated activity, which potentially requires compliance with both national and international legislation, depending on the destinations identified for dismantling and treating any wastes generated.

Premier's HSES Policy supports legal compliance and states that Premier will "do all that is reasonably practicable to prevent major accidents, ensure the safety of everyone involved with our operations and minimise environmental impacts."

Premier will meet statutory or supporting legislation requirements, assessing and managing risks and seeking ways to continually improve performance with respect to waste management activities during Field decommissioning.

Premier's commitments to waste management during decommissioning are to:

1. Manage waste from decommissioning activities in accordance with the applicable regulatory framework and all other obligations required by Premier's HSES Policy;
2. Manage the activities of all contractors and sub-contractors within the decommissioning supply chain that generate and manage waste and ensure their compliance with legal obligations and Premier's HSES Policy;
3. Treat wastes where practicable using the principles of waste hierarchy, with a focus on reuse and recycling of wastes whenever possible;
4. Measure and monitor performance with respect to waste management, including the setting of KPIs for the reuse and recycling of wastes.

2.7 Environmental Management Strategy

Premier is committed to operating responsibly and will never knowingly compromise our health, safety or environmental standards to meet our operational objectives. We will do all that is reasonably practicable to prevent major accidents, ensure the safety of everyone involved with our operations and minimise environmental impacts. Premier's HSES signed policy is shown in Figure 2-3.

Figure 2-3 Premier's HSES Signed Policy

2.8 Proposed Schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability of cost-effective removal services and contractual agreements. The high-level Gantt chart featured in Figure 2-4 provides the overall schedule for the programme of decommissioning activities for the Caledonia Field operated by Premier Oil.

Premier Oil have already flushed and disconnected the subsea pipelines associated with the Caledonia Field in 2018 under MAT PLA/518.

Due to the relatively close proximity of the Caledonia Field to the Premier-operated Fields which make up the Greater Balmoral Area, Caledonia will be decommissioned alongside the Balmoral Area decommissioning activities, hereby maximising efficiency so that decommissioning costs can be minimised.

Also, due to subsea infrastructure intricacies, it is likely that the Caledonia workscopes inside the Britannia 500 m zone will have to be deferred until the Chrysaor-operated Britannia platform is decommissioned. Approximately 330 m of the Caledonia production pipeline (PL1919), approximately 330 m of the gas lift pipeline (PL1920), approximately 357 m of the umbilical (PLU1921), the SSIV installation, 95 concrete mattresses and approximately 800 grout bags are located within the Britannia 500 m zone. As such, these items will be decommissioned at a later date, together with Britannia area infrastructure. However, in the interest of assessing the full impact associated with the Caledonia decommissioning, all of these items and activities are assessed together throughout the EA.

Premier are fully committed to decommissioning remaining infrastructure at the time of the Britannia Field decommissioning and that a tracking regime is in place which will continue until all decommissioning activities have been completed.

This split scheduling is reflected in the high-level project plan in Figure 2-5 below.

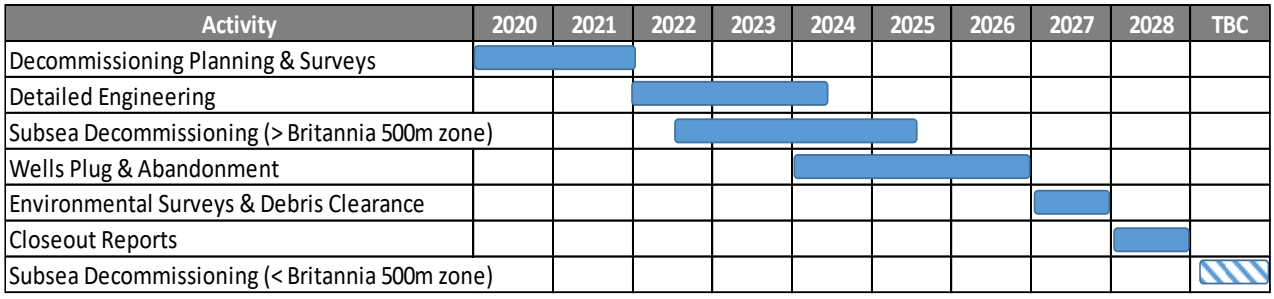

Figure 2-4 Gantt Chart of Project Plan

3 ENVIRONMENTAL AND SOCIETAL BASELINE

3.1 Background

Information is provided here on the environmental baseline characteristics surrounding the Caledonia Field to help inform assessments of the features which may be affected by the proposed decommissioning activities and identify those which may have a bearing on the nature and extent of relevant impacts. The potential interactions between project activities and environmental receptors are detailed and assessed in Section 6. As the activities associated with the DP for the Caledonia Field will be prolonged over several years, environmental features and any relevant changes in their characteristics and sensitivities are described across the entire year.

The project scope (Section 2) and initial screening (Section 5) suggests that the majority of potentially significant environmental impacts would be felt within close proximity to the proposed development location. Therefore, environmental sensitivities are described on a local scale, with broader scale data only used where appropriate for certain ecological characteristics, such as broadscale habitat classification. Certain activities or events, such as water quality impacts, could potentially be more spatially extensive. In these instances, those environmental sensitivities that may be affected are described on a greater spatial scale.

In this regard, Table 3-1 provides an overview of all the environmental and societal sensitivities in the area. Details have been provided on the environmental and societal receptors most likely to be impacted by the proposed activities in Sections 3.4 and 3.5 below. Section 5 provides a justification for each impact which may affect the receptors defined here; the assessment associated with the impacts on receptors is within Section 6. This baseline characterisation describes the current conditions of the receiving environment comprising Caledonia and is considered sufficient to enable effective evaluation of the potential environmental interactions from proposed decommissioning activities.

3.2 Summary of Environmental Surveys

Survey data supplied for the Caledonia Field is limited to a pre-development remote-operated underwater vehicle (ROV), scanning sonar and visual survey of the proposed pipeline route between the proposed Caledonia manifold and the existing Britannia platform (Fugro, 2001). The extent of the geophysical survey effort conducted across Caledonia and the locations of camera stations and transects, environmental grab samples and geotechnical samples are illustrated in Figure 3-1.

Data from the Balmoral Field collected during two surveys of the Greater Balmoral Area conducted in 2018 have been used to supplement this environmental baseline and are illustrated in Figure 3-2. The data from the surveys are described in further detail in the subsequent sections; the results of the surveys are incorporated in the discussion within Section 3.4. The survey provided a bathymetric profile and visual identification of seabed features. As such, the likely environmental conditions have been interpreted as far as possible from this survey, supplemented with dedicated environmental survey data from nearby fields.

A series of site, habitat assessment and environmental baseline surveys have also been conducted in support of offshore operations at the Balmoral Field and in nearby licence blocks (located 2.3 km northeast of the Caledonia Manifold). Information gathered regarding physical, chemical and biological characteristics observed in the Balmoral Field during this survey work is incorporated in the following sections where relevant. The surveys used in this interpretation (Fugro, 2018a and 2018b) gathered seabed samples and imagery in order to acquire an understanding of the range of seabed habitats and communities present, including the potential presence of any species or habitats of conservation concern, such as pockmarks, prior to the commencement of decommissioning activities. The surveys were also designed to determine the nature and extent of any drill cuttings deposits within the Greater Balmoral Area and

establish a pre-decommissioning environmental baseline, focussing on areas of highest potential contamination. The activities that took place at the Caledonia Field differ greatly in comparison to the Balmoral Field; no oil-based drill cuttings were deposited in this area. The Caledonia wells were drilled after changes to legislation with water based mud (WBM) and synthetic based mud (SBM); the latter was skipped and shipped to shore with contaminated cuttings, and thus no drill cuttings piles exist in the Field. Although there is no survey data to confirm this, the total hydrocarbon (THC) levels found at Caledonia are expected to be lower than the levels found within the Balmoral Field surveys.

3.2.1 Habitat Assessment surveys

A pre-decommissioning habitat assessment survey was undertaken from June to July 2018 from a purpose built remotely operated vehicle (ROV) support vessel in the Greater Balmoral Area (Fugro, 2018a). The ROV was equipped with a video camera and digital stills system deployed from the survey vessel to gather footage of the seabed and associated visible animal communities to establish the nature of the seabed prior to decommissioning. The ROV was used as part of visual inspection to gather an inventory of the conditions of wells and other subsea infrastructure including protective concrete mattresses, as well as a debris survey and inspection of burial depths and areas of exposure along pipelines.

As the ROV was already being used for this inspection work, the opportunity was taken to use it to investigate the seabed within the Balmoral Field for habitat assessment purposes. The survey attempted to investigate the range of habitats present in the area via a good spread of video locations, within the limitations of the existing technical scope of work and operating restrictions of the ROV. As well as a general delineation of habitats, this investigation also placed emphasis on locating any areas of potential conservation value.

Video footage and still photos were subsequently assessed to define the habitats present in accordance with the European Nature Information Service classification (EUNIS, 2016).

3.2.2 Environmental Baseline Survey

The environmental baseline survey of the Greater Balmoral Area was conducted to establish the physical, chemical and biological characteristics of the seabed, providing a baseline prior to decommissioning for comparison. The survey provided a bathymetric profile and visual identification of seabed features within the Balmoral Field (Fugro, 2018b) (see Figure 3-2). A vessel- and diver-lead sediment sampling regime was undertaken in 2018 within and surrounding the Balmoral Template to identify baseline conditions of the seabed habitat (Fugro, 2018b).

The physical grab sampling of the seabed conducted as part of the pre-decommissioning surveys was focussed around the Balmoral Template, as this is the site of greatest historical drilling activity and associated discharges related to the development as a whole, including oil base drilling mud discharges. The sampling pattern is shown in Figure 3-1.

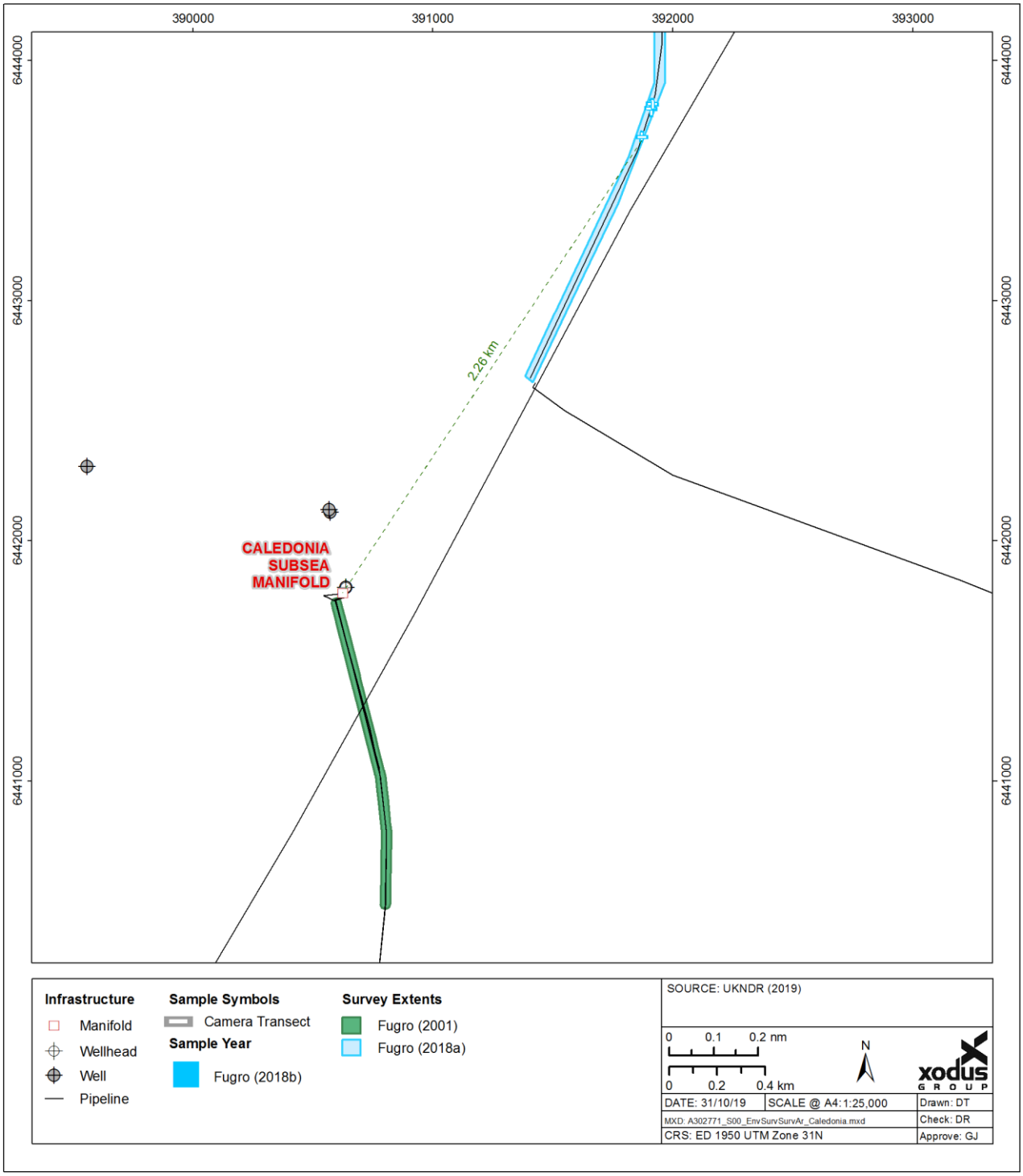

Figure 3-1 Caledonia Geophysical Survey Effort and Sample Locations

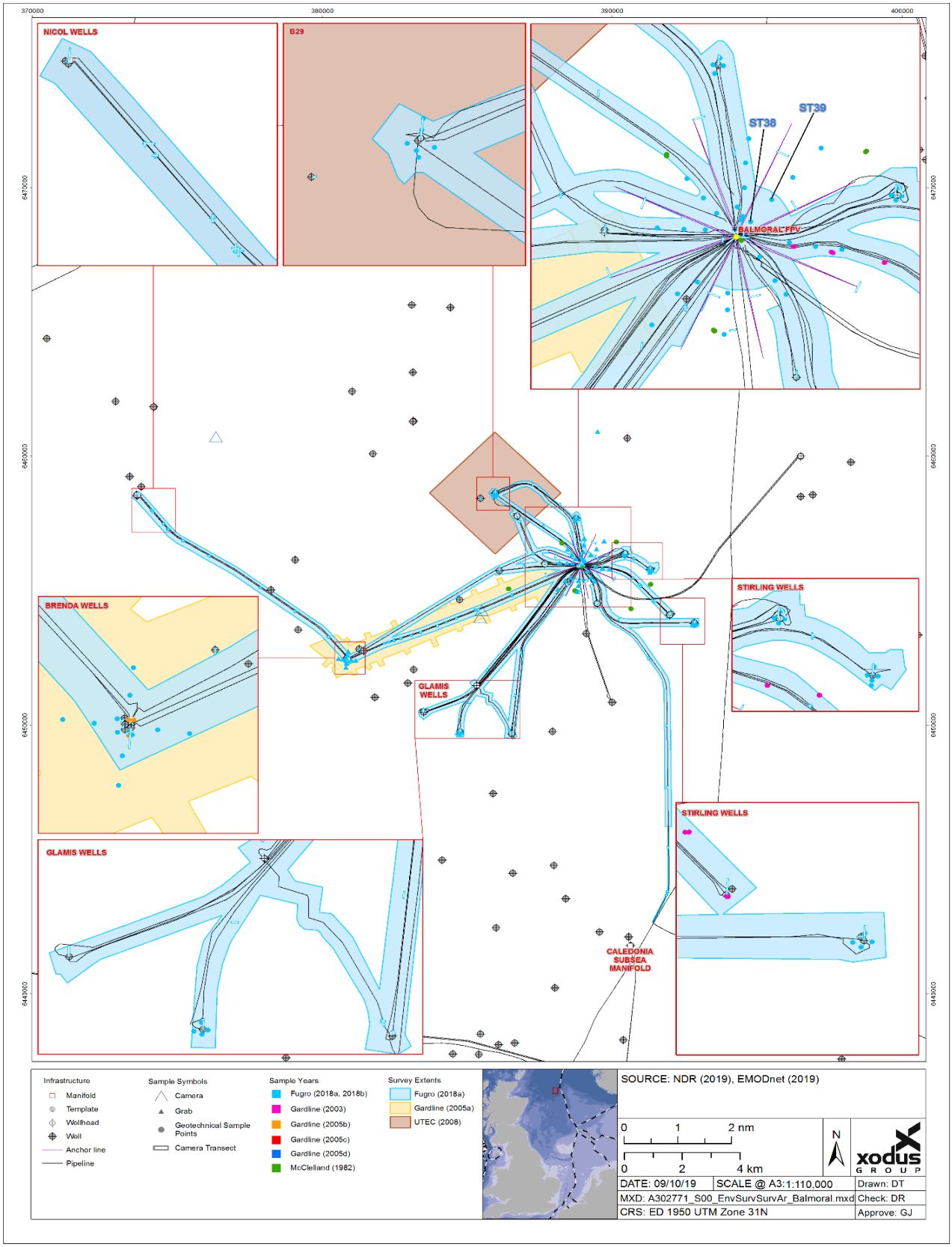

Figure 3-2 Greater Balmoral Area Geophysical Survey Effort and Sample Location

3.3 Summary of Receptors

The baseline environment in the project area is summarised in Table 3-1. For most receptors, the information provided in Table 3-1 is considered sufficient to inform the environmental assessment of potential impacts within this EA. Specific receptors identified during the ENVID and consultation meetings as potentially of specific interest to stakeholders included commercial fisheries, seabed and benthic environment and water quality. These receptors are discussed in more detail in the following Sections.

Table 3-1 Baseline Summary of Environmental and Societal Receptors

Environmental Receptor	Description
Key Conservation interests	
Oslo Paris Convention (OSPAR) (2008) List of Threatened and/or Declining Habitats and Species	
Ocean quahog (*Arctica islandica)*	No evidence of Ocean quahog (*A. islandica)* siphons or aggregations were observed from surveys within the Balmoral Field, within which Caledonia is located closest to. Though this does not definitively rule out the presence of this species either on the investigated transects or at the Caledonia Field. Juvenile ocean quahog were identified in the majority of grab samples collected across the Greater Balmoral Area (Fugro, 2018b).
Seapens and burrowing megafauna communities	During the Fugro (2018a) habitat assessment survey, observations across the Greater Balmoral Area revealed the presence of the 'Seapens and burrowing megafauna communities' habitat. The Balmoral camera transects is close to Caledonia and it is therefore reasonable to assume this habitat is also present at the Caledonia Field. The 'Burrowed mud' Scottish Primary Marine Feature (PMF) habitat is a key component of the OSPAR habitat; this PMF is also present in the Greater Balmoral Area and therefore is likely to be found within the Caledonia area.
Conservation sites	
Special Areas of Conservation (SACs)	The nearest SAC to the Caledonia decommissioning project is the Scanner Pockmark SAC, which is situated 21 km north of the project area. This SAC is designated for the presence of submarine structures formed by leaking gases, which are found within seabed depressions referred to as "pockmarks" and support reef-like communities distinct from the surrounding soft sediments. Depressions have been observed in Caledonia, within 20 m of the pipeline between the Caledonia manifold and Britannia platform; however, it is unclear how they were formed (UTEC, 2008; SNH, 2014).
Nature Conservation Marine Protected Area (NCMPAs) and Marine Protected Areas	The nearest NCMPA to Caledonia is the Norwegian Boundary Sediment Plain MPA located 30 km north east of the project area. The site is designated for the conservation of ocean quahog aggregations, including sands and gravels as their supporting habitat (JNCC, 2014). The East Gannet and Montrose Fields NCMPA is located 60 km to the south of the project area. The site is also designated for the conservation of ocean quahog aggregations and contains supporting sands and gravel habitats. The Central Fladen MPA is located 103 km to the north west of the project area. The site is designated for features such as burrowed mud (seapens and burrowing megafauna and tall seapen components), and sub-glacial tunnel valley representative of the Fladen Deeps Key Geodiversity area (JNCC, 2018b).

Environmental Receptor	Description
Special Protected Areas (SPAs)	There are no SPAs in the vicinity of the project area. The closest SPA is the Buchan Ness to Collieston Coast SPA located approximately 174 km to the south west of the project area. The site is of importance as a nesting area for a number of seabird species (gulls and auks). These birds feed outside the SPA in the nearby waters as well as further offshore. In particular the Northern fulmar (*Fulmarus glacialis*), known to utilise the SPA, has a maximum foraging range of 580 km (Thaxter *et al.*, 2012). However, the likelihood of these birds being within the project area in great numbers is minimal.
Annex I Habitats	Caledonia has been characterised as an "area likely to produce Annex I submarine structures" (Figure 3-7). Seabed depressions were recorded within 20 m of the pipeline route between the Caledonia manifold and the Britannia platform, and within the Greater Balmoral Area (Fugro, 2001; Fugro, 2018a). However, there was no sign of MDAC and associated communities which would constitute these depressions being labelled as Annex I pockmarks.
Conservation Species	
Coastal and Offshore Annex II species most likely to be present in the project area	
Pinnipeds – Harbour and Grey Seals	Due to the distance from Caledonia to shore (185 km), pinnipeds are not expected in significant numbers across the project area, with densities estimated to be 0-1 individuals per 25 km^2 for both harbour and grey seals (Russell *et al*., 2017).
European Protected Species most likely to be present in the project area	
Harbour porpoise	The harbour porpoise (*Phocoena phocoena*) is a small, highly mobile species that is the most commonly occurring cetacean in UK waters. It can be found in the vicinity of the proposed decommissioning area in relative abundance. Particularly large numbers occur in the project area during the summer months, with a peak in numbers in July and August (Reid *et al*., 2003; Hammond *et al*., 2017). The relative density of harbour porpoise is estimated at 0.6 - 0.7 animals/km^2 in the vicinity of the Caledonia decommissioning activities (Hammond *et al*., 2017).
Minke whale	Minke whales (*Balaenoptera acutorostrata*) are usually sighted as individuals or in pairs; however, pods of up to 15 individuals have been seen feeding. It is suggested that animals return to the same seasonal feeding grounds. The relative density of minke whale is estimated at 0.037 animals/km^2 in the vicinity of the Caledonia decommissioning activities (Hammond *et al*., 2017).
White-beaked dolphin	White-beaked dolphins (*Lagenorhynchus albirostris*) are usually found in pods of around 10 individuals, although large pods of up to 500 animals have been seen. They are present in the UK waters throughout the year, however more sightings have been made between June and October. The relative density of white-beaked dolphin is estimated at 0.032 animals/km^2 in the vicinity of the Caledonia decommissioning activities (Hammond *et al*., 2017).
Benthic environment	
Seabed type	The water depth in the vicinity of the Caledonia manifold is approximately 140 m, and sediments comprise soft to very soft clay (Fugro, 2001). Habitat assessment camera transects conducted during the Balmoral Area Pre-decommissioning Survey (Fugro, 2018a) indicate the

Environmental Receptor	Description
	seabed habitat comprises 'circalittoral fine mud' (EUNIS code A5.36), which is comparable to the Fugro (2001) findings. Five seabed depressions were recorded within 20 m of the pipeline route between the Caledonia manifold and the Britannia platform (Fugro, 2001). Seabed depressions with shell accumulations inside were also evident in the Balmoral camera transects (Fugro, 2018a). Forty-one seabed depressions were investigated in Fugro (2018a), and the camera transects closest to Caledonia were conducted specifically to investigate depressions. Of the 41 depressions investigated, no sign of MDAC or associated communities were found that would constitute these depressions being labelled as pockmarks.
Benthic Community	Fugro (2018a) recorded sea pens and faunal burrows across the Balmoral Field, and as such an assessment was conducted on the seabed camera data for the presence of the OSPAR threatened or declining habitat 'Sea pen and burrowing megafauna communities. At the camera transect stations closest to Caledonia, *Virgularia mirabilis* was 'common' (0.1 to 0.9 individuals/m^2) on one transect and 'frequent' (0.1 to 0.9 individuals/m^2) on the other five. Based on this assessment, the Balmoral camera transects close to Caledonia are expected to qualify as an example of 'Sea pen and burrowing megafauna communities', and it is therefore reasonable to assume this habitat is also present at the Caledonia Field. Visible fauna recorded in Fugro (2018a) included: sea pen (*Pennatula phosphorea* and *Virgularia mirabilis*), starfish (*Asteroidea*), sea anemone (*Actiniaria*), hermit crab (*Paguridae sp*.), sea urchin (Echinodermata) and faunal turf comprising hydrozoans and bryozoans. An unidentified fish and a hagfish (*Myxine sp*.) were also seen near the seabed. There were abundant faunal tracks and burrows. No evidence of ocean quahog siphons or aggregations were observed from the Balmoral transects (Fugro, 2018b), but this does not definitively rule out the presence of this species either on the investigated transects or in the Caledonia Field.
Fish – spawning and nursery grounds	
Spawning grounds	Caledonia is located within the spawning grounds of cod (*Gadus morhua)*, mackerel (*Scomber scombrus)*, Norway lobster (*Nephrops norvegicus)* and Norway pout (*Trisopterus esmarkii)* (Coull *et al*., 1998; Ellis *et al*., 2012).
Nursery grounds	The following species have nursery grounds in the vicinity of the project: anglerfish (*Lophius piscatorius)*, blue whiting (*Micromesistius poutassou)*, cod, European hake (*Merluccius merluccius)*, haddock (*Melanogrammus aeglefinus)*, herring (*Clupea harengus)*, ling (*Molva molva)*, mackerel, Norway lobster, Norway pout, sandeel (*Ammodytidae spp.)*, spotted ray (*Raja montagui)*, spurdog (*Squalus acanthias)*, and whiting (*Merlangius merlangus)* (Coull *et al*., 1998; Ellis *et al*., 2012).
Probability of age 0 group fish aggregations	Data from Aires *et al*. (2014) show the probability of the presence of aggregations of age 0 group fish species. The probability of age 0 group fish species occurring at Caledonia is estimated as <0.15 for all species listed (anglerfish, blue whiting, European hake, haddock, herring, mackerel, horse mackerel (*Trachurus trachurus*), Norway pout, plaice (*Pleuronectes platessa*), sprat (*Sprattus sprattus*) and whiting).
Seabirds	

Environmental Receptor	Description

According to the density maps provided in Kober *et al.* (2010), the following species could be found within the Caledonia decommissioning area: northern fulmar (*Fulmarus glacialis)*, European storm-petrel (*Hydrobates pelagicus),* northern gannet (*Morus bassanus)*, Arctic skua (*Stercorarius parasiticus)*, great skua (*Stercorarius skua)*, black-legged kittiwake (*Rissa tridactyla)*, common guillemot (*Uria aalge)*, razorbill (*Alca torda)*, common gull (*Larus canus*) and Atlantic puffin (*Fratercula arctica)*. Seabird Oil Sensitivity Index (SOSI) identifies areas at sea where seabirds are likely to be most sensitive to surface pollution (Webb *et al*., 2016). Seabird vulnerability in Block 16/26 is low throughout the year with no data for November and December (Webb *et al*., 2016).

Seabird Oil Sensitivity Index (SOSI)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
15/25	5*	5	5*	5*	5	4	5	5	5	5*	5*	5*
16/21	5*	5	5*	5*	5	5	5	5	5	5*	N	N
16/22	5*	5	5	5*	5	5	5	5	5	5*	5*	5*
15/30	1*	1	4	4*	5	5	5	4*	4	5*	5	5
16/26	**5***	**5**	**5***	**5***	**5**	**5**	**5**	**5**	**5**	**5***	**5***	**5***
16/27	5*	3*	3	5	5	5	5	5	5	5*	5	5
21/5	5*	5	5*	5*	5	5	5	5	5	5*	5*	5*
22/1	5	5	5*	5*	5	5	5	5	5	5*	N	N
22/2	5	5	5*	5*	5*	5	5	5	5	5*	5*	5*

Key	1 = Extremely high	2 = Very high	3 = High	4 = Medium	5 = Low	N = No data
	* in light of coverage gaps, an indirect assessment of SOSI has been made					

Societal Receptor	Description

Commercial fishing

Caledonia is located in International Council for the Exploration of the Seas (ICES) Rectangle 45F1 (Scottish Government, 2020). Amalgamated VMS data from 2007 – 2015 shows demersal trawling activity associated with oil and gas pipelines in this region from *Nephrops* and demersal trawling. The fishing intensity is generally low and increases slightly from west to east and from north to south. ICES Rectangle 45F1 experiences low/low-moderate levels of trawling (i.e. between 5 – 20 tracks) on the majority of its pipelines, when compared to the rest of the UKCS (Rouse *et al.*, 2017). In 2019, fishing effort in ICES Rectangle 45F1 was highest in February, April and July, which accounted for 72% of the total number of days fished, whilst January, May, November and December experiencing either no or very low (i.e. disclosive) levels of fishing effort (Scottish Government, 2020). Trawls were the most utilised gear in Rectangle 45F1 (Scottish Government, 2020).

<table>
<tr><th>Societal Receptor</th><th>Description</th></tr>
<tr><td colspan="2">Fishing Landings in ICES Rectangle 45F1</td></tr>
<tr><td colspan="2">
<table>
<tr><th rowspan="2">Species type</th><th colspan="2">2019</th><th colspan="2">2018</th><th colspan="2">2017</th><th colspan="2">2016</th><th colspan="2">2015</th></tr>
<tr><th>Live weight (Te)</th><th>Value (£)</th><th>Live weight (Te)</th><th>Value (£)</th><th>Live weight (Te)</th><th>Value (£)</th><th>Live weight (Te)</th><th>Value (£)</th><th>Live weight (Te)</th><th>Value (£)</th></tr>
<tr><td>Demersal</td><td>663</td><td>1,072,806</td><td>365</td><td>643,789</td><td>536</td><td>1,007,325</td><td>627</td><td>1,034,037</td><td>482</td><td>620,334</td></tr>
<tr><td>Pelagic</td><td>1</td><td>796</td><td>1</td><td>674</td><td>0</td><td>5</td><td>421</td><td>189,494</td><td>1,892</td><td>676,413</td></tr>
<tr><td>Shellfish</td><td>1,030</td><td>3,166,226</td><td>293</td><td>988,946</td><td>323</td><td>1,236,543</td><td>218</td><td>1,045,948</td><td>241</td><td>1,012,362</td></tr>
<tr><td>Total</td><td>1,694</td><td>4,239,828</td><td>659</td><td>1,633,409</td><td>859</td><td>2,243,873</td><td>1,266</td><td>2,269,479</td><td>2,615</td><td>2,309,109</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Other sea users</td></tr>
<tr><td>Shipping activity</td><td>Caledonia is located in an area that experiences low shipping intensity (OGA, 2016).</td></tr>
<tr><td>Oil and Gas</td><td>Caledonia is located in the CNS in an area of extensive oil development with a number of fields located nearby. Oil and gas surface and subsea infrastructure within 30 km of the project area is described below:
<table>
<tr><th>Installation</th><th>Installation Type</th><th>Operator</th><th>Distance & direction</th></tr>
<tr><td>Britannia</td><td>Platform</td><td>Chrysaor</td><td>6.0 km SSE</td></tr>
<tr><td>Alba North</td><td>Platform</td><td>Ithaca</td><td>6.1 km SSW</td></tr>
<tr><td>Alba</td><td>Platform</td><td>Ithaca</td><td>8.9 km SSW</td></tr>
<tr><td>Beauly</td><td>Subsea</td><td>Repsol Sinopec</td><td>9.1 km N</td></tr>
<tr><td>Glamis</td><td>Subsea</td><td>Premier</td><td>10.0 km NW</td></tr>
<tr><td>Balmoral</td><td>Platform</td><td>Premier</td><td>14.3 km NNW</td></tr>
<tr><td>Brenda</td><td>Subsea</td><td>Premier</td><td>14.5 km WNW</td></tr>
<tr><td>Hummingbird</td><td>FPSO</td><td>Altera (formerly Teekay)</td><td>15.1 km SSE</td></tr>
<tr><td>Andrew</td><td>Platform</td><td>BP</td><td>16.5 km ESE</td></tr>
<tr><td>Cyrus</td><td>Subsea</td><td>BP</td><td>17.7 km E</td></tr>
<tr><td>Nicol</td><td>Subsea</td><td>Premier</td><td>23.8 km WNW</td></tr>
<tr><td>Alder</td><td>Subsea</td><td>Ithaca</td><td>26.3 km W</td></tr>
</table>
</td></tr>
<tr><td>Telecommuni-cation</td><td>A historic powerline is located approximately 9 km north of Caledonia. Some sections of the cable may remain on the seabed (NMPi, 2021). The closest submarine cable to Caledonia is the CNS Fibre Optic cable, which is located 34 km to the south (KIS-ORCA, 2019). The TAMPNET CNSFTC telecom cable is located roughly the same distance due south of Caledonia (NMPi, 2021).</td></tr>
</table>

Societal Receptor	Description
Military activities	There are no military restrictions on Blocks 16/26 (OGA, 2018) and there are no known military activities within the area (Scottish Government, 2019a).
Renewables	There are no renewable energy activities in the immediate vicinity of Caledonia (The Crown Estate, 2016). The closest renewables site is the Hywind 2 Demonstration approximately 150 km away.
Wrecks	There are two wrecks, Palmyra (confirmed) and another wreck which is thought to form part of Palmyra, located in the vicinity of the project area, approximately 6 km south east and 9 km south west of the project area (Scottish Government, 2019b). There are no protected wrecks in the project area (Scottish Government, 2019b).

3.4 Seabed Habitats and Benthos

The natural seabed generally comprises soft to very soft cay sediments (Fugro, 2001). Habitat assessment camera transects conducted during the Balmoral Area Pre-decommissioning Survey (Fugro, 2018a) indicate the seabed habitat comprises 'circalittoral fine mud' (EUNIS code A5.36), which is comparable to the Fugro (2001) findings. The survey also found the sediment type showed little variation throughout the survey area; sediments were generally classified as poorly sorted coarse to medium silt sediments with moderate carbonate and low organic content (Fugro, 2018a).

Fugro (2018a) recorded sea pens and faunal burrows across the Balmoral Field, and as such an assessment was conducted to assess the seabed camera data for the presence of the OSPAR threatened or declining habitat 'Sea pen and burrowing megafauna communities'. At the camera transect stations closest to Caledonia, Virgularia mirabilis was 'common' (0.1 to 0.9 individuals/m^2) on one transect and 'frequent' (0.1 to 0.9 individuals/m^2) on the other five, and *Pennatula phosphorea* was 'frequent' on all transects, while *Funiculina quadrangularis* was absent from all transects. Megafaunal burrows were 'abundant' (10 to 99 burrows/m^2) on five transects and 'common' (1 to 9 burrows/m^2) on the other. Based on this assessment, the Balmoral camera transects close to Caledonia are expected to qualify as an example of 'Sea pen and burrowing megafauna communities', and it is therefore reasonable to assume this habitat is also present at the Caledonia Field. This also forms one of the biotopes which falls under the Scottish PMF habitat 'Burrowed mud'.

The benthic macrofauna was fairly uniform across Caledonia, with all sample clusters classified as EUNIS biotope A5.375, '*Levinsenia gracilis* and *Heteromastus filiformis* in offshore circalittoral mud and sandy mud'. The polychaete, *Paramphinome jeffreysii,* was the most abundant species at the majority of stations. While there were nine distinct clusters of stations identified, these all supported similar taxa and were differentiated from each other only by slight differences in species composition. The only clearly different result was at Station ST38, located 200 m northeast of the Balmoral Template, where the hydrocarbon-tolerant polychaete, *Cirratulus cirratus,* was the second most abundant taxon. This species did not occur in the top ten most abundant taxa in any of the other stations across the survey area and indicates the community at ST38 is affected by contamination from drilling activity (Fugro, 2018b).

The findings of the Fugro baseline survey (2018b) indicate large variances in THC concentrations across the area surrounding the Balmoral Template (Figure 3-2). THC values recorded within sediment core samples ranged from 9.6 µg/g to 34,000 µg/g. THC levels exceeded the OSPAR (2006) ecological effects threshold of 50 µg/g in all core samples (Fugro, 2018b). This is an indication of some departure from baseline environmental conditions prior to the drilling of the wells supporting the Greater Balmoral development,

particularly those at the Balmoral Field. This indicates residual low-toxicity oil-based mud contamination within 300 m of the Balmoral Template and satellite drill centres. The Brenda cluster was free of this contamination. Heavy metal concentrations were also slightly elevated close to the Balmoral Template (Fugro, 2018b). THC levels are not expected to be as high within the Caledonia Field as no oil base drill cuttings are known to be deposited in this area.

3.5 Other Sea Users

3.5.1 Maritime Activities

The North Sea contains some of the world's busiest shipping routes, with significant traffic generated by vessels trading between ports at either side of the North Sea and the Baltic. North Sea oil and gas fields also generate moderate vessel traffic in the form of support vessels (DECC, 2016).

The CNS sees a moderate number of oil tankers, cargo vessels and ferries passing through (DTI, 2001). Shipping activity is assessed to be low in Block 16/26 (DECC, 2016; OGA, 2016). Figure 3-3 below illustrates the relative vessel activity surrounding Caledonia.

An average of four or less vessel transits per week pass within the project area with the majority of traffic consisting of small to medium sized cargo ships (MMO, 2018). Additionally, to the south of the project area there is a high density of non-profit service vessel that averages between 10-20 vessels per week (Scottish Government, 2018). Other vessels that pass within the vicinity of the project area include tankers, passenger vessels, cargo vessels, dredging or underwater operation vessels, recreational vessels and fishing vessels. A composite from Automatic Identification System (AIS) tracks of vessels using the project area in 2015 is presented in Figure 3-7.

There are no renewable energy sites within 40 km of the Caledonia Field. The Hywind 2 Demonstration is the closest, located approximately 150 km to the south west of the Caledonia Field's subsea infrastructure (The Crown Estate, 2016).

There are no military activity or military restrictions on Block 16/26 (OGA, 2018) and military activity does not generally take place in this region.

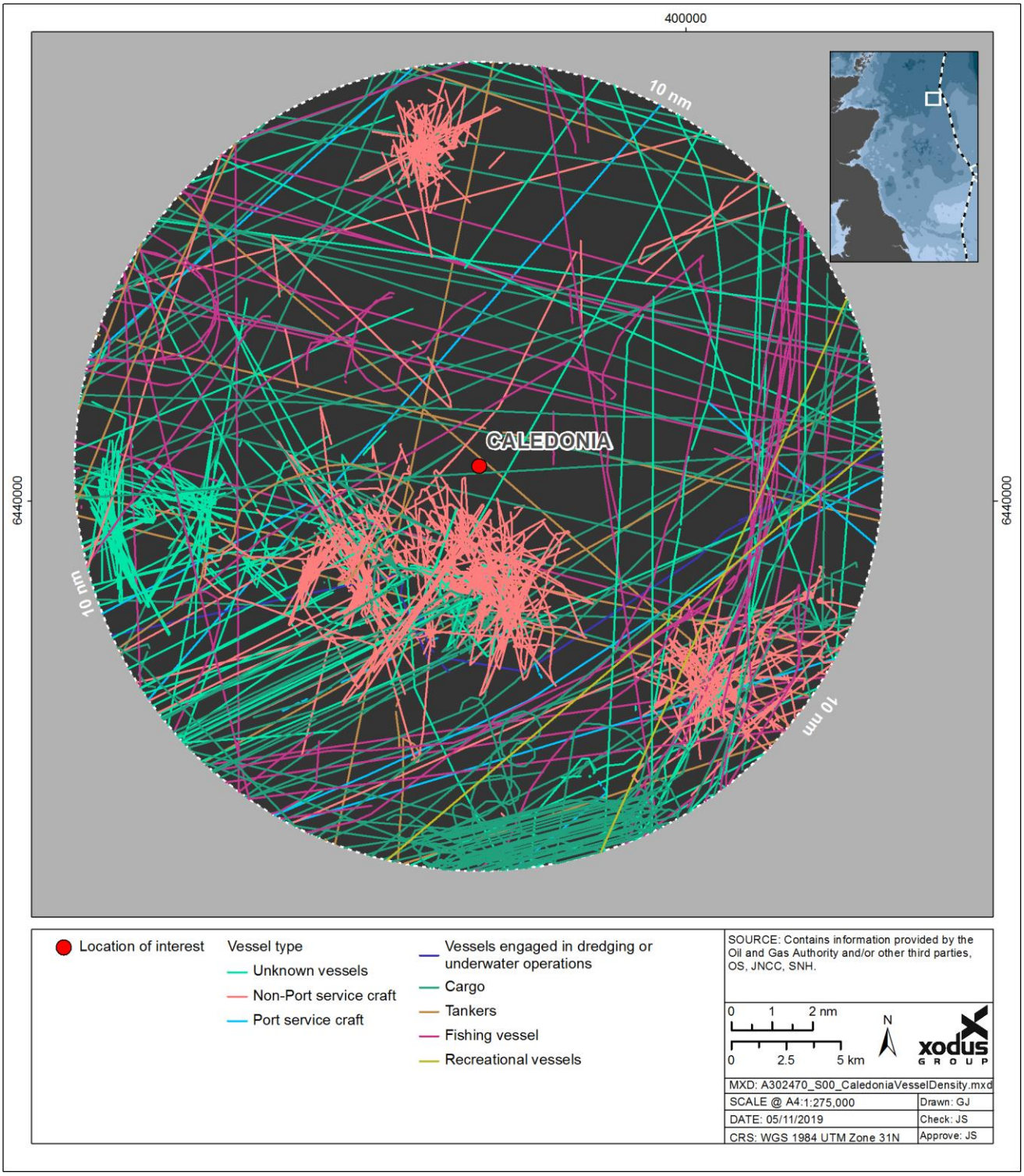

Figure 3-3 Vessel activity around Caledonia over period July 2016 - June 2017 (MMO, 2018)

3.5.2 Commercial Fisheries

This Section describes the type of fishing vessels occurring in the area, the weight and value of fish landed in the UK and the fishing effort. The study area is located in ICES Rectangle 45F1. To provide the fullest

picture of fisheries within the area, the associated landings and effort trends for ICES Rectangle 45F1 have been provided for the five most recent fishing years (2014-2018 inclusive; Table 3-2 and Figure 3-3).

According to fishing data from the Scottish Government (2020), the waters comprising Caledonia are fished for a variety of species by both UK and foreign vessels. ICES Rectangle 45F1 is predominantly targeted for deep-water, demersal and pelagic species (Table 3-2). For the last five fishing years, the total landings value in ICES Rectangle 45F1 was £12.6M, and the live weight was 7,093 Te (Table 3-2). In 2019, the live weight of shellfish caught was almost twice the weight of demersal catch. For the past three years, pelagic species have had a very low contribution to the species landings in this ICES rectangle. In 2015 and 2016, pelagic species contributed a higher live weight to the total landings than both demersal and shellfish species (Table 3-2). Shellfish contributed the greatest total and greatest average monetary value between 2015 and 2019 across ICES Rectangle 45F1. The total annual landings for ICES rectangles 45F1 were ≤0.5% of the total landings within Scotland for each of the five most recent fishing years.

Average annual fishing effort, as a measure of total fishing days per annum, in ICES Rectangle 45F1 decreased gradually between 2015 and 2018 and then more than doubled to 1,042 days in 2019 (Table 3-3). The average landings value and live weight tonnage followed a similar pattern. In 2019, the landings value and fishing effort were markedly higher than the Scottish average for the year. When comparing between data sets, it is worthwhile considering the catch per unit effort (CPUE), a measure of the weight of catch per number of effort days (an indirect measure of fish availability). The average CPUE for ICES Rectangle 45F1 was 2.3 Te/day, which is roughly half the average for the UKCS across this period (4.2 Te/day; Scottish Government, 2020).

Total fishing effort amounted to 1,042 effort days in ICES Rectangle 45F1 in 2019 (Table 3-4). This represents a dramatic increase in effort compared to the four preceding years, particularly compared to the 417 days spent fishing in 2018. Effort within ICES Rectangle 45F1 has been recorded as disclosive or 'no data' for several months (January, May, November and December). This differs slightly from the preceding years which typically showed reduced effort in the summer months (Table 3-4). Fishing effort in 2019 was highest in February, April and July. Trawls were the most utilised gear type used in the ICES Rectangle 45F1 over all the years; other gear types used include seine nets, though effort associated with this gear type was always disclosive (Scottish Government, 2020).

Table 3-2 Live Weight and Value of Fish and Shellfish from ICES Rectangle 45F1 Between 2015-2019 (Scottish Government, 2020)[1]

Species type	2019		2018		2017		2016		2015	
	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)
Demersal	663	1,072,806	365	643,789	536	1,007,325	627	1,034,037	482	620,334
Pelagic	1	796	1	674	0	5	421	189,494	1,892	676,413
Shellfish	1,030	3,166,226	293	988,946	323	1,236,543	218	1,045,948	241	1,012,362
Total	**1,694**	**4,239,828**	**659**	**1,633,409**	**859**	**2,243,873**	**1,266**	**2,269,479**	**2,615**	**2,309,109**
Scottish Landings Total	**493,075**	**767,721,934**	**555,570**	**764,993,803**	**565,635**	**724,854,084**	**564,680**	**729,378,317**	**547,426**	**574,430,213**

[1] All values are rounded to the nearest whole number. For purposes of identifying the Scottish landings totals, disclosive data has not been included to limit the effects of zero-inflation on the results.

Table 3-3 Summary Statistics of Annual Fishing Effort (by UK Vessels) and Landings (by UK and Non-UK Vessels) Within Rectangle 45F1 Compared to the Scottish Average[2] (Scottish Government, 2020)

Year	Within ICES Rectangle 45F1			Average Across Scotland		
	Fishing effort (days)	Landings Value (£)	Live weight (Te)	Fishing effort (days)	Landings Value (£)	Live weight (Te)
2015	572	2,309,109	2,615	686	2,976,322	2,836
2016	559	2,269,479	1,266	685	3,610,784	2,795
2017	514	2,243,873	859	635	3,624,270	2,828
2018	417	1,633,409	659	618	3,805,939	2,764
2019	1,042	4,239,828	1,694	641	3,800,604	2,441
Annual average	**621**	**2,539,140**	**1,419**	**653**	**3,563,584**	**2,733**

Table 3-4 Number of Fishing Days per Month (all gear) for vessels landing into Scotland in ICES Rectangle 45F1 2015-2019 (Scottish Government, 2020)

ICES rectangle	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total[3]
45F1	2015	64	108	31	-	-	D	D	11	8	10	310	22	572
	2016	15	197	8	23	D	10	D	11	17	21	195	60	559
	2017	-	D	214	8	D	D	D	13	14	194	61	D	514
	2018	D	12	D	4	70	D	8	13	105	120	73	D	417
	2019	D	275	35	209	-	45	264	50	47	112	D	-	1,042

Note: Monthly fishing effort by UK vessels landing into UK: green = 0 – 100 days fished, yellow = 101 –200, orange = 201-300, red = ≥301, D = Disclosive data (indicating very low effort, specifically less than 5 over-10 m vessels undertook fishing activity in that month), - = no data

Automatic Identification System (AIS) recordings of fishing vessel movements from 2015 indicate vessel use is dominated by transiting vessels and trawling activity, based on the long 'legs' of vessel movement (Figure 3-4). Fishing vessel activity was generally low close to the Caledonia infrastructure, compared to the surrounding waters and mostly comprised of transiting fishing vessels (Figure 3-4). The increased fishing vessel movement to the north west of the Caledonia Field appears to be associated with pelagic fishing activity, such as pelagic seines and trawls (Figure 3-4). Additionally, fishing vessel movements to the east of the Caledonia Field likely constitutes *Nephrops* trawling activity, based on the sweeping movement patterns (Figure 3-4).

[2] All values are rounded to the nearest whole number. For purposes of identifying averages across the UK, disclosive data has not been included to limit the effects of zero-inflation on the results.

[3] Disclosive data has not been considered in the totals.

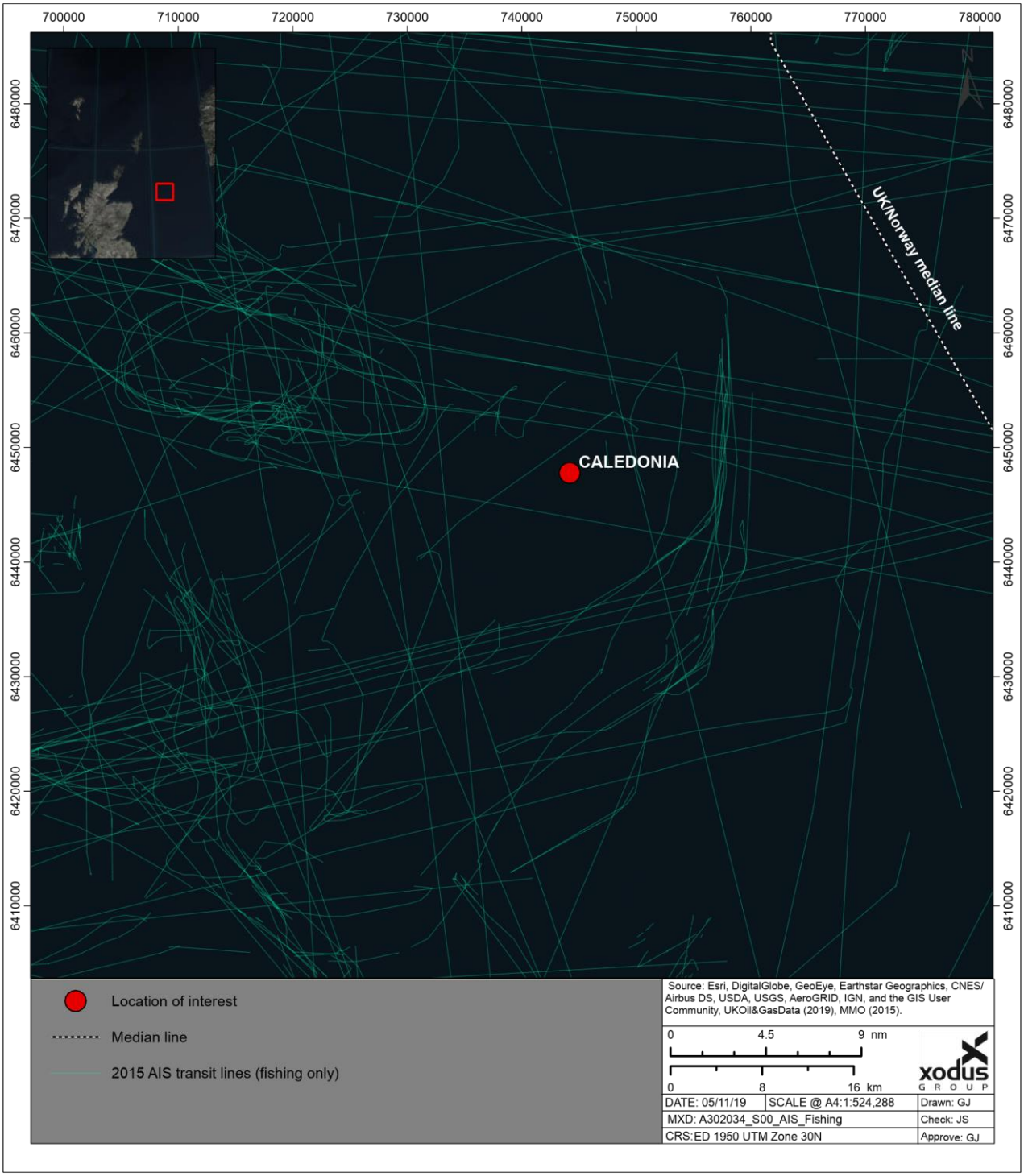

Figure 3-4 AIS Data for Commercial Fishing Vessels During the Year 2015 (MMO, 2015)

Amalgamated Vessel Monitoring System (VMS) data from 2007 – 2015 shows demersal trawling activity associated with oil and gas pipelines in this region from *Nephrops* and demersal trawling (Figure 3-5). The fishing intensity is generally low and increases slightly from west to east and from north to south. ICES Rectangle 45F1 experiences low/low-moderate levels of trawling (i.e. between 5 – 20 tracks) over the majority of its pipelines, when compared to the rest of the UKCS (Rouse et al., 2017; Figure 3-5).

Figure 3-5 shows the relative trawling activity associated with the pipelines relevant to this project, for both demersal and *Nephrops* fisheries between 2007-2015. *Nephrops* trawling activity is markedly higher, based on total trawls, than demersal trawling activity associated with the project's pipelines (Figure 3-5). Of the pipelines and subsea infrastructure, the Caledonia Production line (PL1919) and Balmoral Template to Tap Valve (PL218) experienced the greatest levels of *Nephrops* trawling, with between 50-60 trawls over the majority of the length of the pipeline, compared to 30-50 trawls along Andrew to Brae (PL1078) and Brae A to Forties C pipeline (PL64) and the region surrounding the Caledonia Field (Figure 3-5).

Demersal trawling activity is highest approximately 2 km south of the Caledonia Manifold along the Caledonia production pipeline. The lowest levels of trawling activity are in the immediate vicinity of the Caledonia Manifold (Figure 3-5). Furthermore, amalgamated VMS data from 2009-2013, which has been analysed to generate 'hotpots' of fishing density (i.e. through kernel density estimates) shows low levels of fishing by registered UK vessels (> 15 m) using *Nephrops* mobile gears and pelagic gear for herring (Figure 3-6). Levels of fishing intensity for *Nephrops* mobile gears was relatively high in the project area between 2009-2013 in comparison to other areas in the North Sea (Figure 3-6). In comparison, pelagic fishing intensity was low in 2009-2013 (Figure 3-6).

Nephrops is the key commercial species landed from ICES Rectangle 45F1 for both value and weight for the five most recent fishing years. Landings of *Nephrops* from ICES Rectangle 45F1 comprised 74% of the total value and 60% of the total tonnage of fish landed into the UK in 2019 (Scottish Government, 2020).

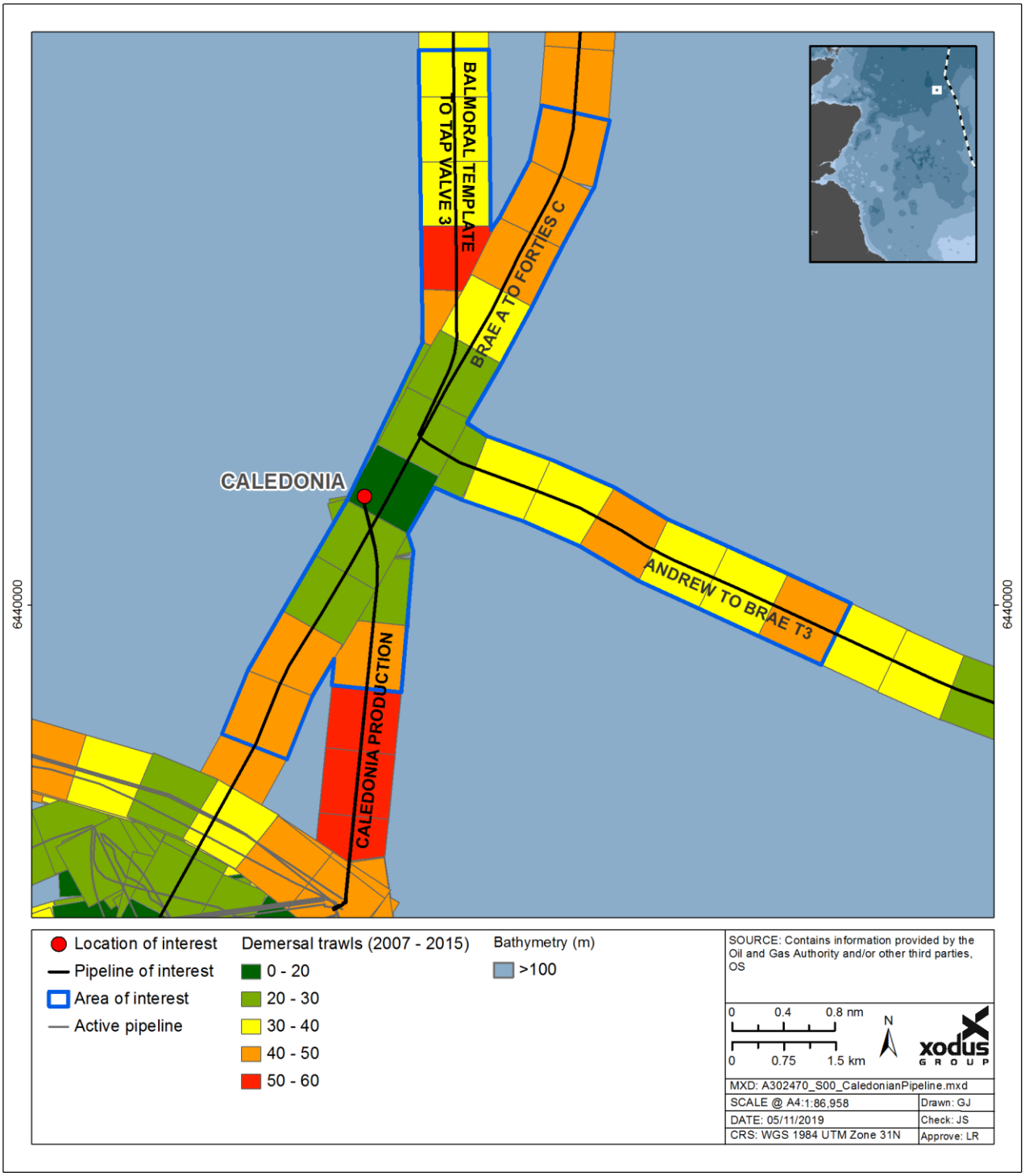

Figure 3-5 Relative Trawling Activity Associated with the Pipelines within Caledonia (Rouse *et al.*, 2017)

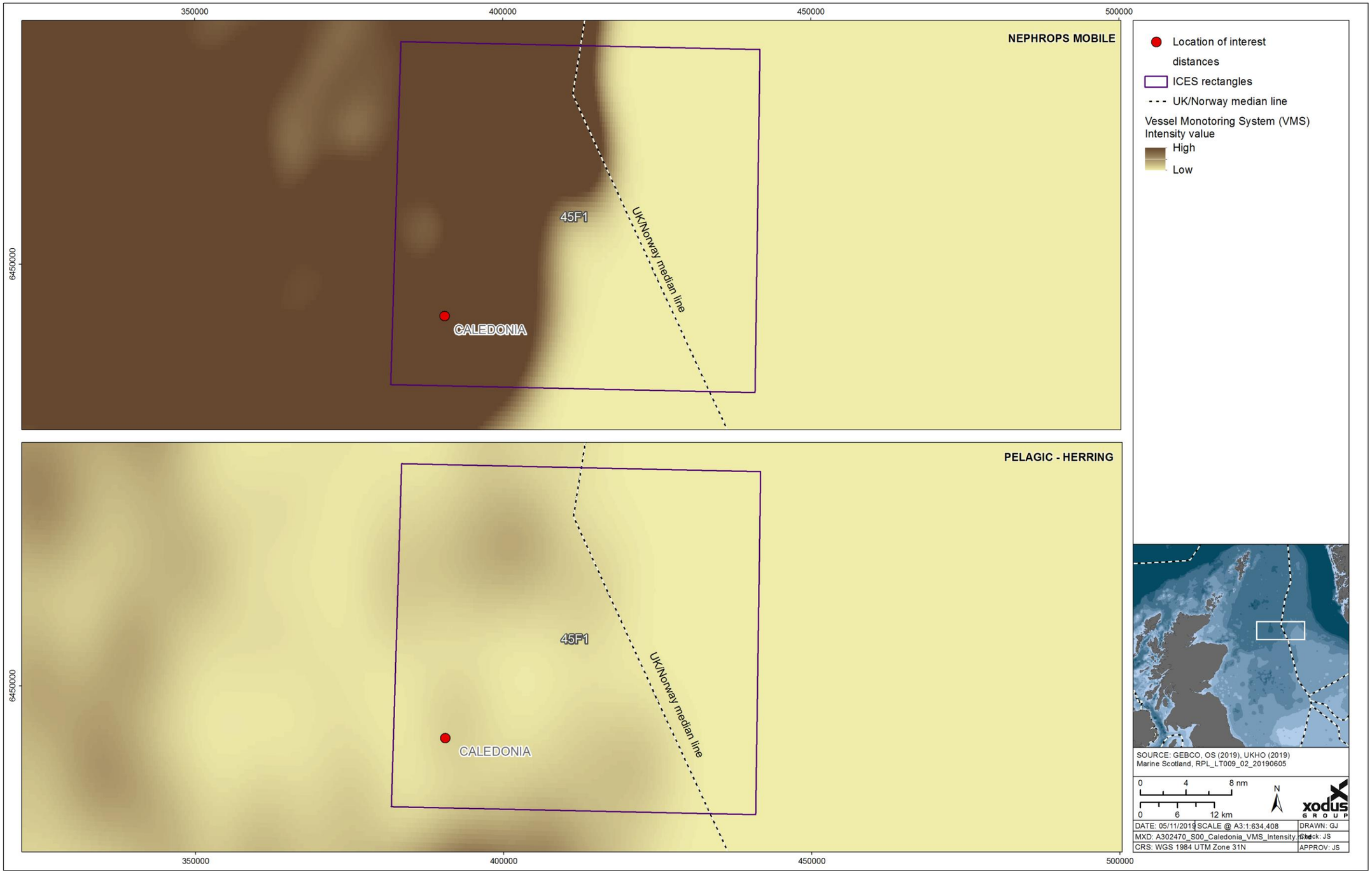

Figure 3-6 Vessel Monitoring Intensity for *Nephrops* (Mobile Gear) and Pelagic (Herring) Fisheries in ICES Rectangle 45F1 (2009 - 2013) (Marine Scotland, 2015)

3.6 Conservation Sites and Species

3.6.1 Offshore Conservation

There are two protected areas within 40 km of Caledonia; the closest of which is the Scanner Pockmark SAC located 21 km to the north west of the project area. This site is designated for the presence of Annex I habitat 'Submarine structures made by leaking gases' (JNCC, 2018a). These structures are pockmarks and depressions which form as a result of leaking gas, mainly methane. Often associated with these habitats is methane-derived authigenic carbonate (MDAC). In the Scanner Pockmark SAC, MDAC lies in the bottom of the pockmark depression and they present a unique habitat and shelter for many species (JNCC, 2020).

Five seabed depressions were recorded within 20 m of the pipeline route between the Caledonia manifold and the Britannia platform (Fugro, 2001). The survey report did not indicate whether MDAC or associated communities were present in the depressions close to the Caledonia manifold.

Seabed depressions with shell accumulations inside were also evident in the Balmoral camera transects (Fugro, 2018a). Forty-one seabed depressions were investigated in Fugro (2018a). Of the 41 depressions investigated across the Balmoral Field, no sign of carbonate or associated communities were found that would constitute these depressions being labelled as pockmarks.

The Norwegian Boundary Sediment Plain NCMPA is 30 km east of the project area. This site is designated for the conservation of ocean quahog aggregations, including sands and gravels as their supporting habitat (JNCC, 2014). The closest known ocean quahog aggregation is located approximately 10 km to the north west of the project area (Scottish Government, 2018a). Caledonia is not located on, or near, any large-scale features of functional significance, for instance shelf mounds or seamounts (Scottish Government, 2016).

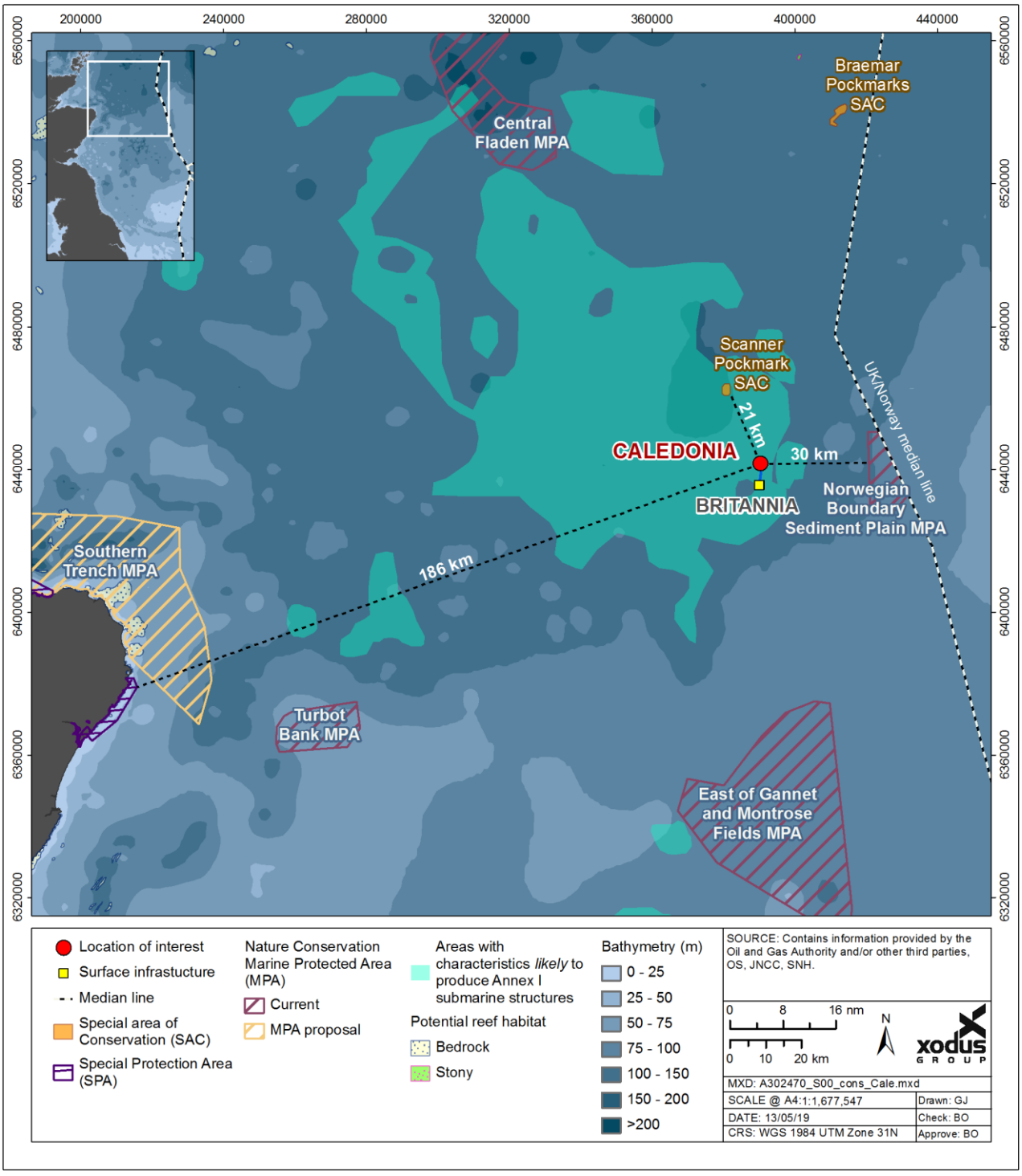

Figure 3-7 Protected Sites Proximal to Caledonia

3.6.2 Onshore Conservation

The Caledonia subsea infrastructure is located approximately 185 km from the northeast coast of Scotland. The closest onshore conservation site is the Buchan Ness to Collieston Coast SPA the located approximately 174 km to the south west (Scottish Government, 2018b). Due to this distance, there will not be any interactions with onshore conservation sites from routine operations at Caledonia in UKCS Block 16/26.

3.6.3 Protected Species

Four species listed under Annex II of the EU Habitats Directive are found in UK waters; harbour porpoise, bottlenose dolphin, grey seal and harbour seal. Grey and harbour seals are unlikely to be observed near Caledonia with any regularity, as both species have very low densities (see Section 3.2). Harbour porpoise is the Annex II species which could be present near Caledonia.

All species of cetacean recorded within the proposed operations area are listed as European Protected Species (EPSs). Other marine species listed as EPSs include turtles and sturgeon (*Acipenser sturio*), which are not likely to be present within this area of the North Sea.

3.6.4 National Marine Plan

The National Marine Plan (NMP) covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles). The aim of the NMP is to help ensure the sustainable development of the marine area through informing and guiding regulation, management, use and protection of the Marine Plan areas. The proposed operations as described in this EA have been assessed against the Marine Plan Objectives and policies, specifically GEN 1, 4, 5, 9, 12, 14 and 21, and Oil and Gas 2, 3, and 6.

The proposed operations do not contradict any of the Marine Plan Objectives and policies. Premier will ensure they comply with all new policies which have been introduced; with particular attention being made to the policies listed above. The following Sections describe the aims of each policy and how Premier's commitments will achieve them.

3.6.4.1 GEN 1 – General planning and principle

Development and use of the marine area should be consistent with the NMP, ensuring activities are undertaken in a sustainable manner that protects and enhances Scotland's natural and historic marine environment. Premier will ensure that any potential impacts associated with Caledonia decommissioning operations will be kept to a minimum.

3.6.4.2 GEN 4 – Co-existence

Where conflict over space or resource exists or arises, marine planning should encourage initiatives between sectors to resolve conflict and take account of agreements where this is applicable. Premier will ensure that any potential impacts on other sea users associated with the proposed Caledonia decommissioning operations will be kept to a minimum.

3.6.4.3 GEN 5 – Climate change

Marine planners and decision makers should seek to facilitate a transition to a low carbon economy. They should consider ways to reduce emissions of carbon and other greenhouse gasses. Premier will ensure that any potential impacts associated with Caledonia decommissioning operations will be kept to a minimum.

3.6.4.4 GEN 9 – Natural heritage

Development and use of the marine environment must:

- Comply with legal requirements for protected areas and protected species.
- Not result in significant impact on the national status of PMF.
- Protect and, where appropriate, enhance the health of the marine area.

Premier will ensure that any potential impacts to protected species and sites associated with Caledonia decommissioning operations will be kept to a minimum.

3.6.4.5 GEN 12 – Water quality and resource

Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives that apply. Premier will ensure that any potential impacts to water quality associated with Caledonia decommissioning operations will be kept to a minimum.

3.6.4.6 GEN 14 – Air quality

Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits. Some development and use may result in increased emissions to air, including particulate matter and gasses. Impacts on relevant statutory air quality limits must be taken into account and mitigation measures adopted, if necessary, to allow an activity to proceed within these limits. Premier will ensure that any potential impacts to air quality with Caledonia decommissioning operations will be kept to a minimum.

3.6.4.7 GEN 21 – Cumulative impacts

Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation. Premier will ensure that any potential impacts to air and water quality and biological communities with Caledonia decommissioning operations will be kept to a minimum.

3.6.4.8 Oil and Gas 2 – Decommissioning end-points

Where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process. Premier will ensure that any material returned to shore as a result of Caledonia decommissioning activities adheres to the waste hierarchy as discussed in Section 2.6.

3.6.4.9 Oil and Gas 3 - Minimising environmental and socio-economic impacts

Supporting marine and coastal infrastructure for oil and gas developments, including for storage, should utilise the minimum space needed for activity and should take into account environmental and socio-economic constraints. Premier will ensure that the onshore resources required for decommissioning activities will be minimised, as discussed in Section 5.

3.6.4.10 Oil and Gas 6 – Risk reduction

Consenting and licensing authorities should be satisfied that adequate risk reduction measures are in place, and that operators should have sufficient emergency response and contingency strategies in place that are compatible with the National Contingency Plan and the Offshore Safety Directive. Premier have the relevant risk reduction measures in place for the decommissioning of the Caledonia subsea infrastructure, as discussed in Section 4.2.8.

4 EA METHODOLOGY

The Impact assessment is designed to: (1) identify potential impacts to environmental and societal receptors from the proposed decommissioning activities; (2) evaluate the potential significance of any identified impacts in terms of the threat that they pose to these receptors; and (3) assign measures to manage the risks in line with industry best practice; and address concerns or issues raised by stakeholders through consolation.

The impact assessment was undertaken using the following approach:

1 The potential environmental issues arising from decommissioning activities were identified through a combination of the expert judgement of project engineers and marine environmental specialists in a screening workshop, and consultation with key stakeholders (Section 4.1). The potential environmental issues were grouped under the following key receptor risk groups:
   - Atmospheric emissions;
   - Disturbance to the seabed;
   - Physical presence;
   - Discharges to sea;
   - Underwater noise;
   - Resource use;
   - Onshore activities;
   - Waste; and
   - Unplanned events.

2 Undertake initial screening based on a high-level consideration of these aspects against the evaluation criteria. Screening aspects in or out of further detailed assessment. Justification statements will be compiled detailing the rationale for screening out any aspects from further assessment (Section 5.1).
   - For aspects which are considered potentially significant, evaluate significance of potential impacts against impact criteria definitions (Section 6); and
   - For any potentially significant impact, capture any potential mitigation and/or control measures to be used to further reduce any impact to 'as low as reasonably practicable' (ALARP).

4.1 Stakeholder Engagement

The consultation for the Caledonia Field decommissioning has been largely based on sharing project expectations, approach and specific considerations with key stakeholders including:

- Scottish Fishermen's Federation (SFF)
- Joint Nature Conservation Committee (JNCC)
- Marine Scotland
- Oil & Gas UK (OGUK)
- OPRED Environmental Management Team (EMT)
- OPRED Offshore Decommissioning Unit (ODU) (observers)
- Scottish Environmental Protection Agency (SEPA)

This is summarised in Table 4-1 and full details of the consultation to date are provided in Section 5 of the DP (Premier, 2020).

Table 4-1 Stakeholder Issues and Concerns Raised Through Consultation

Relevant Party	Comments/Concerns Raised	Response & EA Section where addressed
Informal Consultations		
SFF, JNCC, Marine Scotland, OGUK, OPRED EMT, OPRED ODU (observers)	Premier Oil has engaged with interested parties and stakeholders who participated in CA workshops. No objections have been raised to date.	N/A
Statutory Consultations		
SFF	No objections have been raised to date.	N/A
SEPA	No objections have been raised to date.	N/A
JNCC	Scoping Letter has been issued to statutory consultants and comments received. In addition to minor comments, the following important comments have been considered: Survey data should at least include the area of proposed operations, unless justification is provided as to why wider area surveys are sufficiently representative of conditions at the site of proposed operations. Survey data should provide adequate evidence that habitats and species of nature conservation concern (including Annex I habitats) are or are not present. It is good practice to include a diagram indicating the surveyed area in the context of the proposed activity and to identify any sample points or the location of photographic evidence. Data provided should also include high resolution acoustic data, video and / or still images. Any gaps or limitations in environmental information should be acknowledged with, where appropriate, strategies to address these gaps or limitations. We would highlight that when using the SOSI for assessment that blocks surrounding the operations should also be reviewed and not just the “central” block. We look forward to seeing this fuller assessment within the DPs.	Section 3.2 - Summary of Environmental Surveys Section 3.3 - Summary of Receptors

4.2 EA Process

4.2.1 Overview

The decision process related to defining whether a project is likely to significantly impact on the environment is the core principle of the environmental impact assessment process. The methods used for identifying and assessing potential impacts should be transparent and verifiable.

The method presented here has been developed using the following sources:

- The Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for marine impact assessment (CIEEM, 2018);
- The Marine Life Information Network (MarLIN, 2019) species and ecosystem sensitivities guidelines (Tyler-Walters *et al*., 2004)
- Guidance provided by Scottish Natural Heritage (SNH) in their handbook on environmental impact assessment (SNH, 2013b)
- The Institute of Environmental Management and Assessment (IEMA) in their guidelines for environmental impact assessment (IEMA, 2015; 2016).

Environmental impact assessment provides an assessment of the environmental and societal effects that may result from a project's impact on the receiving environment. The terms impact and effect have different definitions in environmental impact assessment, and one drives the other. Impacts are defined as the changes resulting from an action, and effects are defined as the consequences of those impacts.

In general, impacts are specific, measurable changes in the receiving environment (volume, time and/or area); for example, were a number of marine mammals to be disturbed following exposure to vessel noise emissions. Effects (the consequences of those impacts) consider the response of a receptor to an impact; for example, the effect of the marine mammal/noise impact example given above might be exclusion from an area caused by disturbance, leading to a population decline. The relationship between impacts and effects is not always so straightforward; for example, a secondary effect may result in both a direct and indirect impact on a single receptor. There may also be circumstances where a receptor is not sensitive to a particular impact and thus there will be no significant effects/consequences.

For each impact, the assessment identifies a receptor's sensitivity and vulnerability to that effect and implements a systematic approach to understand the level of impact. The process considers the following:

- Assessment of the consequence/extent of the impact, defined by the nature and type of impact, and the spatial extent of the impact on the receptor;
- Identification of the duration and frequency of the effect of the receptor;
- Definition of magnitude of impact, based on the magnitude of the shift from the environmental baseline conditions;
- Definition of the probability of impacts; and
- Ranking of impact significance, considering the probability that it will occur, the spatial and temporal extent and the magnitude of the impact and any residual effects after mitigations are applied.

Each of these variables are expanded upon in the following Sections to provide consistent definitions across all EA topics. In each impact assessment, these terms are used in the assessment summary table to summarise the impact and are enlarged upon as necessary in any supporting text. It should be noted that all impacts discussed in this EA report are adverse unless explicitly stated otherwise.

Once the consequence of a potential impact has been assessed it is possible to identify measures that can be taken to mitigate impacts through engineering decisions or execution of the project. This process also identifies aspects of the project that may require monitoring, such as a post-decommissioning survey at the completion of the works to inform inspection reports.

For some impacts, significance criteria are standard or numerically based. For others, for which no applicable limits, standards or guideline values exist, a more qualitative approach is required. This involves assessing significance using professional judgement.

Despite the assessment of impact significance being a subjective process, a defined methodology has been used to make the assessment as objective as possible and consistent across different topics. The assessment process is summarised below. The terms and criteria associated with the impact assessment process are described and defined; details on how these are combined to assess consequence and impact significance are then provided.

4.2.2 Baseline Characterisation

In order to assess potential impacts on the environment it was necessary to firstly characterise the different aspects of the environment that could potentially be affected (the baseline environment). The baseline environment has been described in Section 3 and is based on desk studies combined with additional site-specific studies such as surveys and modelling where required. Information obtained through consultation with key stakeholders was also used to help characterise specific aspects of the environment in more detail.

The EA process requires identification of potential receptors which could be affected by the Caledonia Decommissioning Project (e.g. commercial fisheries, seabed impacts, etc.). Important receptors are identified within the impact assessments (Section 6).

4.2.3 Impact Definition

4.2.3.1 Impact Consequence/Extent

The impact consequence is based on the geographical extent, as described in Table 4-2.

Table 4-2 Impact Consequence Criteria

Ranking	Consequence	Criteria
High	**Major**	Extent of change: Impact occurs over a large scale or spatial geographical extent.
Medium	**Moderate**	Extent of change: Impact occurs over a local to medium scale/spatial extent and/or has a prolonged duration.
Medium	**Minor**	Extent of change: Impact occurs on-site or is localised in scale/spatial extent.
Low	**Negligible**	Extent of change: Impact is highly localised.

4.2.3.2 Duration/Frequency of Effect

The duration of effect is key to determining the final ranking of impact significance. This criteria takes account of:

- Duration over which the impact is likely to occur e.g. days, weeks; and
- Frequency and/or intensity of impact, i.e. how often the impact is expected to occur.

These variables are defined in Table 4-3 and Table 4-4, and the overall ranking methodology of duration of effects is provided in Table 4-5.

Table 4-3 Definition of Duration Criteria

Duration	Definition
Short-term	Impacts that are predicted to last for a short duration (e.g. less than one year).
Temporary	Impacts that are predicted to last a limited period (e.g. a few years). For example, impacts that occur during the decommissioning activities and which do not extend beyond the main activity period for the works or which, due to the timescale for mitigation, reinstatement or natural recovery, continue for only a limited time beyond completion of the anticipated activity.
Prolonged	Impacts that may, although not necessarily, commence during the main phase of the decommissioning activity and which continue through the monitoring and maintenance, but which will eventually cease.
Permanent	Impacts that are predicted to cause a permanent, irreversible change.

Table 4-4 Definition of Frequency Criteria

Frequency	Description
Continuous	Impacts that occur continuously or frequently.
Intermittent	Impacts that are occasional or occur only under a specific set of circumstances that occurs several times during the course of the Caledonia Decommissioning Project. This definition also covers such impacts that occur on a planned or unplanned basis and those that may be described as 'periodic' impacts.

Table 4-5 Overall Duration/Frequency Ranking Criteria

Ranking	Duration	Criteria
High	**Major**	Frequency/intensity of impact: high frequency (occurring repeatedly or continuously for a long period of time) and/or at high intensity.
Medium	**Moderate**	Frequency/intensity of impact: medium to high frequency (occurring repeatedly or continuously for a moderate length of time) and/or at moderate intensity or occurring occasionally/intermittently for short periods of time but at a moderate to high intensity.
Medium	**Minor**	Frequency/intensity of impact: low frequency (occurring occasionally/intermittently for short periods of time) and/or at low intensity.
Low	**Negligible**	Impact is very short term in nature (e.g. days/few weeks).

4.2.3.3 Impact Magnitude

The impact magnitude requires an understanding of how far the receptor will deviate from its baseline condition as a result of the impact. The resulting effect on the receptor is considered under vulnerability and is an evaluation based on scientific judgement. Table 4-6 defines the criteria for impact magnitude.

Table 4-6 Impact Magnitude Criteria

Ranking	Magnitude	Criteria
High	**Major**	Total loss or major alteration to key elements/features of the baseline conditions.
Medium	**Moderate**	Partial loss or alteration to one or more key elements/features of the baseline conditions.
Medium	**Minor**	Minor shift from the baseline conditions. Impact is localised and temporary/short term with minor detectable change to site characteristics or a minor change to a small proportion of the receptor population. Low frequency impact occurring occasionally or intermittently.
Low	**Negligible**	Very slight change from baseline conditions. Impact is highly localised and short term resulting in very slight or imperceptible changes to site characteristics.

4.2.3.4 Impact Probability

The probability of an impact captures the probability that the impact will occur and also the probability that the receptor will be present and is based on knowledge of the receptor and experienced professional judgement.

Table 4-7 provides definitions of the different levels of probability of impact that are used in the Caledonia Decommissioning Project impact assessment.

Table 4-7 Impact Probability Criteria

Ranking	Probability	Criteria
High	**Major**	The impact is likely to occur.
Medium	**Moderate**	The impact is moderately likely to occur.
Medium	**Minor**	The impact is possible.
Low	**Negligible**	The impact is unlikely to highly unlikely.

4.2.4 Receptor Definition

As part of the assessment of impact significance it is necessary to differentiate between receptor sensitivity, vulnerability and value. The sensitivity of a receptor is defined as 'the degree to which a receptor is affected by an impact' and is a generic assessment based on factual information whereas an assessment of vulnerability, which is defined as 'the degree to which a receptor can or cannot cope with an adverse impact' is based on professional judgement taking into account an number of factors, including the previously assigned receptor sensitivity and impact magnitude, as well as other factors such as known population status or condition, distribution and abundance.

4.2.4.1 Receptor Sensitivity

Receptor sensitivity to potential impact activities ranges from negligible to very high. Definitions for assessing the sensitivity of a receptor are provided in Table 4-8.

Table 4-8 Criteria for Assessment of Sensitivity of Receptor

Receptor Sensitivity	Definition
Very high	Receptor with no capacity to accommodate a particular effect and no ability to recover or adapt.
High	Receptor with very low capacity to accommodate a particular effect with low ability to recover or adapt.
Medium	Receptor with low capacity to accommodate a particular effect with low ability to recover or adapt.
Low	Receptor has some tolerance to accommodate a particular effect or will be able to recover or adapt.
Negligible	Receptor is generally tolerant and can accommodate a particular effect without the need to recover or adapt.

4.2.4.2 Receptor Vulnerability

Information on both impact magnitude and receptor sensitivity is required to determine receptor vulnerability. These criteria, described in Table 4-6 and Table 4-8 are used to define receptor vulnerability as per Table 4-9.

Table 4-9 Criteria for Assessment of Vulnerability of Receptor

Receptor Vulnerability	Definition
Very high	The impact will have a permanent effect on the behaviour or condition on a receptor such that the character, composition or attributes of the baseline, receptor population or functioning of a system will be permanently changed.
High	The impact will have a prolonged or extensive temporary effect on the behaviour or condition on a receptor resulting in long term or prolonged alteration in the character, composition or attributes of the baseline, receptor population or functioning of a system.
Medium	The impact will have a short-term effect on the behaviour or condition on a receptor such that the character, composition, or attributes of the baseline, receptor population or functioning of a system will either be partially changed post development or experience extensive temporary change.
Low	Impact is not likely to affect long term function of system or status of population. There will be no noticeable long-term effects above the level of natural variation experience in the area.
Negligible	Changes to baseline conditions or receptor population of functioning of a system will be imperceptible.

It is important to note that the above approach to assessing sensitivity/vulnerability is not appropriate in all circumstances and in some instances professional judgement has been used to determine receptor sensitivity. In some instances, it has also been necessary to take a precautionary approach where

stakeholder concern exists regarding a particular receptor. Where this is the case, this is detailed in the relevant impact assessment in Section 6.

4.2.4.3 Receptor Value

The value, or importance, of a receptor is based on a pre-defined judgement established in legislative requirements, guidance or policy. Where these may be absent, it is necessary to make an informed judgement on receptor value based on perceived views of key stakeholders and specialists. Examples of receptor value definitions are provided in Table 4-10.

Table 4-10 Criteria for Assessment of Value of Receptor

Receptor Value	Definition
Very high	Receptor of international importance (e.g. United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site). Receptor of very high importance or rarity, such as those designated under international legislation (e.g. EU Habitats Directive) or those that are internationally recognised as globally threatened (e.g. International Union for Conservation of Nature (IUCN) red list). Receptor has little flexibility or capability to utilise alternative area. Best known or only example and/or significant potential to contribute to knowledge and understanding and/or outreach.
High	Receptor of national importance (e.g. Nature Conservation Marine Protected Area (NCMPA), Marine Conservation Zone (MCZ)). Receptor of high importance or rarity, such as those which are designated under national legislation, and/or ecological receptors such as United Kingdom Biodiversity Action Plan (UKBAP) priority species with nationally important populations in the study area, and species that are near-threatened or vulnerable on the IUCN red list. Receptor provides the majority of income from the Caledonia Area. Above average example and/or high potential to contribute to knowledge and understanding and/or outreach.
Medium	Receptor of regional importance. Receptor of moderate value or regional importance, and/or ecological receptors listed as of least concern on the IUCN red list but which form qualifying interests on internationally designated sites, or which are present in internationally important numbers. Any receptor which is active in the Caledonia Area and utilises it for up to half of its annual income/activities. Average example and/or moderate potential to contribute to knowledge and understanding and/or outreach.

Receptor Value	Definition
Low	Receptor of local importance. Receptor of low local importance and/or ecological receptors such as species which contribute to a national site, are present in regionally. Any receptor which is active in the Caledonia Area and reliant upon it for some income/activities. Below average example and/or low potential to contribute to knowledge and understanding and/or outreach.
Negligible	Receptor of very low importance, no specific value or concern. Receptor of very low importance, such as those which are generally abundant around the UK with no specific value or conservation concern. Receptor of very low importance and activity generally abundant in other areas/ not typically present in the Caledonia installation area. Poor example and/or little or no potential to contribute to knowledge and understanding and/or outreach.

4.2.5 Impact Significance Ranking

The initial ranking of impact significance is based on the criteria described in Sections 4.2.3 and 4.2.5. It involves:

- Determination of the extent of impact, the duration/frequency, the impact magnitude and its probability;
- Consideration of sensitivity, vulnerability and value of the receptor; and
- Existing controls which can be industry standards, legislation requirements or prescriptive.

The sensitivity, vulnerability and value of receptor are combined with the impact magnitude (and probability, where appropriate) using informed judgement to arrive at a significance assessment for each impact, as described in Table 4-11. The assessment of significance considers mitigation measures that are embedded within the proposed activities.

Table 4-11 Criteria for Assessment of Significance

Ranking	Significance	Criteria
High	**Major**	Impacts are likely to be highly noticeable and have long term effects, or permanently alter the character of the baseline, and are likely to disrupt the function and status/value of the receptor population. They may have broader systemic consequences (e.g. to the wider ecosystem/industry). These impacts are a mitigation priority to avoid or reduce the anticipated effects of the impact.
Medium	**Moderate**	Impacts are likely to be noticeable and result in prolonged changes to the character of the baseline and may cause hardship to, or degradation of, the receptor population, although the overall function and value of the baseline/ receptor population is not disrupted. Such impacts are a priority for mitigation in order to avoid or reduce the anticipated effects of the impact.
Medium	**Minor**	Impacts are expected to comprise noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause long term degradation, hardship, or impair the function and value of the receptor. However, such impacts may be of interest to stakeholders and/or represent a contentious issue during the decision-making process, and should therefore be avoided or mitigated as far as reasonably practicable.
Low	**Negligible**	Impacts are expected to be either indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not anticipated to be a stakeholder concern and/or a potentially contentious issue in the decision-making process.

4.2.6 Cumulative Impact Assessment

While the scope of this impact assessment is restricted to the decommissioning of the Caledonia Field, there will be other marine activities which have the potential to interact with the activities completed under the decommissioning work scope. The impact assessments presented in the following Sections also consider the potential for significant cumulative impacts to occur as a result of overlapping activities.

4.2.7 Transboundary Impact Assessment

For most potential impacts from decommissioning, the likelihood of transboundary impact is low. However, where impacts on mobile receptors are of concern, the likelihood of a transboundary impact is higher. The impact assessments presented in the following Sections have identified the potential for transboundary impacts and the potential for transboundary impact is considered within the definition of significance.

4.2.8 Mitigation

Where potentially significant impacts (i.e. those ranked as ‘moderate’ or ‘major’ in Table 4-11) are identified, mitigation measures must be considered. The intention is that mitigations should remove, reduce or manage potential impacts to a point where the resulting residual significance is at an acceptable or insignificant level. Mitigation is also proposed in some instances to maintain the significance levels of impacts defined as ‘not significant’. The impact assessment conclusions define the residual impact significance after mitigations are applied.

5 INITIAL ASSESSMENT SCREENING AND JUSTIFICATION

A screening workshop was undertaken to discuss the proposed decommissioning activities and any potential impacts these may pose. This discussion identified ten potential impacts based on the proposed removal methods identified in Section 2. Two of these potential impacts could not be screened out of further assessment based on the significance or likelihood of the impact occurring. The ten potential impacts and their screening rationales are detailed in Section 5.1, and those impacts carried forward for further assessment are defined in Section 5.2.

5.1 Assessment of Potential Impacts

The screening of potential environmental impacts from the decommissioning of Caledonia for further assessment is provided in Table 5-1, including summarised rationales for the screening outcomes.

Table 5-1 Environmental Impact Screening Summary for Caledonia Decommissioning

Potential impact	Further assessment?	Rationale
Emissions to air	No	Emissions during decommissioning activities, (largely comprising fuel combustion gases) will occur in the context of the CoP. As such, emissions generated by maintenance vessels associated with the Caledonia Field will be replaced by those from vessels and equipment required for decommissioning activities, as well as the recycling of decommissioned materials. Reviewing historical EU Emissions Trading Scheme data and comparison with the likely emissions from the proposed workscope suggests that emissions relating to decommissioning will be minor relative to those generated during production. Review of available decommissioning EAs shows conclusively that atmospheric emissions in highly dispersive offshore environments do not present significant impacts and are extremely small in the context of UKCS and global emissions. Most submissions also note that emissions from short-term decommissioning activities are small compared to those previously arising from the asset over its operational life. The majority of atmospheric emissions for the Caledonia Decommissioning Project relate to vessel time, or are associated with the recycling of material returned to shore. As the decommissioning activities proposed are of short duration, this aspect is not anticipated to result in significant impacts. The vessels under considerations for emissions to air are limited to decommissioning vessels associated with the Caledonia Field (e.g. CSV, DSV, pipehaul vessel, supply vessel, etc.). The estimated CO_2 emissions to be generated by the selected decommissioning options is 8,644 Te, this equates to 0.11% of the total UKCS vessel emissions (excluding fishing vessels) in 2017 (7,800,000 Te; BEIS, 2019). In addition to materials emissions, this CO_2 total has been calculated assuming an anticipated 52 days of

Potential impact	Further assessment?	Rationale
		vessel activity for the duration of the project, split across three vessel types (including but not limited to a DSV, trawler and survey vessel). This is a worst-case estimate of vessel days based on extensive overtrawling (which, as detailed in Section 2.4.6, will not be required). Considering the above, atmospheric emissions do not warrant further assessment.
Seabed impacts	Yes	There is potential for decommissioning activities to generate disturbance to the seabed; these include activities associated with the removal of Caledonia's subsea installations, pipelines and umbilicals, and any associated remediation post-decommissioning, including potential overtrawling. Seabed impacts may range in duration from short-term impacts, such as temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. Additionally, seabed disturbance from the removal of infrastructure has the potential to modify the habitat in a way which might impact upon other sea users which utilise the seabed. While not a confirmed activity, the reverse reeling of trenched and buried flexible flowlines has the potential to generate clay berms in the muddy benthic habitat which defines the Caledonia Field Area. Clay berms may pose a potential snagging hazard to commercial fishing gears which make contact with the seabed. However, Premier is committed to leaving a clear seabed following decommissioning and will include any clay berms identified in the Clear Seabed Verification Survey, following the decommissioning of the infrastructure listed above. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. The methods used will be discussed and finalised with OPRED. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF, seabed clearance is likely to require conventional overtrawl survey methods. Impacts to the seabed from project activities have been assessed further in Section 6.1, whilst impacts to commercial fisheries generated by seabed disturbance are assessed fully in Section 6.2.
Physical presence of vessels in	Yes	The presence of a small number of vessels for decommissioning activities will be short-term in the context of the life of the Caledonia Field. A collective 177 days of total vessel time is anticipated for the

Potential impact	Further assessment?	Rationale
relation to other sea users		project area, split across three vessel types (possibly including, but not limited to, a DSV/CSV, trawler and survey vessel). Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities. The small number of vessels required will also generally be within the existing 500 m safety zone and the decommissioning of the Caledonia manifold will reduce the number of vessels in the area on the long-term. Other sea users will be notified in advance of planned activities through the appropriate mechanisms, meaning those stakeholders will have time to make any necessary alternative arrangements during the finite period of operations. Although the Caledonia decommissioning project is estimated to require various vessels depending on the selected method of removal, these would not all be on location at the same time. Despite these management measures and the short-term nature of the proposed decommissioning activities, there exists the potential for residual impacts to commercial fisheries to result from the temporary limitation on access to fishing grounds. Assessment of potential impacts to commercial fisheries associated with changes in access to fishing grounds during decommissioning activities is addressed in Section 6.2.
Physical presence of infrastructure decommissioned *in situ* in relation to other sea users	Yes	The physical presence of infrastructure decommissioned *in situ* has limited potential of impacting other sea users and is limited to potential snagging risks to commercial fisheries. All substructures will be fully removed. All jumpers and spool pieces will be fully removed. The dynamic surface laid section of umbilical will be fully removed at the time of the Britannia platform decommissioning. Trenched and/or buried flexible flowlines will be decommissioned *in situ* but the ends will be cut and lifted, with remediation. Depth of Burial (DoB) surveys have confirmed the position of these flowlines within the seabed, they are suitably buried and therefore do not pose any risk of interaction with other sea users (see Appendix C). Future monitoring work will ensure the integrity of the DoB of these flowlines, but further consideration of the proposed decommissioning activities are necessary, and therefore will be discussed in this EA. Mattresses and grout bags will be fully removed and be cleaned of marine growth if required, and either reused, recovered as aggregate for infrastructure projects or disposed of in landfill sites. In the

Potential impact	Further assessment?	Rationale
		instance that some mattresses are unable to be recovered OPRED will be consulted. The clear seabed will be validated by an independent verification trawl over the installation sites and pipeline corridors, non-over-trawl techniques such as Side Scan Sonar (SSS)/ROV or by the post decommissioning survey. The methods used will be discussed and finalised with OPRED. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF, seabed clearance is likely to require conventional overtrawl survey methods. The risk associated with the decommissioning activities generating snagging hazards is negligible. However, further assessment related to potential snagging risks associated with the decommissioning of infrastructure *in situ* is provided.
Water quality	No	All Caledonia subsea infrastructures have already been flushed and disconnected under MAT PLA/518. Vessel discharges are managed through existing, International Convention for the Prevention of Pollution from Ships (MARPOL) compliant controls, including bilge management procedures and good operating practices. Any residual liquids present during the decommissioning of pipelines and substructures have been treated before being discharged to sea, such that the discharge comprised of treated water. Any residual remaining material was in trace levels/volumes following the DFPV regime and did not pose any significant risk to water quality. All residual solids were shipped to shore for disposal.
Underwater noise emissions	No	Vessel presence will be limited in scale (i.e. the size and number of vessels) and duration and, therefore, does not constitute a significant or prolonged increase in noise emissions across the project area. To remove the subsea installations, the cutting of flowlines will likely be done with shears, thereby minimising produced underwater noise during this activity. There is potential that external cuttings using diamond wire may be required; however, noise associated with this activity will be temporary and generated very close to the seabed, where absorption rates are highest. All other noise generating activities associated with the decommissioning of the Caledonia Field are considered negligible in the context of ambient noise levels, and are likely to be masked by project related vessel activities.

Potential impact	Further assessment?	Rationale
		Geophysical surveys undertaken for post-decommissioned infrastructure left *in situ* will be assessed in future, through the process of permit application. Multibeam echosounder survey equipment is likely to be used for imaging and identification of pipeline exposures. The JNCC (2017) Guidelines will be employed for mitigation of noise impacts to marine mammals for future survey work involving seismic survey equipment. The project is not located within an area protected for marine mammals and none of the activities associated with the decommissioning of the Caledonia Field are considered to generate significant noise levels which may cause injury or significant disturbance to marine species or other users. On this basis, underwater noise does not require further assessment.
Resource use	No	Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Any opportunities for increasing fuel efficiency and reducing use of resources will be identified and implemented by Premier during the decommissioning programme. The estimated total energy usage for the project is 155,965 GJ. This figure accounts for all operations, materials recycling, and the loss associated with decommissioning items *in situ*. This is considered very low, compared to the resources generated during the production phase of the project. Considering the above, resource use does not warrant further assessment.
Onshore activities	No	The OPRED Guidance states that onshore activities are not in scope of Decommissioning EAs, and this topic does not require further assessment. It should be noted that, only licenced contractors which can demonstrate they are capable of handling and processing the material to be brought ashore (e.g. permitted capacity to accept the relevant waste streams) will be used. This will form part of the commercial tendering process, including duty of care audits and due diligence on the successful contractor. Approval is determined through due-diligence assessment comprising site visits, review of permits and consideration of the facilities design and construction has been developed to minimise environmental impact. Premier understands that dismantling sites will also require consents and approvals from onshore regulators such as the Scottish Environment Protection Agency (SEPA), who apply conditions relating to mitigation, management and who are responsible for the provision of permits for such work.

Potential impact	Further assessment?	Rationale
Waste	No	The recycling and disposal of wastes are covered by Premier's Waste Management Strategy, which is compliant with relevant regulations relating to the handling of waste offshore, transfer of controlled, hazardous and special waste, and TFSW. The Waste Management Strategy is guided by Premier's HSES Policy and commitments to best practice in waste management. This includes the mapping and documenting of waste management arrangements for each phase of the Caledonia Field's end of life in individual Active Waste Management Plans (AWMPs), and ongoing monitoring of waste procedures and performance review against target Key Performance Indicators (KPIs). Waste will be treated using the principles of the waste hierarchy, focusing on the reuse and recycling of wastes where possible. Raw materials will be returned to shore with the expectation to recycle the majority of the returned material. There may be instances where infrastructure returned to shore is contaminated (e.g. by Naturally Occurring Radioactive Material (NORM), hazardous, and/or special wastes) and cannot be recycled. In these instances, the materials will require disposal. However, the weight and/or volume of such material is not expected to result in substantial landfill use. On this basis, no further assessment of waste is necessary.
Unplanned events	No	There will be a variety of vessel types and sizes on-site during the decommissioning process. However, of the volume of vessel diesel inventory lost would be less than the worst-case crude oil spill from loss of well containment. The decommissioning activities detailed in this EA will occur after well P&A, therefore the fuel inventory of a vessel likely to be present during decommissioning has been used as a worst-case unplanned event scenario. A vessel's fuel inventory is likely to be split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of the full inventory. Any spills from vessels in transit and outside the 500 m safety zone are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). Premier will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP. Consequently, any impact from vessel-based fuel inventory release will be less than that already assessed and mitigated against within the OPEP for the operational phase of the Caledonia Field. The worst-case unplanned event during decommissioning activities would be the release of fuel inventory from the largest vessel on site. This is thought to be a CSV or DSV type vessel. The Seven Falcon, a vessel which is comparable to one which may be used during decommissioning has a fuel capacity of 1,335 m^3. As stated

Potential impact	Further assessment?	Rationale
		previously, the nature of the fuel tank layout is such that this is unlikely to be released all at once. In addition to the mitigation measures outlined in the individual vessel SOPEPs, Premier maintains manned bridges, navigational aids and monitoring of safety zones. Considering the above, the potential impacts from accidental chemical/ hydrocarbon releases during decommissioning activities do not warrant further assessment. As the methodology for the substructure and pipeline removal and return to shore has not been defined in detail, there exists the remote possibility that during transport of those materials, elements may dislodge and drop from the transport vessel. Premier will cut and lift the unburied sections of the pipeline; however, these sections are short therefore the likelihood of accidental loss of pipeline materials to the seabed is low. Moreover, all substructures are considered sound and no issues regarding their integrity have been identified. Dropped object procedures are industry-standard. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Any dropped objects will be reported to OPRED via PON2 notifications and addressed during the debris clearance survey. These will be removed or remediated in agreement with OPRED. In line with the mitigation measures in place, unplanned loss of materials to the sea do not require further assessment.

5.2 Aspects taken Forward for Further Assessment

Based on the initial screening provided in Section 5.1, the following potential environmental and societal impacts have been identified as requiring further assessment within the EA:

- Seabed impact; and
- Commercial Fisheries.

These potential impacts are addressed in detail within Section 6.

5.3 Proposed Mitigations and Existing Controls

To ensure that impacts remain as described above, Premier will follow routine environmental management activities, for example appropriate project planning, contractor management, vessel audits, activity permitting and legal requirements to report discharges and emissions, such that the environmental and societal impact of the decommissioning activities will be minimised. The activities associated with the decommissioning Caledonia assets are not likely to result in significant impacts to the environment or other sea users, including fishing or seabed communities, if appropriate mitigation and control measures are effectively applied. A summary of the proposed control and mitigation measures is shown in Table 5-2.

Table 5-2 Proposed Mitigation and Control Measures

General and Existing

• Lessons learnt from previous decommissioning scopes will be reviewed and implemented as appropriate;
• Vessels will be managed in accordance with Premier's existing marine procedures, including:
  ○ The vessels' work programme will be optimised to minimise vessel use where possible;
  ○ All infrastructure will be subject to a drain, flush, purge and vent philosophy that will be assessed and permitted under existing operational permits prior to decommissioning, to ensure minimal residual contaminants are present in the infrastructure before removal operations commence;
  ○ The OPEP is one of the controls included in a comprehensive management and operational control plan developed to minimise the likelihood of hydrocarbon releases and to mitigate their impacts should they occur;
  ○ All vessels undertaking decommissioning activities will have a MARPOL-approved SOPEP;
  ○ Existing processes will be used for contractor management to assure and manage environmental and social impacts and risks;
  ○ Premier's management of change process will be followed should changes of scope be required;
  ○ Careful planning, selection of equipment, subsequent management and implementation of activities; and
  ○ Impacts resulting from the disturbance of the drill cuttings deposits are expected to be minimal given their rapid resettlement and the fact that drill cuttings deposits will be directed to the immediate vicinity of the wellhead, minimising the extent of any seabed impacts or reduction in water quality. Remediation of any potential impacts on seabed communities will be undertaken, where required.
• A post-decommissioning environmental seabed survey, centred around the well locations, will be carried out. The survey will focus on chemical, physical and biological changes, disturbances and will be compared with the pre-decommissioning survey. Results of this survey will be available once the work is complete, with a copy forwarded to OPRED.
• All pipeline routes and installation sites will be the subject of oilfield debris clearance and as-left verification surveys when decommissioning activity has concluded.
• The main risk from infrastructure remaining *in situ* is the potential for interaction with other users of the sea, specifically from fishing related activities. Where the infrastructure is trenched below seabed level or trenched & buried below, the effect of interaction with other users of the sea is considered to be negligible.
• The infrastructure is currently shown on Admiralty Charts and the FishSafe system. When decommissioning activity has been competed, updated information will be made available to update Admiralty Charts and FishSafe system.
• When decommissioning activities have been completed, and where applicable, the safety zones around offshore infrastructure will be removed.
• The licence holders recognise their commitment to undertake post-decommissioning monitoring of infrastructure decommissioned *in situ*. After the post-decommissioning survey

reports have been submitted to OPRED and reviewed, a post-decommissioning monitoring survey regime, scope and frequency, will be agreed with OPRED. • Any snagging risk to other sea users will be minimised by continual monitoring of degrading installations or free spans.
Large-scale Releases to Sea
• All solid waste will be skipped and shipped to shore for disposal, rather than being discharged at sea. • Risk of full inventory loss from a vessel is very low given that the majority of vessels have multiple, separated fuel tanks, making full contaminant loss highly unlikely and the distance from shore would prevent any significant volume of diesel reaching any shoreline. Any potential diesel fuel spillages resulting from unplanned collisions will be minimised by approved OPEP/SOPEP, in which risks associated with the decommissioning activities have been appropriately assessed and planned for.
Waste Management
• All waste have and will continue to be managed in accordance with the Waste Management Plan, including any marine growth waste, or NORM identified during flushing and cleaning of substructures. • The Waste Management Plan will involve the use of a waste inventory, and all residual wastes being shipped to shore for processing.

6 IMPACT ASSESSMENT

The following aspects have been identified as requiring further assessment against potential impacts from the proposed decommissioning activities:

- Seabed impact (Section 6.1); and
- Commercial fisheries (Section 6.2)

Sources and environmental response to potential impacts to these receptors are detailed in the sections below.

6.1 Seabed impacts

The impact of Caledonia decommissioning activities on seabed receptors is discussed in the following section, along with measures proposed to minimise the scale and duration of any potential impacts.

6.1.1 Approach

There are two seabed impact pathways associated with the decommissioning operations: direct and indirect disturbance.

Direct disturbance is considered the physical disturbance of seabed sediments and habitats. Direct disturbance has the potential to cause temporary or permanent changes to the marine environment, depending upon the nature of the associated activity. Activities which contribute to the direct disturbance impact pathway include the removal of infrastructure and remediation of snagging hazards, either from overtrawling or placement of material (rock armour) on the seabed. The total area of seabed expected to be impacted by direct physical disturbance has been calculated by adding together the individual areas of physical disturbance estimated for each activity and the expected duration of the direct disturbance has been provided. All dimensions used in calculating the disturbance area of each decommissioning activity are available in Appendix A.

The second impact mechanism, indirect disturbance, is that which occurs outside of the direct disturbance footprint. It may be caused by the suspension and re-settlement of natural seabed sediments and cuttings pile materials disturbed during activities. This secondary impact pathway is considered temporary in all instances, based on the definitions provided in Section 4. The scale of indirect disturbance due to re-suspension and re-settlement of natural sediment has been estimated based on the expected area of direct disturbance from any activity. The estimated indirect disturbance area is assumed to be double the direct disturbance area for all installations and activities taking place.

6.1.2 Sources of Potential Impact

6.1.2.1 Overview

The following activities within the Caledonia Field have been identified as sources of potential seabed disturbance:

- Pipeline, flowline and umbilical decommissioning:
  - Cutting and removal of short, surface-laid end portions of rigid flowlines; and
  - Cutting and removal of short, surface-laid end portions of flexible flowlines; and
  - Full removal and recovery of spools and jumpers; and
  - Dynamic umbilical disconnect and removal.
- Additional subsea infrastructure decommissioning:
  - Full removal of infrastructure.

- Stabilisation materials:
  - Removal of grout bags and concrete mattresses; and
  - Deposition of new rock armour to protect ends and cut exposures of flowlines decommissioned *in situ*.
- Clear seabed verification (overtrawling).

Seabed disturbance may be classified in the following sections as short-term, temporary, prolonged or permanent; these terms are defined in Table 4-3.

As highlighted in Section 2, it is likely that the Caledonia workscopes inside the Britannia 500 m zone will have to be deferred until the Chrysaor-operated Britannia platform is decommissioned. However, in the interest of assessing the full impact associated with the Caledonia decommissioning, items within the Britannia 500 m zone and activities associated with their removal are assessed together throughout the coming sections.

6.1.2.2 Pipelines, Flowlines and Umbilicals Decommissioning

As described in Section 2.4, all surface laid lines (comprising flowlines, umbilicals, jumpers and rigid spools) will be recovered. Rigid flowlines that are trenched and buried will have their unburied ends cut and removed. The resulting exposed cut ends will be covered with rock armour to mitigate snag risk. The trenched and buried sections will be decommissioned *in situ*. The trenched and buried static umbilical will also be decommissioned *in situ* with the surface laid ends cut and lifted. The remediation required at the cut ends has been addressed separately in Section 6.1.2.4.

The area of seabed disturbed by recovery of each individual line to the surface has been estimated by multiplying the length of each individual line section which will be removed, by the outer diameter. A full inventory of infrastructure dimensions is available in Appendix A. The areas disturbed by recovery of each individual line have then been summed to give an overall area of disturbance. The disturbance areas are presented in Table 6-1.

The single dynamic umbilical (PLU1921) will be decommissioned at the time of the Britannia platform decommissioning. While the method of removal will be chosen at a later date, with regards to impacts to the seabed, full removal by reverse reeling would be a worst-case scenario. Therefore reverse reeling has been assumed in the assessment. This is expected to have an impact beyond the area of the flowline alone. The direct disturbance area is therefore calculated by adding a 10 m buffer (5 m either side of the line) to the width of the line. This buffer allows for instances in which reverse reeling may not occur in a straight line. While only 187.5 m of total length of the dynamic umbilical (357 m) is in contact with the seabed, to present a worst-case seabed impact, it has been assumed that during the reverse reeling procedure, the whole length of the umbilical may come into contact with the seabed.

Buried sections of rigid flowline that are decommissioned *in situ* are not expected to cause any seabed disturbance and are excluded from the table.

The direct and indirect disturbance areas associated with these proposed operations are summarised in Table 6-1. The area indirect disturbance is twice the area of direct impact. Both of these disturbance levels are temporary and will only last as long as activities are occurring. Disturbance due to placement of rock armour to protect exposed ends of flowlines decommissioned *in situ* has been assessed separately in Section 6.1.2.4.

Table 6-1 Seabed Impacts Associated with Pipeline, Flowline and Umbilical Decommissioning

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km²)	Indirect disturbance area (km²)
Removal of surface laid sections of pipeline	180 m section of production pipeline (diameter 323.9 mm) 180 m section of gas lift pipeline (diameter 114.3 mm)	Temporary	0.000079	0.00016
Removal of surface laid sections of static umbilical	350 m section of static umbilical (diameter 172 mm)	Temporary	0.000060	0.00012
Full removal of dynamic umbilical	One dynamic umbilical of length 357 m (diameter 172 mm)	Temporary	0.0036	0.0073
Removal of spools and jumpers	Eight spools of varying dimensions, and one jumper	Temporary	0.00014	0.00028
		Total	**0.004**	**0.008**

6.1.2.3 Additional Subsea Infrastructure Decommissioning

As described in Section 2.4.4, all seabed infrastructure will be recovered to the surface.

The area of seabed disturbed by recovery of each individual item has been estimated by multiplying the item length by the width. The areas disturbed by each individual item have then been summed to give the overall area of seabed disturbed. As described in Section 2.4.4, some of the seabed installations are gravity based. In a worst-case scenario, should extraction from the seabed prove difficult, liquification of the seabed around the installation may be required. This has been accounted for when calculating the area of disturbance by adding a 10 m buffer around the installation. The direct and indirect disturbance areas associated with the proposed operations are summarised in Table 6-2 (for full inventory refer to Appendix A).

Table 6-2 Seabed Disturbance Associated with Decommissioning of Other Seabed Infrastructure

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km²)	Indirect disturbance area (km²)
Removal of seabed infrastructure	Comprised of two items: SSIV (6.5 m x 4.4 m), and a manifold (10.6 m x 8.4 m), plus 10 m buffer	Temporary	0.00076	0.0015
		Total	**0.00076**	**0.0015**

6.1.2.4 Stabilisation Materials

Concrete mattresses and grout bags have previously been deployed across the Caledonia Field to stabilise and protect seabed infrastructure.

As noted in Section 2.4.5, the intention is that all concrete mattresses and grout bags will be recovered, this will cause a temporary disturbance. Deposits of rock armour will also be required in order to protect the newly cut ends of trenched and buried rigid pipelines due to be decommissioned *in -situ.* An estimated

30 m^2 will be deposited per cut end (6 m width by 5 m length along the pipeline). This is based on the assumption that "a 36" pipeline would need to covered by 0.5 metres of rocks, which would require a pile 3 metres either side" (AURIS, 1995; as referenced in Etkins, Vanner and Firebrace, 2006). With six cut ends, the total rock placement is expected to cover an area of approximately 180 m^2. This is considered a source of permanent disturbance. Rock placement also has an associated indirect disturbance area due to the sediment suspension that rock placement will cause. As previously, this has been assumed to be double the direct impact area.

In the case of grout bags, there are an estimated 1,400 in the Caledonia Field. Grout bags are used in conjunction with different subsurface installations to provide protection or stability. As such, they are usually stacked or piled on top of one another or on top of other installations / mattresses. The exact layout of the bags in the Caledonia Field is unknown. Although highly unlikely, the worst-case scenario has been defined as all 1,400 bags spread in a single layer on the seabed. A standard grout bag size has been used to estimate the area cover by grout bags in the Caledonia Field. The seabed disturbance associated with the stabilisation materials is summarised in Table 6-3.

Table 6-3 Seabed Disturbance Associated with Stabilisation Materials (Including Existing Materials Decommissioned *in situ* and New Materials Deposited to Protect Pipeline Ends)

Activity	Quantity and dimensions	Expected duration of disturbance	Temporary direct disturbance area (km^2)	Indirect disturbance area (km^2)	Permanent disturbance area (km^2)
Removal of existing concrete mattresses	Estimated 156 mattresses of two different sizes: 65 mattresses (6 m x 2 m) and 91 mattresses (6 m x 3 m)	Temporary	0.0024	0.0048	0
Removal of grout bags	Estimated 1,400 grout bags of standard dimensions (0.6 m x 0.3 m)	Temporary	0.00025	0.00050	0
Deposition of new rock armour to protect other infrastructure decommissioned *in situ*	Rock armour covering an area of approximately 180 m^2 (30 m^2 per cut end)	Permanent	0	0	0.00018
		Total	**0.0027**	**0.0053**	**0.00018**

6.1.2.5 Clear Seabed Verification

As detailed in Section 2.4.6, a seabed clearance verification survey is required following all decommissioning projects to ensure there is no residual risk to other sea users, particularly those which make contact with the seabed, such as trawl fisheries.

Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the Scottish Fishermen's Federation (SFF), seabed clearance is likely to require conventional overtrawl survey methods. Where there is evidence of residual snagging hazards (e.g. any

spans, berms, dropped objects, etc.), then intervention in the form of overtrawling to re-level the seabed or the addition of rock placement will be implemented.

Seabed clearance verification includes surveillance of the decommissioned area and, where residual risks remain, remediation in the form of overtrawling to re-level the seabed. Overtrawling is currently not anticipated, however the clear seabed verification survey will ultimately determine this. All flowlines will have their ends cut and removed before being decommissioned *in situ*. All other infrastructure is to be removed and rock placement is designed to be overtrawlable. Therefore, overtrawling is not currently proposed and so there is no associated footprint which must be taken into account here. Should overtrawling be required, this will be discussed with the regulator.

6.1.2.6 Summary of Seabed Impacts

Seabed disturbance from the decommissioning activities discussed throughout Section 6.1.2 is summarised in Table 6-4. This illustrates a worst-case scenario for seabed disturbance, in which the majority of impact comes from removal of stabilisation materials. The area calculated to be impacted by this activity is likely an overestimation as stabilisation materials have been assumed to be laid in a single layer, which is unlikely. Therefore, the area impacted by the decommissioning activities should be less than what is represented in Table 6-4.

Table 6-4 Total Potential Seabed Disturbance from Caledonia Decommissioning Activities

Activity	Temporary direct disturbance area (km^2)	Temporary indirect disturbance area (km^2)	Permanent disturbance area (km^2)
Pipelines, Flowlines and Umbilicals Decommissioning	0.004	0.008	0
Subsea Infrastructure Decommissioning	0.00076	0.0015	0
Stabilisation Materials	0.0027	0.0053	0.00018
Total	**0.0075**	**0.015**	**0.00018**

6.1.3 Effects on Sensitive Receptors

6.1.3.1 Direct Disturbance

Decommissioning activities are expected to lead to two types of direct physical disturbance. The first is temporary disturbance, which will result from the removal of infrastructure from the seabed. Overtrawling is also a source of direct disturbance, though in this instance it is not anticipated to occur. The sediment will be disturbed when retrieving equipment from the seabed and by the trawl running over the seabed, but once decommissioning is complete, the affected areas will be free of anthropogenic material. This should allow recovery in line with natural processes such as sediment re-suspension and deposition, movement of animals into the disturbed area from the surrounding habitat, and recruitment of new individuals from the plankton.

The second type of direct disturbance will be permanent disturbance caused by the deposition of additional rock armour on the seabed to protect infrastructure decommissioned *in situ*. This type of disturbance will effectively change the seabed type in the affected areas from the naturally occurring soft clay sediment (as described in Section 3.4) to a hard substrate. As these materials will be permanently left

on the seabed. Over time these deposited materials will become fully buried by the deposition of new natural sediment. Due to the extended length of time over which this occurs, the impact is defined as permanent. The two types of direct disturbance are discussed in the subsections below.

The areas of anticipated direct and indirect disturbance are captured in Figure 6-1. Existing environmental survey data in proximity to the areas of disturbance is shown in Figure 6-2, along with images taken within the survey area of the seabed which may be encountered at Caledonia (fully detailed in Section 3.2 and 3.4). The location of the survey images is 2.62 km from Caledonia manifold. Areas of temporary direct disturbance are shown in light grey, whilst areas of permanent disturbance from rock placement are in dark grey.

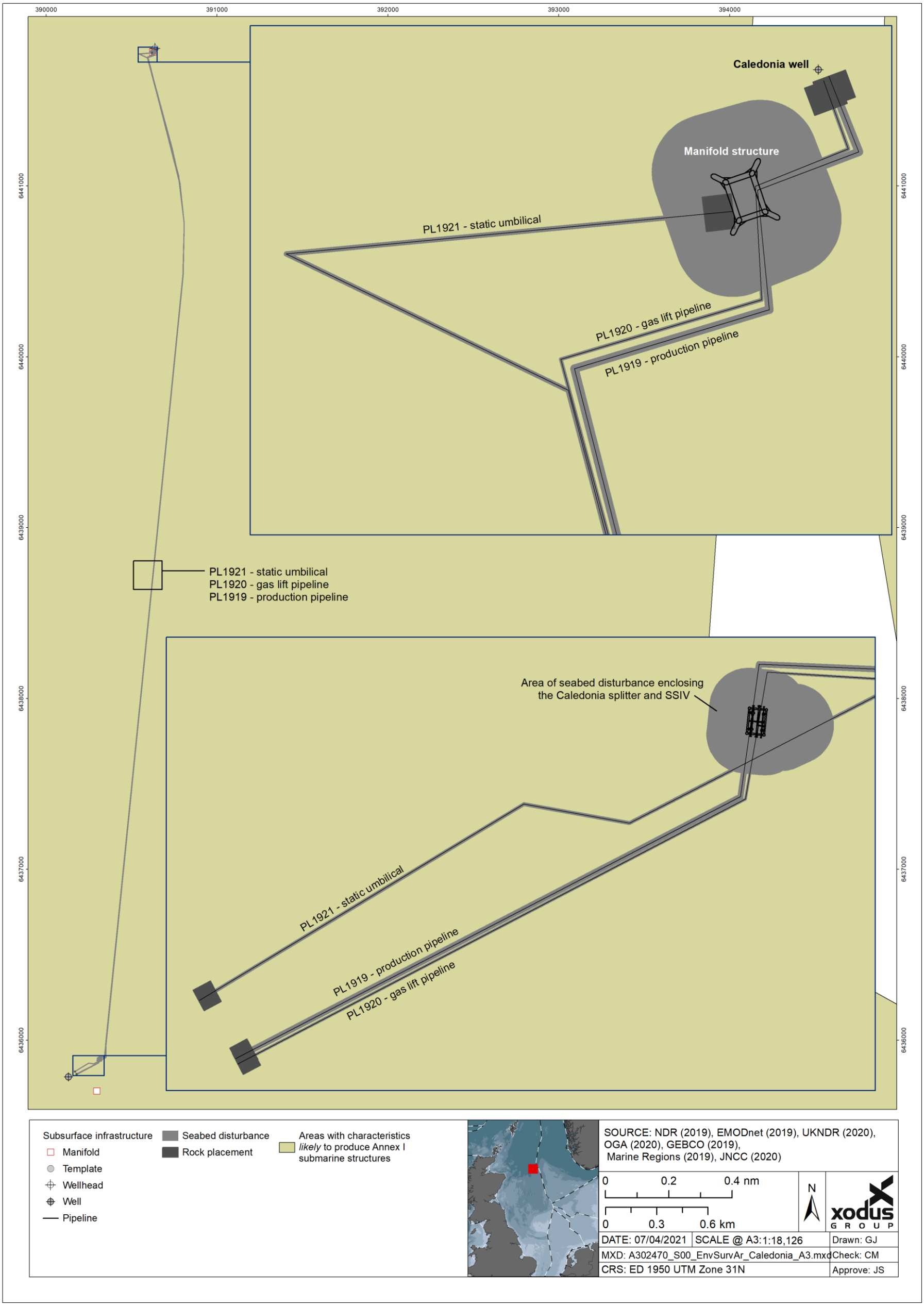

Figure 6-1 Extent of potential seabed impacts associated with the Caledonia decommissioning

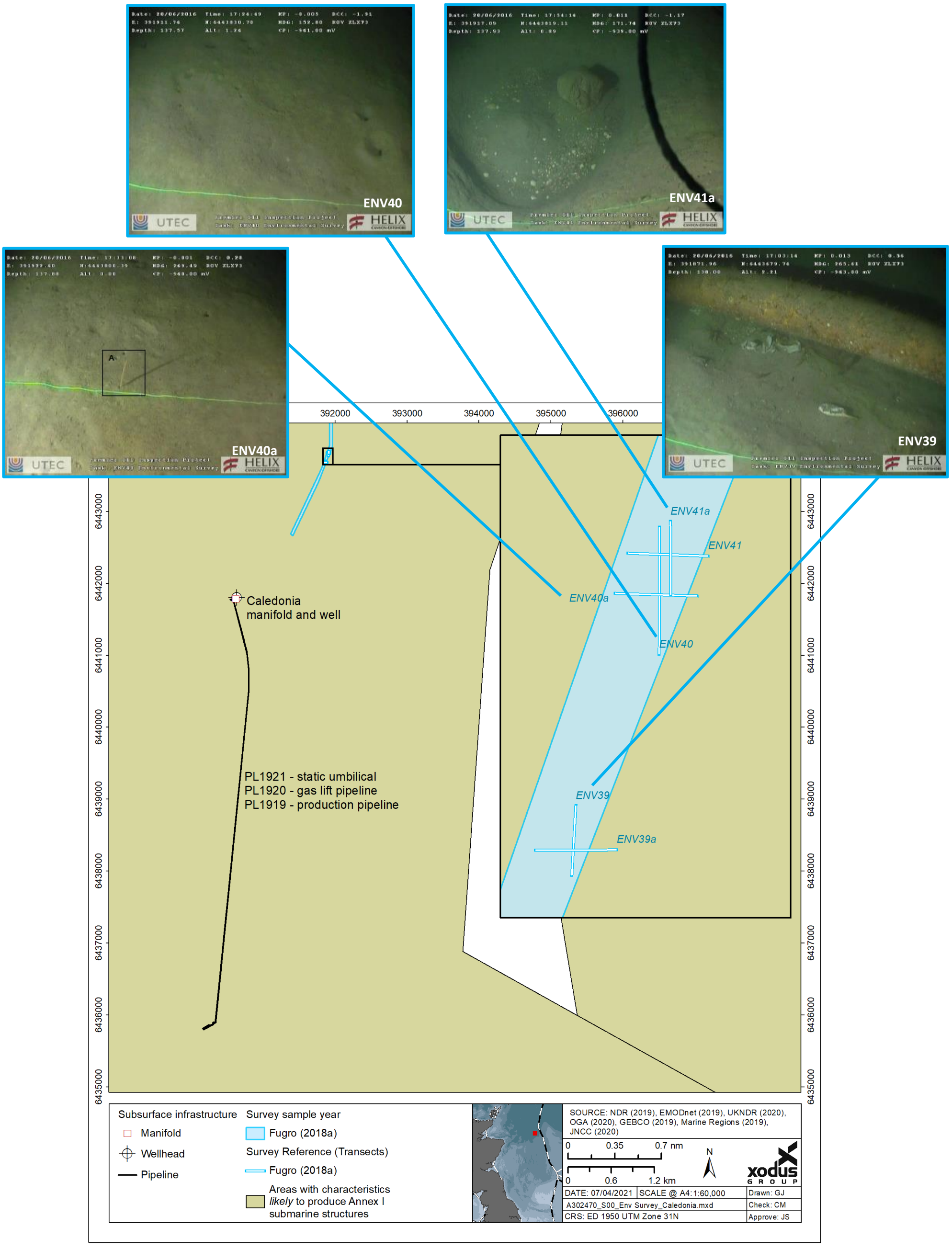

Figure 6-2 Areas of environmental sampling data and potential Annex I habitat

6.1.3.1.1 Temporary Direct Disturbance

As noted in Table 6-4, approximately 0.0075 km^2 of seabed would be affected by temporary disturbance. The scale of the disturbance is small when compared to other forms of disturbance that occur in the area, such as commercial trawling. A commercial trawler with a 12 m wide beam trawl trawling at its slowest rate of approximately 4.7 km/h would cover an area of roughly 0.06 km^2 per hour and would therefore take approximately 7 minutes to cover the anticipated direct disturbance area (FAO, 2019). As stated in Section 3.5, fishing effort in ICES Rectangle 45F1, within which the Caledonia Field is located, in 2018 amounted to 424 days (10,176 hours). In this context, the limited scale of the disturbance associated with the decommissioning activities is clear.

Decommissioning disturbance will cause mortality to benthic and epibenthic fauna, due to injuries arising from the crushing of species which are sedentary or unable to move quickly. Mobile fauna will likely also be disturbed. The sediment structure, including the burrows of any animals present, will be affected. Past surveys of benthic fauna across the Greater Balmoral Area identified communities comprised of sea pens (*P. phosphorea* and *V. mirabilis*), starfish, sea anemone, hermit crab, sea urchin and faunal turf comprising hydrozoans and bryozoans (as described in Section 3.4, Fugro 2018a).

Surveys in the Greater Balmoral Area identified the OSPAR listed habitat 'seapens and burrowing megafauna' as present, and the Scottish PMF 'Burrowed mud', therefore it is likely that this habitat extends into the vicinity of the Caledonia Field. Seapens have some resistance to being disturbed and generally can reinsert themselves into the sediment if removed, as long as they remained undamaged. However, damaged individuals show poor recovery, and therefore resilience is considered low, giving an overall sensitivity of medium (MarLIN, 2018). As such, temporary disturbance is expected to cause some mortality to any seapens that are physically damaged during operations, but this is expected to be extremely localised and not have any effect on the viability of the local population. Replacement of damaged individuals would be expected to occur either from the zooplankton or from "adult" seapens moving in from the surrounding area. Survey of historical trawl scars in the Balmoral Field showed that seapens were common (Fugro, 2018b), suggesting there is good scope for recovery which would be expected to occur within ten years.

6.1.3.1.2 Permanent Direct Disturbance

Permanent direct disturbance will occur due to leaving hard substrate on the seabed in perpetuity. This encompasses both the leaving *in situ* of existing material that has previously been introduced (rock armour), and the introduction of new rock armour to protect trenched and buried rigid flowlines that will be decommissioned *in situ*. Approximately 180 m^2 of seabed will be subject to permanent direct disturbance due to the introduction of hard substrate.

The immediate effect of the introduction of new hard substrate will be mortality and injury of benthic and epibenthic fauna that cannot move away from the activities, as well as disturbance of motile fauna. Following the introduction of the material, the ongoing effect will be the change of an area of softer habitat to a hard substrate, and a related change in the types of organisms that can use the habitat. Organisms such as sea pens and burrowing bivalves, anemones and crustaceans will no longer be able to use the area affected, while new habitat will be created for other groups such as encrusting sponges and species of anemone. In the Greater Balmoral Area, survey effort at existing hard substrate deposits (Fugro, 2018a) showed that the hard substrate community will likely comprise molluscs (as evidenced by the increase in shells and shell debris), anemones, sponges, starfish (*A. rubens*), sea urchins, soft coral, and crabs. Gadoid (cod-like) fish were also commonly observed around the deposits (Fugro, 2018a). Seapens were noted to be common in the soft sediment directly surrounding the hard substrate deposits. Given the similarity in benthos expected at Caledonia, a similar change in community composition could occur.

While the introduction of hard substrate clearly results in a change in the habitat type and associated fauna present, the scale of the impact is negligible considering the very large extent of sandy seabed available in the CNS. Recovery of the affected areas is expected to take many years but will eventually occur as the deposited rock material is gradually buried by natural sediment deposition. Therefore, the community is expected to recover and revert to pre-disturbance composition with time. Given the length of time this recovery is expected to take, this disturbance has been classified as permanent.

6.1.3.2 Indirect Disturbance

Direct disturbance of the seabed during decommissioning operations (Section 6.1.3.1) will cause sediment re-suspension. Sediments that are re-suspended will travel in the water column before settling. Most sediment is expected to settle within the direct disturbance area, but some may settle in adjacent areas not directly affected by decommissioning operations.

6.1.3.2.1 Suspended Sediment in the Water Column

Increased suspended sediment load in the water column, and the subsequent settling can negatively affect seabed habitats and species. The impacts include interference with feeding due to individuals inability to keep their feeding apparatus clear of sediment, and physical burial of individuals that are unable to recover to the surface through layers of newly deposited sediment (Rogers, 1990; Gubbay, 2003). The potential area of direct seabed disturbance is 0.0075 km^2 (Table 6-4). Taking into account the footprint of indirect impact, this doubles the area of impact to 0.015 km^2 of seabed indirectly impacted by sediment settlement.

Increased suspended sediment may reduce feeding efficiency of filter feeders due to clogging of feeding structures. Defra's Charting Progress for UK Seas report (Defra, 2010) considers that impacts arising from sediment re-suspension are short-term (usually over a period of a few days to a few weeks). Generally, infaunal communities are naturally habituated to sediment transport processes and are therefore less susceptible to the direct impact of temporarily increased sedimentation rates. Experimental evidence further suggests that seapens, the main filter feeder of concern identified in the Greater Balmoral Area, are not sensitive to increased suspended sediment. Both species observed in the area (*P. phosphorea* and *V. mirabilis*), and therefore assumed to be present in the Caledonia Field, are capable of cleaning themselves of excess sediment by the production of mucous (MarLIN, 2018). No other habitats or species of concern were identified in past surveys of the Greater Balmoral Area. As such, the impact of increased suspended sediment on the benthos surrounding Caledonia is expected to be negligible.

6.1.4 Cumulative and Transboundary Impacts

The closest installations are the Britannia platform (Operator: Chrysaor), to which Caledonia is tied-back, and the Alba North platform (Operator: Ithaca), located 6 km south south-east and south south-west of the Caledonia Field respectively. Given the relatively small scale of the Caledonia decommissioning activities, interaction with impacts from operations at these installations are not anticipated. The Caledonia Field is also located 34 km west south-west of the UK/Norway median line and therefore no transboundary impacts are expected.

6.1.5 Mitigation Measures

There are mitigation measures relating to the placement of rock armour. Rock armour will be placed by a fall pipe vessel equipped with an underwater camera on the fall pipe. This will ensure accurate placement, that the rock armour footprint will be as small as possible, and that the minimum safe quantity of rock is used.

6.1.6 Conclusion

Receptor	Impact Magnitude	Receptor Sensitivity	Receptor Vulnerability	Receptor Value
Seabed	**Low**	**Medium**	**Low**	**Low**
Validation				
Decommissioning activities in the Caledonia Field will result in temporary direct disturbance to the seabed amounting to 0.0075 km^2, or 0.015 km^2 when accounting for temporary indirect disturbance. Permanent disturbance caused by long term rock armour placement will affect 180 m^2. As the area expected to be impacted by the activities outlined in the EA, the magnitude of the impact on seabed features is classed as **low**. Temporary direct seabed disturbance may cause injury and mortality to the benthos within the disturbance footprint, whilst indirect temporary disturbance may interfere with feeding, and smother individuals that are unable to burrow back to the surface through settled sediment. Permanent direct disturbance will result in the loss of a small area of soft-sediment habitat, which will be replaced with an equivalent area of hard substrate. As some of the species which may be present within the Caledonia Field are considered moderately sensitive to sediment disturbance, sensitivity is considered **medium**. With respect to the OSPAR habitat 'seapen and burrowing megafauna communities', seapens are able to cope with increased levels of suspended sediment. Should mortality occur, seapens are also well situated for population recovery and there is past evidence of this in the general Greater Balmoral Area. As such, the community is on the whole expected to recover relatively rapidly in the wake of the decommissioning. As such, vulnerability is considered **low**. The EUNIS habitat type that categorises much of the Caledonia Field area is A5.36 'circalittoral fine mud'. This habitat complex covers approximately 18,900 km^2 of the CNS (UKSeaMap, 2016), as such, the small area of disturbance associated with the Caledonia decommissioning activities will affect a very small proportion of the similar habitat available in the region. The scale of disturbance associated with the decommissioning is small relative to the area of similar habitat available. Due to the presence of this habitat throughout the North Sea, the receptor value is deemed **low**. Based on the highly localised and mostly temporary nature of the disturbance, the impact of Caledonia decommissioning activities on seabed receptors is expected to be **negligible**.				
Residual Impact Significance	**Negligible**			

6.2 Commercial Fisheries

The impact of Caledonia decommissioning activities on commercial fisheries is discussed in this Section, along with measures proposed to minimise the scale and duration of potential impacts.

6.2.1 Approach

Potential impacts to other sea users from decommissioning of infrastructure are limited to:

- The introduction of possible snagging risks to commercial trawl fisheries and other fisheries which utilise the seabed; and
- The presence of decommissioning vessels temporarily restricting the area available as fishing grounds.

6.2.2 Sources of Potential Impacts

Free-spans associated with infrastructure decommissioned *in situ* during their initial decommissioning and long-term degradation have the potential to snag demersal fishing gears. Snagging may lead to the loss or damage of catch and fishing gears or may cause vessels to capsize in extreme circumstances (MAIB, 2019). The greatest identified risk to commercial fisheries is the potential snagging of fishing gears on exposed infrastructure (e.g. deburied infrastructure or spans along rigid pipelines) or seabed modified by removal of infrastructure (e.g. clay berms generated by the removal of flexible umbilicals).

Data from the Marine Accident Investigation Branch (MAIB, 2019) shows that 15 fishing vessels were recorded to have sunk due to snagged fishing gear between 1989 and 2014, resulting in 26 fatalities. As discussed in Section 3.5.2, demersal mobile gear used in the Caledonia Field includes trawls and demersal seine nets which may be impacted by snagging (Scottish Government, 2020).

Any infrastructure decommissioned *in situ* in the Caledonia Field has the potential to be a snagging risk. The only infrastructure to be decommissioned *in situ* are the trenched and buried rigid flowlines and static umbilical (as described in Section 2.4). As described in Section 3.4, the seabed within the Caledonia area is described as 'circalittoral fine mud' (Fugro, 2018a). This sediment type lends itself to the formation of clay berms. As the section of dynamic umbilical associated with the Caledonia Field is located within the Britannia 500 m safety zone, it is to be decommissioned at a later date along with the Britannia platform. Therefore, the method of removal for the dynamic section of the umbilical has yet to be confirmed. Reverse reeling, though not a confirmed method of removal for this umbilical section, may be the chosen option. Reverse reeling can, in certain sediments, generate clay berms however, this section of dynamic umbilical is surface laid and therefore there is minimal risk of clay berm creation.

While pipeline degradation has the potential to introduce snagging risk in certain circumstances, the PL1912 production pipeline, piggybacked PL1920 gas lift line and associated PLU1921 umbilical, are known to be stable and has remained buried throughout the lifetime of Caledonia Field. Information on the DoB of the existing pipeline infrastructure indicates it is suitably buried along its length, with an average depth of burial of 1.46 m (Appendix C). This is almost 2.5 times the 0.6 m standard for 'stable burial' (BEIS, 2018). Any potential changes in burial status of the Caledonia pipelines resulting in legacy impacts to commercial fisheries due to its degradation over time, will be managed through continued monitoring and communication with relevant users of the sea, as detailed in Section 6.2.5 below. Consequently, residual risk of snagging is not considered further in this assessment.

Potential residual impacts to commercial fisheries from the temporary loss of fishing grounds during decommissioning activities remains. This impact pathway has been addressed in the Sections below.

6.2.3 Effects on Sensitive Receptors

Considering the negligible likelihood of residual snagging risk to fisheries following decommissioning activities and the continued monitoring of infrastructure decommissioned *in situ*, effects on commercial fisheries will be limited to temporary loss of access to commercial fishing grounds. Various data sources indicate that use of the decommissioning area by commercial fisheries is considered low compared to the surrounding region (see Section 3.5.2). Demersal species comprised 37% of live weight landings over the last five years. Pelagic catch was extremely high in 2015, so excluding this year, demersal landings constitute 49% of the total landings between 2014 and 2018. Trawling constitutes a form of demersal fishing.

On review of demersal trawling activity in the North Sea, Rouse *et al*. (2017) found that a low percentage (0.93%) of demersal trawling trips specifically targeted pipelines compared with surrounding areas. Amalgamated VMS data indicates that trawling activity associated with pipelines within Caledonia is higher for *Nephrops* fisheries than demersal (Section 3.5.2) (Rouse *et al*., 2017). *Nephrops* are the key commercial species landed from ICES Rectangle 45F1 for both value and weight. Of the pipelines and subsea infrastructure, the Caledonia production line (PL1919) experienced amongst the greatest levels of *Nephrops* trawling, with between 50-60 trawls over sections of the pipeline. Generally, trawling over the pipeline routes is low within the Caledonia Field. The pipeline is buried to an average depth of 1.46 m, which is considerable, and therefore offers limited potential to act as an artificial aggregate for commercially fished species as other, unburied or superficially buried infrastructure might.

The temporary loss of access to fishing grounds during decommissioning activities is not likely to have a significant impact on the economic value of fisheries operating within this region. Moreover, existing controls on decommissioning vessel movements across the project area and the promulgation of Notices to Mariners (NtMs) assist with reducing the severity of such impacts to a minor disturbance of localised fishing operations. For these reasons, potential impacts associated with decommissioning vessel presence are considered negligible.

6.2.4 Cumulative and Transboundary Impacts

The Caledonia Field is located approximately 30 km from the UK-Norway border (Figure 1-1). As such, this region experiences higher levels of fishing by foreign vessels compared to other regions of the UKCS (Scottish Government, 2020; Marine Scotland, 2012).

As all infrastructure will either be removed or decommissioned *in situ* to an overtrawlable condition, no cumulative impacts to any UK and/or foreign fishing fleets, demersal or otherwise, are expected to result from the Caledonia project.

6.2.5 Mitigation Measures

The existing controls of continued monitoring for an agreed period, remediation where required, accurate mapping of the locations and state of infrastructure which has been decommissioned *in situ* reduces the probability of impacts to commercial fisheries.

The physical presence of vessels during decommissioning operations can cause disturbance to commercial fishing vessels. There are a number of existing controls which Premier is utilising for the impact of vessel presence on commercial fisheries. Stakeholder engagement will continue prior to commencement of operations, including the promulgation of NtMs detailing any decommissioning activities. Appropriate navigation aids will be used in accordance with the Consent to Locate conditions, to ensure that sea users are made aware of the presence of vessels undergoing decommissioning activities. In addition, there will be continual use of Automatic Identification System satellite vessel tracking and all decommissioning vessel activities will be in accordance with national and international regulations.

Pipelines will be remediated should any pre-decommissioning of DoB/monitoring surveys indicate the integrity of the pipelines or DoB has been compromised or a free span has emerged. In such instances, other sea users would be notified via the appropriate communications channels (as described in Section 5.3).

The decommissioning operations will be designed and executed to minimise the area of seabed that is disturbed. A clear seabed verification survey following completion of decommissioning will be carried out and on review of the results of this survey, an overtrawl survey will be considered, though at present overtrawling is not expected to be required.

Premier has a responsibility to ensure all potential residual impacts to fisheries from snagging risk are minimised, given the magnitude of this impact factor. A post-decommissioning survey using geophysical survey methods to provide a collective profile of the buried flowline/seabed interface to identify potential free spans, as well as identify any remaining Field debris, will be carried out. Where necessary, overtrawl assessments will be undertaken to further verify the presence of other snagging risks. Any identified snagging hazards will be remediated with rock placement or other stabilisation materials, as required. Following this, continued monitoring and remediation will take place to ensure that all buried infrastructure remains stable and without exposures or spans.

6.2.6 Conclusion

Receptor	Impact Magnitude	Receptor Sensitivity	Receptor Vulnerability	Receptor Value
Commercial Fisheries	**Low**	**Low**	**Negligible**	**Low**
Validation				
Considering the negligible likelihood of potential snagging risks predicted from the proposed decommissioning activities, alongside the management and control measures that are in place to ensure no such risks arise, residual impacts associated with snagging of commercial fisheries are considered **negligible**. The area is of relatively low fishing effort and is below average compared to the UK in terms of fishing effort days and landings value. As such, the temporary decommissioning activities may affect the industry, albeit temporarily. However, the nature of commercial fisheries is such that they are able to adapt to change, therefore sensitivity is **low**. In addition to this, there will be no long-term impacts associated with the decommissioning. Therefore, vulnerability is considered **negligible**. The majority of the value of catch in the area is attributed to shellfish. As the pipelines within the Caledonia Field are being decommissioned *in situ*, the seabed is not anticipated to change therefore, post-decommissioning the area will remain as productive to fisheries as before. This, in combination with the fact that the disturbance is only temporary, means the receptor value is **low**. Overall, residual impacts to commercial fisheries as a result of the activities outlined in the EA are considered **negligible**.				
Residual Impact Significance	**Negligible**			

7 CONCLUSIONS

Following detailed review of the proposed decommissioning activities, the environmental sensitivities characteristic of the Caledonia Field, industry experience with decommissioning activities, and consideration of stakeholder concerns, it was determined that potential impacts to the seabed and commercial fisheries required further consideration. As the approach for the decommissioning of Caledonia infrastructure varies, the worst-case aspects from each method were considered and assessed in line with a tried and tested EA Methodology described in Section 4 and the results are detailed in Section 6.

The Caledonia Field is located offshore in the CNS, remote from coastal sensitivities and approximately 21 km away from the nearest offshore conservation site, the Scanner Pockmark SAC. The potential to impact upon the integrity of this site was reviewed in the assessment of seabed impacts (Section 6.1). The scale of direct and indirect disturbance associated with the decommissioning activities is small relative to the area of similar habitat available. Furthermore, no habitats or species of conservation concern were identified within the decommissioning footprint or its immediate vicinity. However, this overtrawling worst-case scenario is considered highly unlikely. The overtrawling of the project area will occur in specific locations determined by the post-decommissioning clear seabed verification survey. Furthermore, all the infrastructure being decommissioned *in situ* is considered stably buried and should not require further intervention. Based on the localised and mostly temporary nature of the disturbance, accounting for overtrawling, the impact of the Caledonia decommissioning activities on seabed receptors is considered **negligible**.

Activities with the potential to impact upon commercial fisheries were limited to the potential snagging of fishing gears on exposed infrastructure or seabed modified by removal of infrastructure. However, such impacts are restricted to commercial fisheries which make active contact with the seabed such as those which operate bottom trawl or dredging gears. The waters comprising the Caledonia infrastructure experience relatively low levels of demersal fishing when compared to the surrounding regions (see Section 6.1). Based on this observation, coupled with the continued stability of the flowlines within Caledonia, and mitigation measures (which include overtrawl surveys and monitoring for exposures), impacts to commercial fisheries from the decommissioning of the Caledonia infrastructure will be highly localised, short-term and therefore deemed **negligible**.

Finally, this EA has considered the objectives and marine planning policies of the National Marine Plan across the range of policy topics including biodiversity, natural heritage, cumulative impacts and the oil and gas sector. Premier considers that the proposed decommissioning activities are in alignment with such objectives and policies.

Based on the findings of this EA, including the identification and subsequent application of appropriate mitigation measures and Project management according to Premier's HSES Policy and EMS, it is considered that the proposed Caledonia decommissioning activities do not pose any threat of significant impact to environmental or societal receptors within the UKCS or internationally.

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APPENDIX A: CALEDONIA INVENTORY – INFRASTRUCTURE DETAILS

1 Pipelines and Umbilicals

ID	Description	OD (mm)	Length (m)
PL1919	8”/12” Production Pipeline, trenched and buried	323.9	6,391
PL1920	4” Gas Lift Pipeline (piggybacked to PL1919)	114.3	6,432
PLU1921	Static Umbilical, trenched and buried	172.0	6,092

2 Spools and Jumpers

ID	Description	OD (mm)	Length (m)
PL1919	Manifold – Production Pipeline Tie-In Spool	203.2	70
PL1919	Production Pipeline – SSIV Tie-In Spool	203.2	60
PL1919	SSIV – Production Riser Tie-In Spool	304.8	170
PL1919	Caledonia Well – Manifold Tie-In Spool	152.4	35
PL1920	Gas Lift Riser Base – SSIV Tie-In Spool	203.2	170
PL1920	SSIV – Gas Lift Pipeline Tied _in Spool	101.6	60
PL1920	Gas Lift Pipeline – Manifold Tie-In Spool	101.6	70
PL1920	Manifold – Caledonia Well Tie-In Spool	50.8	35
PLU1921	Manifold – Caledonia Well Controls Jumper	152	50

3 Dynamic Umbilicals

ID	Description	OD (mm)	Length (m)
PLU1921	Dynamic Controls Umbilical Britannia TUTU – Termination Assembly	172	357

4 Subsea Installations

Infrastructure	Description	Dimensions (m)	Weight (Te)
SSIV	Steel Framed Gravity Based Installation	6.5 x 4.4 x 3.75	30.4
Manifold	Steel Framed Piled Installation	10.6 x 8.4 x 3.7	50.8

Infrastructure	Description	Dimensions (m)	Weight (Te)
Xmas tree and WHPS Note 1	Xmas tree and Well Head Protection Structure	6.4 x 6.4 x 4	55.9

Notes:

1. The Xmas tree and WHPS are out of scope of the EA and will be covered by the appropriate permits as part of well decommissioning.

APPENDIX B: ENVID SUMMARY

The ENVID workshop was held to review environmental sensitivities and potential impact pathways for all of Premier's assets which are under consideration for decommissioning (i.e. Greater Balmoral Area (includes Balmoral, Glamis, Nicol, Brenda and Stirling), Caledonia, Huntington, Hunter & Rita, and Johnston Fields). As such, infrastructure and sensitivities associated with all of these assets are included in the ENVID Summary Table below.

Premier Oil UK Ltd. Decommissioning Project: Environmental Management Worksheet **06/08/2019**

Environmental Impact Review					Controls, Mitigations, Review and Ranking												Identified Actions		
						Initial Ranking						Residual Ranking							
Operational Phase	Project Element	Operation / Aspect	Activity	Summary of Environmental Impact	Existing Controls (Standards, Legislative, or Prescriptive)	Consequence/Extent	Duration of Effect	Impact	Probability	Rank	Premier Specific / Best Practice Standards	Consequence/Extent	Duration of Effect	Impact	Probability	Rank	Description	Comment	Status
General	Vessels	Physical presence	Vessels	Disturbance to vessel operations offshore (e.g. fisheries and other maritime users); disturbance to marine species	Stakeholder engagement. Existing controls through DP Vessels and the usual notifications (key stakeholders).	L	M	L	M	M	In addition to existing controls, Premier keeps manned bridges.	L	M	L	M	M		Screened out	
			Discharges	Vessel discharge of grey water, bilge water, etc.	MARPOL compliant, bilge management procedures, good operating practices.	L	L	L	H	L		L	L	L	H	L		Screened out	
			Vessel engine noise	Underwater noise - behavioural modifications to marine mammals, turtles and potentially fish.	Vessel noise will not have significant sound levels - unlikely to be far above ambient noise levels.	L	M	L	M	L		L	M	L	M	L		Screened out	
		Power generation	Emissions	Gaseous emissions to atmosphere cause increased degradation of local/regional air quality (NOx and particulates). Transboundary air pollution. Contributing to global warming (CO2).	Lift vessel likely to dominate gaseous emissions.												Not assessed at this stage due to global scale. This would be a very small amount of CO2 emissions.	Screened out	
			Energy Use	Impact on climate change and reduction of resources of hydrocarbons. Products used for recycling.	Lift vessel and onshore smelting processes will dominate energy usage.												Not assessed at this stage due to global scale. This would be a very small amount of fuel usage.	Screened out	
	Waste	Waste management	Onshore	Use of landfill and landfill resource take (non-hazardous); special disposal (hazardous)	All waste will be handled and disposed of in line with regulations as detailed in the Waste Management Plan. Inventory of waste - tracking materials to final place. There are potential positive impacts from recycling of steel.	L					All wastes, including normal, hazardous and special wastes, will be shipped to shore for processing. Any transfrontier shipments of waste, including those for landfill, will be non-hazardous and will be managed under the Waste Management Plan and will comply with relevant legislation.	L						Screened out under Waste Management Strategies	
Preparation	Substructures	Template, wellheads, etc.	Flushing and cleaning	Liquid discharge to sea - Water quality in immediate vicinity of discharge will be reduced, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Potential NORM impacts from sediment.	Treated water discharged to sea after cleaning.	L	L	L	M	L	Any NORM identified during flushing and cleaning of substructures are covered under the appropriate Waste Management Plan. This includes NORM from all subsea and topsides sources and from Non-Destructive Testing (NDT).	L	L	L	L	L	There is a higher risk of NORM at Balmoral and around the Voyageur FPSO. It is not significant at the moment, but likely to get worse. Brenda will undergo NDT, but this is covered by the handling of radioactive waste outlined in the Waste Management Strategy for Balmoral.	Screened out under Waste Management Strategies	
			Marine growth removal	Disposal to landfill. As a worst case assume landfill, but look for alternative route.	Waste management strategy.	L	H	L	H	M	All wastes, including special wastes, such as marine growth, will be shipped to shore for processing. Any transfrontier shipments of waste, including those for landfill, will be non-hazardous and will be managed under the Waste Management Plan and will comply with relevant legislation.	L	H	L	H	M	Soft growth will be jetted off the deck, *Lophelia* or other hard substrates/species would not be jetted off (it's a hard coral), may remain stuck on the structure when it's shipped to shore, but can't go to normal landfill because it's classed as biological waste.	Screened out under Waste Management Strategies	
	Pipelines & Umbilicals	Pipelines	Disconnect ends	Liquid / solid discharge to sea - Water quality in immediate vicinity of discharge will be reduced, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Potential NORM impacts? Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	Treated water discharged to sea after cleaning. Solids will be shipped to shore for disposal.	L	L	L	M	L		L	L	L	L	L	Residuals at cut ends released into the marine environment (post-flushing - should be low). Flooding into the pipeline only up to a certain level (pressure dependent), so displacement is not complete pipeline.	Screened out	
				Liquid /solid discharge to sea - Water quality in immediate vicinity of discharge will be reduced, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Agate discharge as solid . Potential NORM impacts? Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	Treated water discharged to sea after cleaning. Solids will be shipped to shore for disposal.	L	L	L	M	L		L	L	L	L	L	Low risk of substructures emitting fluids/solids - everything cut post-flushing. Residuals released in minute amounts.	Screened out	

		Template, wellheads, etc.	Internal cutting (water jetting)	Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	M	L	L	M	L		M	L	L	M	L	Impacts include localised deposition and localised smothering, leading to localised seabed disturbance.	Screened in	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	M	L	L	M	L		M	L	L	M	L	Impacts include localised deposition and localised smothering., leading to localised seabed disturbance. Wellheads around Brenda includes clean cuttings deposits (not classed as piles under OSPAR assessments). Assumes some level of residuals present in deposits, but all below OSPAR thresholds, given they're not classed as piles.	Screened in	
			External cutting with diamond wire (as fallback option)	Underwater noise - behavioural modifications to marine mammals, turtles and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	Diamond wire cutting noise will not have significant sound levels.	L	L	L	L	L		L	L	L	L	L	Ambient noise levels in the SNS are already very high due to vessel traffic, and any noise impacts from cutting will be negligible and limited in duration.	Screened out	
				Liquid / solid discharge to sea - Water quality in immediate vicinity of discharge will be reduced, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Potential NORM impacts? Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	Treated water discharged to sea after cleaning. Solids will be shipped to shore for disposal.	L	L	L	L	L	Transfer of controlled, hazardous and special wastes to UK ports for disposal will be governed by waste management plans.	L	L	L	L	L		Screened out under Waste Management Strategies	
				Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	M	L	L	M	L		M	L	L	M	L	Perhaps there are old piles at Johnston (old), but cuttings will have dissipated in the currents of the SNS which run closer to the coastline.	Screened in	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	M	L	L	M	L		M	L	L	M	L		Screened in	
	Substructure			Water quality in immediate vicinity of the jetted cuttings will be reduced, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Potential NORM impacts?	Approximately 2 Te of cuttings jetted to surrounding environment - dynamic environment means dispersal and resettlement anticipated to be rapid.	H	M	H	M	H	MFE will direct the majority of the cuttings pile to the seabed immediate to the template (i.e. within hundreds of metres).	M	M	L	L	M	The MFE plume will only carry approximately 0.001 ppm of particulates from the cuttings pile within the water column. Whilst the plume will travel quite far in the water currents, this level of contamination is highly diluted and anticipated to have negligible impacts on marine species within the water column.	Screened in	
				Underwater noise - behavioural modifications to marine mammals, turtles and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	MFE will not generate sound levels which will generate injury or significant disturbance to any marine species.	L	M	M	L	L	Premier will undertake MFE outwith periods of concern for drilling activities, as this activity is considered greater than a worst-case analogue for underwater noise generated by MFE.	L	L	L	L	L	Noise emissions from MFE are likely to be lower than drilling sounds and will be masked to a certain degree by the excavation vessel. MFE will be limited in duration and unlikely to exceed emissions for any of the operational equipment assessed for noise impacts. It is noted that the JNCC's period of concern for drilling activities, which are anticipated to generate noise levels slightly above those produced during MFE, is October to December.	Screened out	

Decommissioning		Template (and potentially old wellheads)	MFE of cuttings	Seabed disturbance - Template is 9 km outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles. Cuttings deposits - in and around template, jetting deposit (2K tonnes) into water column - modelling report	Volume of sediment/ cutting mobilised - Large quantities of material excavated and introduced into a dynamic environment - region of impact will be large, but dispersal and resettlement anticipated to be rapid.	H	M	H	H	H	MFE will direct the majority of the cuttings pile to the seabed immediate to the template (i.e. within hundreds of metres).	M	M	M	M	M	The area is characterised by benthic fauna which includes species sensitive to smothering, particularly seapens. Seabed impacts will be most marked within several hundred metres of the Balmoral template, though beyond this the template cuttings deposition rates fall below 1 mm . There will be some movement of cuttings material towards the Scannar Pockmarks SAC, located approx. 9 km NW of the template. However, the majority of sediment deposition will occur to the south and southeast of the template. Any sediment deposition which reaches the SAC is likely to fall below 0.01 mm, based on available modelling, which is indiscernible against background sedimentation levels. Moreover, the template structure needs to be removed to be legally compliant. For these reasons no significant impacts to the SAC anticipated.	Screened in	
			Lifting and removal	Underwater noise - behavioural modifications to marine mammals, turtles and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	Lifting and removal will not generate significant sound levels.	L	L	L	L	L		L	L	L	L	L		Screened out	
				Seabed disturbance - Template is 9 km outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles. Cuttings deposits - in and around template, jetting deposit (2K tonnes) into water column - modelling report	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation.	M	M	M	M	M		M	M	M	M	M		Screened in	
		Decommissioned *in situ*	Residuals	Liquid / solid discharge to sea - Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	Treated water discharged to sea after cleaning. Solids will be shipped to shore for disposal.	L	L	L	L	L		L	L	L	L	L	There may be some residuals from when cuts take place, but small volumes to shoot out at end, but these will be permitted with flushing of pipelines.	Screened out	
			Free spans	Snagging risk to trawl and other demersal fisheries	Continued monitoring for an agreed period and remediation if required, accurate mapping of decommissioned in situ location and state	H	M	H	M	H	Almost all pipelines are stable and have remained buried. However, pipelines will be remediated regardless.	H	M	H	L	M	Majority of pipelines don't have free spans - except potentially around 'dog kennels' which protect locations where umbilicals have popped out. These protections cover the free spans, and would only expose free spans if they are removed.	Screened in	
			Rock dump	Introduction of new substrate which may alter habitat architecture, influencing water movement, sediment accumulation and light conditions.	Minimise introduction of material where possible	L	H	L	L	L		L	H	L	L	L		Screened in	
				Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	L	H	L	L	L		L	H	L	L	L	Relatively small footprint compared to volume of fishing taking place in surrounding edges.	Screened in	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	L	H	L	L	L		L	H	L	L	L		Screened in	

	Pipelines & Umbilicals	Full removal	Reverse reeling and cut & lift	Liquid / solid discharge to sea - Water quality in immediate vicinity of discharge will be reduced, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Potential NORM impacts. Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	Treated water discharged to sea after cleaning. Solids will be shipped to shore for disposal.	L	L	L	L	L	Transfer of controlled, hazardous and special wastes to UK ports for disposal will be governed by waste management plans.	L	L	L	L	L		Screened out under Waste Management Strategies	
				Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	H	M	M	H	H	Remediation will be undertaken where required.	H	L	M	H	M	Clay berms may require remediation (overtrawl) so that lumps of clay exposed during reverse reeling do not pose a snagging risk.	Screened in	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	H	M	M	H	H	Remediation will be undertaken where required.	H	L	M	H	M	Clay berms may require remediation (overtrawl) so that lumps of clay exposed during reverse reeling do not pose a snagging risk.	Screened in	
			Rock dump	Introduction of new substrate which may alter habitat architecture, influencing water movement, sediment accumulation and light conditions.	Minimise introduction of new material where possible	L	H	L	L	L		L	H	L	L	L		Screened in	
				Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	L	H	L	L	L		L	H	L	L	L		Screened in	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	L	H	L	L	L		L	H	L	L	L		Screened in	
	Surveys	Surveys for post-decommissioned infrastructure left in-situ	Geotechnical survey activities - may include grab sampling	Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	L	L	L	L	L		L	L	L	L	L	Seabed disturbance from benthic surveys will be minute and limited to the immediate vicinity of the installations, with the odd grab sample along the pipelines, though this is unlikely. Only relevant to Rita/Hunter installations.	Screened out as no significant impacts identified	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	L	L	L	L	L		L	L	L	L	L	Seabed disturbance from benthic surveys will be minute and limited to the immediate vicinity of the installations, with the odd grab sample along the pipelines, though this is unlikely.	Screened out as no significant impacts identified	

Legacy			Geophysical survey activities	Underwater noise - Physiological harm, behavioural modifications to marine mammals, turtles and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	Noise impacts to marine species from use of seismic, sub-bottom profiler, and other survey equipment. JNCC (2017) Guidelines will be employed for mitigation of noise impacts to marine mammals for future survey work involving seismic survey equipment.	H	L	H	M	H	Future permitting will cover post-decommissioning geophysical surveys. Multibeam will likely be used for imaging and identification of any exposures.	H	L	H	M	H		Screened out as covered by future permitting	
	Remediation	Remediation of spans	Rock dump/ reburial	Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	L	H	L	L	L	Exposures remediated primarily with rockdump rather than reburial, but with additional discussion inside SAC. However, the use of rockdump will be minimised where possible.	L	H	L	L	L		Screened in	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	L	H	L	L	L	Exposures remediated primarily with rockdump, rather than reburial. However, the use of rockdump will be minimised where possible.	L	H	L	L	L		Screened in	
	Degradation	Degradation of substructure	Free spans	Snagging risk to trawl and other demersal fisheries	Continued monitoring for an agreed period and remediation if required, accurate mapping of decommissioned in situ location and state.	H	L	H	L	M	Eventual corrosion and collapse of structures pose a potential snagging risk. Continued monitoring and remediation will be undertaken where required. This includes deployment of a PowerBuoy at Balmoral.	H	L	H	L	M	This is primarily an issue at Balmoral, where additional monitoring will take place via a PowerBuoy.	Screened in	
Unplanned events	Vessels	Significant Hydrocarbon release	Unplanned collision	Catastrophic loss of containment Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	Unplanned - Project will introduce new diesel inventory to the site with additional inherent spill / pollution risk e.g. from heavy lift vessel. OPEP MAS Navaids SOPEP	H	M	H	L	H	This will be covered in future Navigational Risk Assessment work.	H	M	H	L	M	SNS higher risk of collision, but manned wheelhouses, notifications, AIS, etc. No modelling required.	Screened Out; *Johnston may need assessment b/c seabirds, seals, etc.*	
		Dropped Objects	Unplanned loss of material to sea	Seabed disturbance - **inside Dogger Bank SAC** - edges mostly clay/not replaceable (CMS assets). Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - Dogger Bank is an extensive sublittoral sandbank which is characterised by moderately mobile, clean sediments. Impacts to fauna will be minor, due to community-level change from bottom-trawling. Impacts to the gross physical nature of the site are not expected.	L	H	L	L	L	Everything will be endeavoured to be retrieved. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Debris clearance surveys will aid in the identification of any dropped objects.	L	M	L	L	L	Not undertaking any cutting or lifting of pipelines, just reverse reel, and the integrity of all subsea structures is considered sound. No issues have been identified.	Screened out as no significant impacts identified	
				Seabed disturbance - outside SAC Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation	L	H	L	L	L	Everything will be endeavoured to be retrieved. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Debris clearance surveys will aid in the identification of any dropped objects.	L	M	L	L	L	Not undertaking any cutting or lifting of pipelines, just reverse reel, and the integrity of all subsea structures is considered sound. No issues have been identified.	Screened out as no significant impacts identified	

APPENDIX C: DEPTH OF BURIAL PROFILE