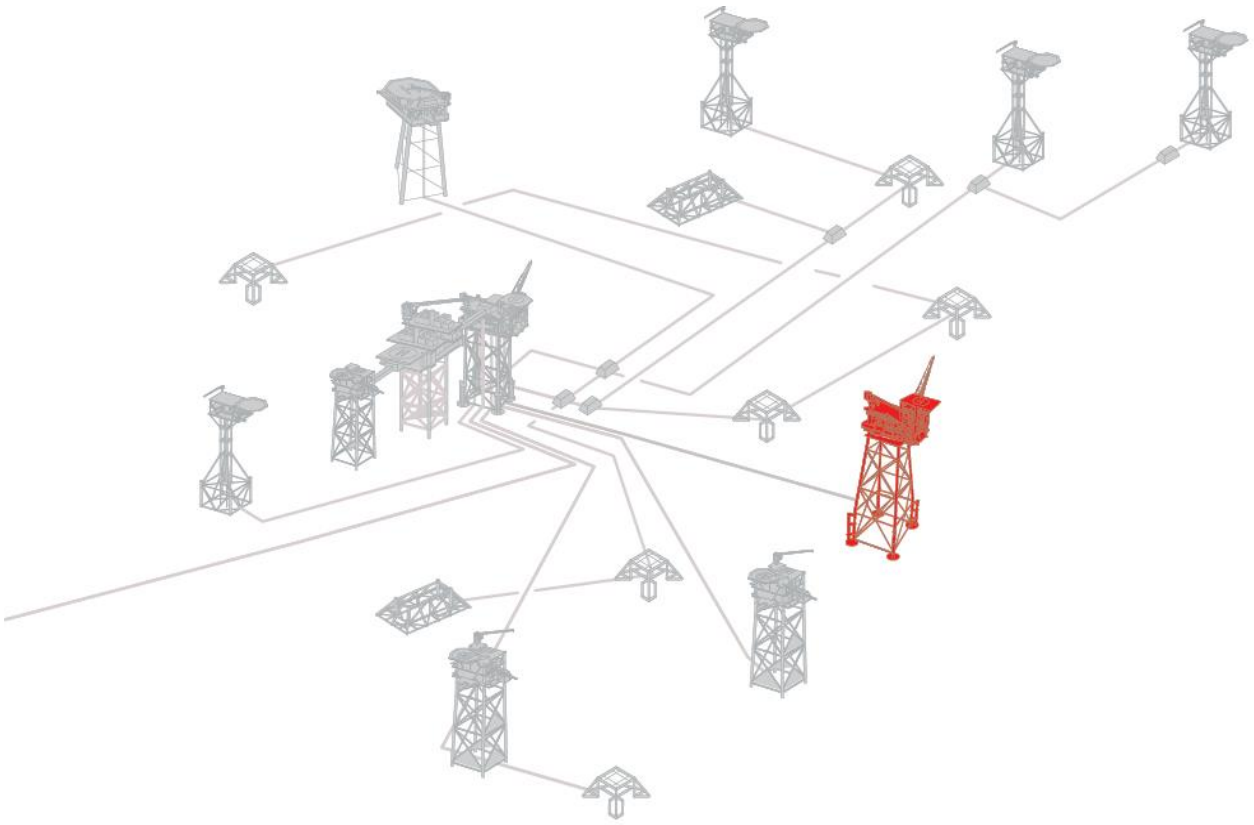
CHRYSAOR



Caister Decomissioning Programmes: CDP1a

Caister CM Platform and Associated Riser Sections Environmental Appraisal

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REVISION CHANGE NOTICES

Revision	Location of Change	Brief Description of Change
C1	Throughout	Amendments to document to address OPRED comments received on 29/11/19
C2	Section 2.0	Amendments to document to align with Caister DP
C3	Section 5.0	Amendments to document to align with Caister DP
C4	Section 5.0	Amendments to document to align with Caister DP

GLOSSARY OF TERMS

Abbreviations

" – inch

% -- percent

µg.g^{-1} – microgram per gram

µm – micrometres

AIS – Automatic Identification System

AWV – Accommodation Works Vessel

BEIS – Department for Business, Energy and Industrial Strategy

cm – centimetre

CM – Caister Murdoch

CMS – Caister Murdoch Schooner

CO_2 – Carbon Dioxide

db re 1 µPa @ 1 m – decibel relative to one micropascal at one metre

DECC – Department of Energy and Climate Change

Defra – Department for Environment, Food and Rural Affairs

DP – Dynamic Positioning

EA – Environmental Appraisal

EIA – Environmental Impact Assessment

EMS – Environmental Management System

ERRV – Emergency Response and Rescue Vessel

EU – European Union

EU ETS – European Union Emissions Trading Scheme

EUNIS – European University Information Systems

EWC – European Waste Catalogue Codes

HLV – Heavy Lift Vessel

HMPA – Historic Marine Protected Area

HRA – Habitats Regulations Assessment

HSE – The Health and Safety Executive

IAPP – International Air Pollution Prevention Certificate

ICES – International Council for the Exploration of the Sea

IED – Industrial Emissions Directive

IUCN – International Union for the Conservation of Nature

JNCC – Joint Nature Conservation Committee

km – kilometre

km^2 – square kilometre

LAT – Lowest Astronomical Tide

LDP1 – LOGGS Decommissioning Programme 1

LDP2 – LDP5 LOGGS Decommissioning Programme 2 to LOGGS Decommissioning Programme 5

LNG – Liquid Natural Gas

LOGGS – Lincolnshire Offshore Gas Gathering System

m – metres

m^2 – square metre

m^3 – cubic metre

MARPOL –The International Convention for the Prevention of Pollution from Ships

MAT – Master Application Template

MCZ – Marine Conservation Zone

MPA – Marine Protected Area

MeOH – Methanol

mm – millimetres

NFFO – National Federation of Fishermen' s Organisation

NORM – Naturally Occurring Radioactive Material

NO_x – nitrous oxide

N_2O – nitrogen oxides

OGUK – Oil and Gas UK

OGA – Oil and Gas Authority

OMS – Operating Management System

OPEP – Oil Pollution Emergency Plan

OPRED – Offshore Petroleum Regulator for Environment and Decommissioning

OSPAR – Oslo Paris Convention

PEXA – Practice and Exercise Area

ROV – Remotely Operated Vehicle

SAC – Special Area of Conservation

SCI – Site of Community Importance

SFF – Scottish Fishermen's Federation

SNS – southern North Sea

SO_2 – Sulphur dioxide

SOPEP – Shipboard Oil Pollution Emergency Plan

SOSI – Seabird Oil Sensitivity Index

SPA – Special Protection Area

Te – Tonnes

UK – United Kingdom

UKAPP – United Kingdom Air Pollution Prevention Certificate

UKCS – United Kingdom Continental Shelf

VDP1 – Viking Decommissioning Programme 1

VOCs – volatile organic compounds

WONS – Well Operations Notification System

Non-Technical Summary

Introduction and Background

Chrysaor Production (U.K.) Limited (Chrysaor) operates the Caister Bunter Field and Caister Carboniferous Field from the Caister CM platform in the UK Southern North Sea. The owners of the Caister platform and associated pipeline infrastructure are Chrysaor Production (U.K.) Limited with 9% equity, Chrysaor (U.K.) Beta Limited holding 30% equity, Neptune E&P UKCS Limited with 21% equity and Premier Oil E&P UK Limited with 40% equity. The Caister CM platform is in the eastern area of the Caister Murdoch Schooner (CMS) Complex. Murdoch acted as a gathering platform, receiving gas from the CM platform via an 11 km, 16" pipeline (PL935). This non-technical summary outlines the findings of the Environmental Appraisal (EA) conducted on behalf of Chrysaor in support of the Decommissioning Programmes for the Caister CM platform and associated riser sections.

The location of the Caister facilities and surrounding infrastructure is shown in Figure i. The Caister facilities include the CM platform (topsides and jacket) and associated truncated riser sections attached to the Caister CM platform. It is the only platform within this field. A summary of the main facilities and associated infrastructure is given in Table i.

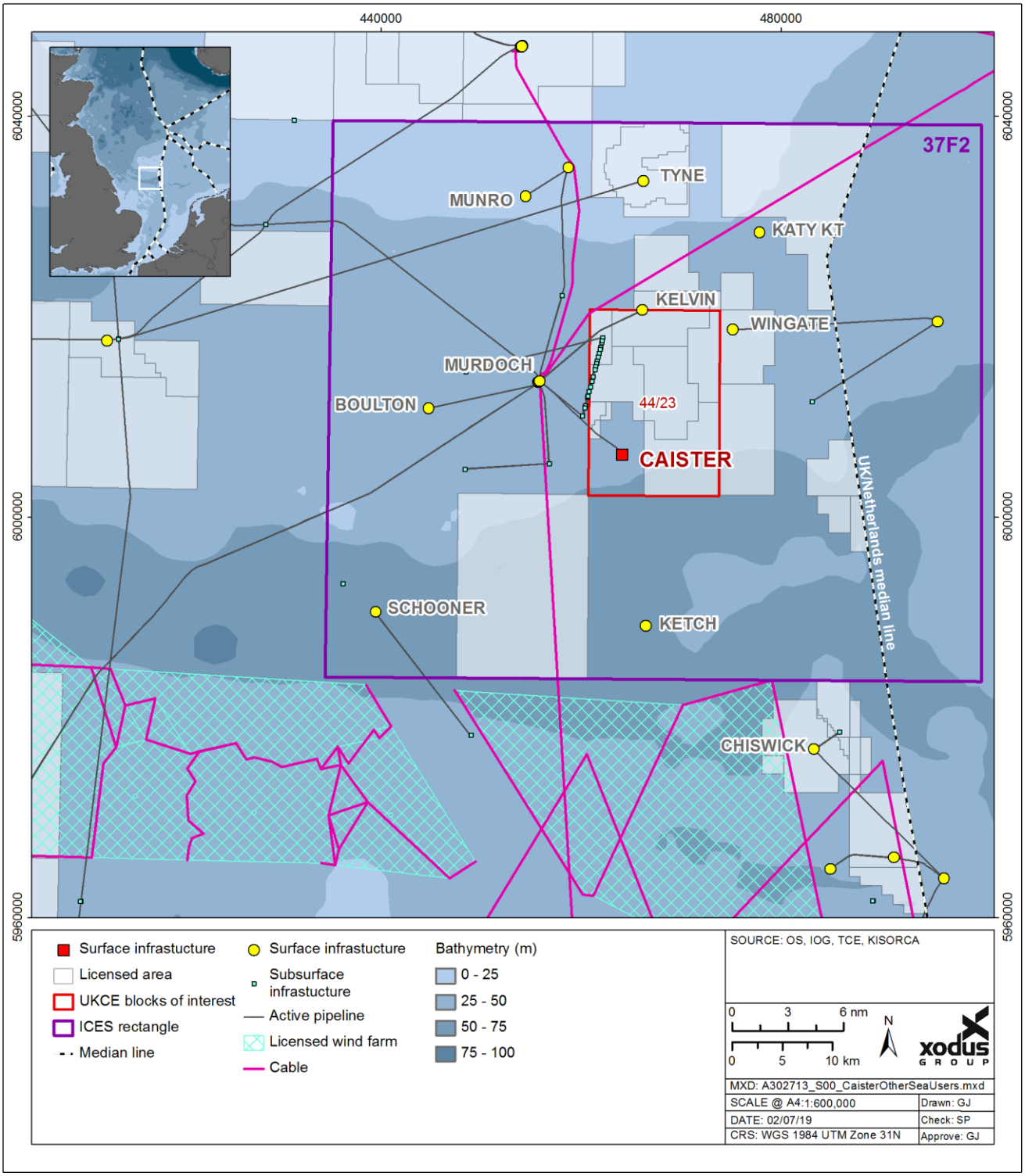


Figure i Infrastructure in the vicinity of the CM platform

Field Name		Quad / Block	
Field	Caister	**Production Type**	Gas / Condensate
Water Depth	41m below LAT	**UKCS block**	Quad 44 Block 23a

Surface Installations			
Number	**Type**	**Topsides Weight (Te)**	**Jacket Weight (Te)**
1	Fixed steel jacket	1,255 (inclusive of 313 Te removed during earlier removal campaign)	1,253 (inclusive of four piles to be cut 3 m below the mudline and exclusive of the two risers, which have a combined weight of 10 Te)

Subsea Installations		Number of Wells	
Number	**Type**	**Number**	**Type**
1	Drilling template: 41 Te (to -3 m below mud line)	8	Platform

Drill Cuttings Piles		Distance to Median Line	Distance from nearest UK coastline
Number of Piles	**Total Est volume m^3**		
0	0	Caister CM 23 km	Caister CM 163 km

Table i Caister area infrastructure to be decommissioned

Regulatory Context

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the United Kingdom Continental Shelf (UKCS). The Act requires the operator of an offshore installation or pipeline to submit a draft Decommissioning Programme for statutory and public consultation, and to obtain approval of the Decommissioning Programme from the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), part of the Department for Business, Energy and Industrial Strategy (BEIS), before initiating decommissioning work. The Decommissioning Programme outlines in detail the infrastructure being decommissioned and the method by which the decommissioning will take place.

Formal Environmental Impact Assessment (EIA) to support the Decommissioning Programme is not explicitly required under existing UK legislation. However, the primary guidance for offshore decommissioning that was updated and published by OPRED in 2018 detailed the need for an EA to be submitted in support of the Decommissioning Programme. The latest guidance recognises that environmental deliverables to support Decommissioning Programmes were historically overly lengthy and did not focus in on the key issues, and now describes a more proportionate EA process that culminates in a streamlined EA rather than a lengthy Environmental Statement.

OSPAR Decision 98/3 sets out the United Kingdom's international obligations on the decommissioning of offshore installation. The Decision prohibits the dumping and leaving wholly or partly in place of offshore installations and is in line with the UK's agreements made under the London Convention 1972, as amended 2006. Under Decision 98/3, the topsides of all installations must be removed and returned to shore, and all installations with a jacket weight of less than 10,000 tonnes must be completely removed for re-use, recycling or disposal on land. Any piles securing the jacket to the seabed should be cut below the natural seabed level at a depth that will ensure they remain covered. The depth to which this is required will be dependent on prevailing seabed conditions and currents.

In terms of offshore activities in the southern North Sea (SNS), The East Inshore and East Offshore Marine Plans have been developed by the Department for Environment, Food and Rural Affairs (Defra) to help ensure sustainable development of the marine area. Although the Plans do not specifically address decommissioning of oil and gas facilities, they do note the challenges that such activities can bring. As part of the Caister facilities decommissioning, Chrysaor has considered the broader aims of the Plans and made a statement on alignment with the aims.

Scope and Schedule of the Decommissioning Programmes

The proposed activities planned for the preparation and decommissioning of the infrastructure in this programme include the following:

- Phase 1: (2016) Pipeline flushing, preparation for removals and soil plug removal using an Accommodation Work Vessel (AWV);
- Phase 2: (2018) All wells abandoned in accordance with Oil & Gas UK guidelines;
- Phase 3: (2019) Subsea disconnects and conductor stub removals;
- Phase 4: (2020) Platform removal.
- Phase 5: (2021- TBC) Post decommissioning surveys, debris clearance and overtrawl trials to be carried out following the completion of decommissioning activities. The schedule is to be determined in agreement with OPRED.

Chrysaor anticipates executing the Caister decommissioning activities in 2020; an indicative schedule is provided in Figure ii. However, the specific timing is still to be agreed with OPRED and the Health and Safety Executive. All relevant permits and consents will be submitted, and approval sought, prior to activities commencing.

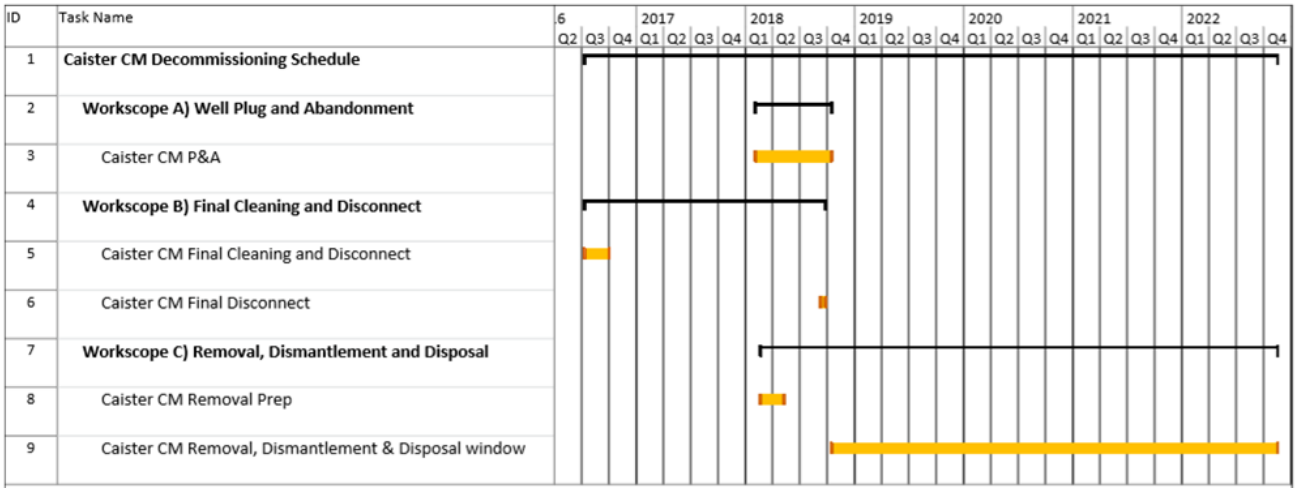


Figure ii Indicative decommissioning schedule

Consideration of Alternatives and Selected Decommissioning Options

Most of the Caister infrastructure being decommissioned is considered obsolete and/ or in a degraded condition and so not suitable for safe reuse. The dismantling contractor will market any items of platform equipment (e.g., valves) suitable for alternative use.

Environmental and Societal Sensitivities

Key environmental and societal sensitivities are described in Table ii. In particular, any habitats listed in Annex I or species listed in Annex II of the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as Habitats Directive, have been listed below. Species or habitats listed in Annex I or Annex II of the Habitats Directive are protected through the Natura 2000 network which includes Special Areas of Conservation (SACs) and Sites of Community Importance (SCI).

Table 0-1 Environmental and societal sensitivities

Environmental Receptor	Description
Conservation Interests and sites	
Special Areas of Conservation (SACs)	The closest protected site to the Caister facilities is the Dogger Bank SAC which lies 5 km to the north west. This site is designated for Annex I habitat sandbanks which are slightly covered by sea water all the time. The Southern North Sea SAC is located 10 km south east of the Caister CM platform at its nearest point. This site is designated for the protection of the harbour porpoise. Additionally, the North Norfolk Sand Banks and Saturn Reef SAC is located 54 km south of the platform. This site is designated for the presence of two Annex I habitats: biogenic reefs; and sandbanks which are slightly covered by sea water all the time.
Special Protection Areas (SPAs)	The Flamborough and Filey Coast SPA is the closest SPA, located approximately 162 km from the platform.
Marine Protection Area (MPAs)	The closet MPA to the Caister facilities is the Markham's Triangle MCZ located 26 km to the south east of the Caister CM platform. This site is designated for protected features including subtidal coarse sediments, subtidal mixed sediments, subtidal mud and subtidal sand.
Coastal and Offshore Annex II species most likely to be present in the project area:	
Harbour porpoise	Harbour porpoise are frequently found throughout UK waters. They usually occur in groups of one to three individuals in shallow waters, although they have been sighted in larger groups and in deep water. It is not thought that the species migrates.
Minke whale	Minke whales usually occur in water depths of 200 m or less and occur throughout the North Sea. They are usually sighted in pairs or in solitude; however, groups of up to 15 individuals can be sighted feeding. Minke whales tend to return to the same seasonal feeding grounds.
White-beaked dolphin	White-beaked dolphins are usually found in water depths of between 50 and 100 m in groups of around 10 individuals, although large groups of up to 500 animals have been seen. They are present in UK waters throughout the year, but sightings are more frequent between June and October.
Pilot whale	Pilot whales mostly occur in large pods. The distribution map of pilot whale highlights its deep-water habitat, the species occurring in greatest number to the north of Scotland and south-east of the Faroes as well as along the shelf edge from southern Ireland south to the Bay of Biscay. Sightings peak in the south-west English Channel and North Sea between November and January when pods are frequently seen fishing for mackerel.
Grey seal Harbour seal	As the project area is located approximately 163 km offshore, these species may be encountered in the vicinity from time to time, but the project area is not of specific importance for these species. The presence of grey and harbour seals in the project area is between 0 – 1 individual per 25 km^2 (Jones *et al.,* 2015).
Benthic Environment	
Bathymetry	The Caister CM platform stands in 41 m of water.
Seabed sediments	Seabed surveys of the location described the seabed at Caister as being generally homogeneous, consisting of silty fine to medium sands with shell fragments throughout. All survey stations were classed with EUNIS level 4 category as the habitat 'deep circalittoral sand (EUNIS habitat code A5.27). Occasional boulders were noted in side scan sonar data (Gardline, 2015a).
Benthic fauna	Visible fauna observed throughout stations surveyed (Gardline, 2015a) consisted of; Annelida (Polychaeta including *Oxydromus flexuosus*), Arthropoda (Paguridae), Bryozoa, Chordata (*Limanda limanda, Pleuronectes platessa*), Cnidaria (Hydrozoa) and Echinodermata (Asteroidea including *Asterias rubens*).

	Total hydrocarbon (THC) concentrations ranged from 6.4 µg g^{-1} to 10.6 µg g^{-1} with the highest concentrations being found close to the platform. The threshold for significant environmental impacts (SEI) to macrofauna is 50 µg g^{-1}. There was no conclusive evidence of any Annex I habitats protected under the Habitats Directive (1992). Seven juvenile ocean quahog (*Arctica Islandica*) were found 200 m east of the Caister CM platform (Gardline, 2015b). When found in more extensive aggregations, these species are protected on the OSPAR list of threatened and/ or declining species.

Fish – Spawning and Nursery Grounds

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anglerfish	N	N	N	N	N	N	N	N	N	N	N	N
Blue whiting	N	N	N	N	N	N	N	N	N	N	N	N
Cod	SN	S*N	S*N	SN	SN	N	N	N	N	N	N	N
European hake	N	N	N	N	N	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	SN	SN	SN	SN	N
Lemon sole	N	N	N	SN	SN	SN	SN	SN	SN	N	N	N
Ling	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	SN	S*N	S*N	N	N	N	N	N
Norway lobster	SN	SN	SN	S*N	S*N	S*N	SN	SN	SN	SN	SN	SN
Plaice	SN	S*N	S*N	N	N	N	N	N	N	N	N	SN
Sandeel	SN	SN	N	N	N	N	N	N	N	N	SN	SN
Sole	N	N	SN	S*N	SN	N	N	N	N	N	N	SN
Sprat	N	N	N	N	SN	SN	SN	SN	N	N	N	N
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
Tope shark	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	N	SN	SN	SN	SN	SN	N	N	N	N	N	N

S = Spawning, N = Nursery, SN = Spawning and Nursery; * = peak spawning; Species = High nursery intensity as per Ellis *et al*, 2012; Species = High intensity spawning as per Ellis *et al* (2012); Species = High concentration spawning as per Coull *et al.*, 1998;

Spawning grounds	The project area is located within the spawning grounds of herring *Clupea harengus* (August to November), cod *Gadus morhua* (January to April [peak spawning February – March]), whiting *Merlangius merlangus* (February to June), mackerel *Scomber scombrus* (May to July [peak spawning June-July]), plaice *Pleuronectes platessa* (January to March [peak spawning February-March)], sole *Solea solea* (March to May [peak spawning April]), lemon sole *Microstomus kitt* (April to September), Norway lobster *Nephrops norvegicus* (all year [peak spawning April-June]), sandeel *Ammodytes tobianus* (November to February) and sprat *Sprattus sprattus* (May to August). High intensity spawning occurs for plaice and sandeel. Of the species listed, herring and sandeel spawn demersally (on the seabed).
Nursery grounds	The following species have nursery grounds in the vicinity of the project: anglerfish *Lophiiformes*, cod, lemon sole, ling *Molva molva*, Norway lobster, sprat, whiting *Merlangius merlangus,* tope shark *Galeorhinus galeus*, plaice, sandeel, blue whiting *Micromesistius poutassou*, spurdog *Squalus acanthias*, herring *Clupea harengus*, European hake *Merluccius merluccius*, mackerel *Scomber scombrus* and sole. High intensity nursing occurs for plaice and sandeel.

Seabirds

The project area is important for northern fulmar *Fulmarus glacialis*, northern gannet *Morus bassanus*, great black-backed gull *Larus marinus*, Atlantic puffin *Fratercula arctica*, black-legged kittiwake *Rissa tridactyla*, common guillemot *Uria aalge,* razorbill *Alca torda*, little auk *Alle alle* and black-backed gull *Larus marinus* for the majority of the year.
In Block 44/23, the sensitivity of seabirds to oil is high from November to January and in July. Where data are available, low vulnerability occurs throughout the rest of the year (see table below).

Seabed Oil Sensitivity Index (SOSI)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

44/23	3*	5*	5	5*	5*	5	3	5	5	5*	3*	3
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											

Socio-economic Receptor	Description

Commercial Fishing

ICES divides the North Sea and surrounding waters into fishing areas. The UKCS Block 44/23 lies in ICES statistical rectangle 37F2. Fishing intensity in the project area is moderate in comparison to other areas in the North Sea. The table below describes the fishing effort, the weight and value of fish landed from ICES rectangle 37F2 and UK rectangle (see table below).

Year	Within ICES Rectangle 37F2			Average Rectangle Values Throughout the UK	
	Total fishing effort (days)	Average value of landings (£)	Average quantity (Te)	Average value of landings (£)	Average quantity (Te)
2014	567	£2,617,039	498	£103,052	108
2015	635	£2,514,490	484	£92,248	88
2016	949	£3,522,308	590	£ 110,594	86
2017	574	£1,756,194	285	£ 108,202	85
2018	224	£658,460	114	£ 113,551	85
Annual average	**590**	**£2,213,698.20**	**394**	**£105,529**	**90**

Scottish Government (2018) data for 2018 for ICES rectangle 37F2 states that 342 tonnes of fish were landed with a value of £658,460. The area is predominantly targeted for demersal and shellfish species with the relative importance of each depending on the conditions each year.
Fishing effort amounted to 224 days in ICES rectangle 37F2 in 2018, and 574 days in 2017. This represents a significant decline in effort compared to the three preceding years, particularly compared to the 949 days spent fishing in 2016. Effort within 37F2 has been recorded as disclosive or no data for most of the winter months each year between 2014 and 2018, indicating very low levels of fishing effort. Fishing effort is generally highest between May and September. Demersal trawls were the most utilised gear type in ICES rectangle 37F2 over all the years.
The value of fish landed from ICES rectangle 37F2 between 2014 and 2018 is above average for the UK.

Other Users

Shipping activity	Block 44/23 has moderate shipping density areas (OGA, 2016).
Oil and Gas	There are numerous offset wells, pipelines and platforms in the region. Third Party installations within 50 km of the CMS field include Trent, Cavendish, Wingate, Tyne, Chiswick, Windermere, Markham, Ketch and Schooner. Windermere, Markham, Ketch, Schooner are currently undergoing Decommissioning Programmes.
Telecommunications	The closest cable to the Caister platform is the TAMPNET telecommunication cable (active) which passes 7.5 km to the northwest. The MCCS telecommunication cable passes approximately 10 km to the northwest (KIS-ORCA, 2018) and the BT UK-Germany 6 Seg 4 cable runs 50 km to the northeast of the Caister platform.
Military activities	There are no charted military Practice and Exercise Areas (PEXAs). There is a Ministry of Defence submarine exercise area to the south of the Caister facilities.
Renewables	The Hornsea Project Heron East windfarm, which is currently under construction, is located 37 km to the southeast of the Murdoch MD platform (which forms part of the CMS complex). Hornsea Project Three (HOW03) and Hornsea Project Two (HOW02) are located 25 km and 34 km from the platform respectively. Hornsea Project Four (HOW04) is located 57 km from the platform.
Wrecks	There are seven dangerous wrecks close to the project area ranging in distance between 29 and 40 km from the Caister platform.

Impact Assessment

An initial screening of the impacts and receptors was undertaken as part of the environmental impact identification (ENVID) workshop. This workshop identified the key environmental sensitivities, discussed the sources of potential impact and identified those sources which required further assessment. Table iii summarises the findings of the impact identification workshop and provides justification as to inclusion in further assessment within the EA. Detailed outcomes from the ENVID can be seen in Appendix 1.

Table iii Summary of the identification workshop, with justification for the inclusion and exclusion of impact sources

Impact	Further Assessment	Rationale
Operational discharges to sea	No	• Pipelines flushed to within the 30 ppm hydrocarbon discharge limit (outside the scope of this DP and will be covered by separate permit application). • Topsides cleaned and all wells abandoned (well P&A covered by separate permit application). • Decommissioning-related discharges will be limited to small volumes of relatively 'clean' fluids, or assessed in more detail as part of the environmental permitting process. • Controls in place through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations.
Dropped objects	No	• Dropped object procedures are industry standard. • Only very remote probability of any interaction with any live infrastructure. • Recovery of any dropped materials.
Underwater noise emissions from vessels and cutting operations	No	• The location of project activities 163 km from shore and 10 km south east of the Southern North Sea SAC, designated for harbour porpoise, puts the operations primarily outside of any sensitive areas. • Noise associated with cutting is unlikely to generate a great deal of noise and may not be detectable above other sources operating simultaneously (i.e. vessels). (Chrysaor, 2019b; Pangerc *et al*., 2016; Anthony *et al*., 2009). • As operations are generally classed as not significant (such as cutting and vessel noise) and will be limited in duration, this aspect has not been considered further. • Any marine mammals are likely to be habituated to vessel traffic noise of the type posed by the decommissioning vessels.

Impact	Further Assessment	Rationale
Waste: resource use, energy consumption and use of landfill space	No	• Resource use restricted to fuel use and will therefore contribute to atmospheric emissions, which have been assessed separately. • The majority material returned to shore is expected to be recycled, minismising the amount of waste required to go to landfill, in line with the waste hierarchy. • Components will be re-used where appropriate, reducing the energy use associated with recycling. • In the context of Chrysaor's 10-year decommissioning programme, there will be a positive impact on both socioeconomic and environmental receptors as a result of returning resource to shore, making materials available for re-use. • The limited waste to be brought to shore, which will be routine in nature, will be managed in line with the Chrysaor Waste Management Strategy as part of the project Active Waste Management Plan, using suitably permitted decontamination, dismantlement and disposal facilities and competent contractors.
Waste: including non-hazardous, hazardous, radioactive and marine growth	No	• The weight/volume of hazardous material is not expected to result in substantial landfill use. • Duty of care with regards to appropriate handling and disposal of waste. • As the wider SNS Chrysaor decommissioning projects evolve, decommissioning teams will liaise with approved waste management teams, to assess whether alternatives to landfill (i.e. digestion plant) are an alternative option.
Waste: onshore decontamination, dismantlement and disposal facility activities including airborne noise, odour, light, dust and aesthetics	No	• Negligible consequences for the human population in terms of an increase in dust, noise, odour and reduced aesthetics. • All onshore waste management facilities are currently operational with systems in place to manage environmental impacts as part of their existing site management plans. • Chrysaor aim to identify facilities based on proximity to the landing site. • 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.
Gaseous emissions to atmosphere and energy use.	No	• Emissions during decommissioning activities will occur following the cessation of production. Almost all operational emissions (from Project operations and vessels) will cease at this time.

Impact	Further Assessment	Rationale
		• Emissions regulated under the European Union Emissions Trading Scheme (EU ETS) and Industrial Emissions Directive (IED) have ceased as the combustion plant has been taken out of use. • In the context of Chrysaor's 10-year decommissioning programme, it is unlikely that there will be a significant adverse cumulative impact from energy use as resultant emissions will be significantly lower than those produced during the operational phase of the assets in question. • All vessels used during the decommissioning of the Caister facilities will have the appropriate UK Air Pollution Prevention Certificate (UKAPP) or International Air Pollution Prevention Certificate (IAPP) in place, as required. • The estimated CO_2 emissions to be generated by the proposed decommissioning options for the Caister jacket and topsides is 5,374 Te (Appendix 2). Of this total, recycling of materials accounts for 2,990 Te CO_2, the replacement of material decommissioned *in situ* accounts for 1,086 Te CO_2 and Vessel emissions account for 2,198 Te CO_2. Vessel emissions associated with this project equate to less than 0.02% of the total UKCS vessel emissions in 2017 (7,800,000 te; BEIS, 2019a).
Loss of containment	No	• Well plugging and abandonment is outside of the scope of this specific impact assessment. The possibility of a well blowout therefore does not require consideration here. • Pipelines will have been flushed and cleaned. • Pipeline decommissioning is also not a component of these Decommissioning Programmes. Release of a live hydrocarbon and chemical inventory is therefore also out of scope of this assessment. • Chrysaor expect that the HLV will have an accompanying Communication Interface Plan (CIP) and Shipboard Oil Pollution Emergency Plan (SOPEP). Oil spill modelling is included in the relevant field Oil Pollution Emergency Plan (OPEP). Chrysaor also have a Dismantlement Safety Case in place.
Routine vessel discharges (e.g. grey water, blackwater, ballast)	No	• Routine discharges from vessels managed on an ongoing basis the Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.
Physical presence of vessels during operations.	No	• Relatively short-term presence of vessels. • Activity will occur using similar vessels to those currently deployed for oil and gas operations across the SNS.

Impact	Further Assessment	Rationale
		• Vessel Traffic Survey (VTS) and a Navigational Risk Assessment (NRA) in place for CMS (Anatec, 2019a and 2019b). • Notice to Mariners. • 500m safety exclusion zone. • Use of navigation aids. • Safety standby vessels. • No sites of cultural heritage are identified in the area. • No impacts to coastal landscape and onshore visual receptors are expected. • The proposed operations will not result in significant changes to the offshore seascape.
Seabed disturbance: Disturbance to the seabed, including to features of conservation importance during removal	Yes Section 5.1	• The Caister decommissioning facilities are located 5 km from Dogger Bank SAC. Given the proximity to these sites and the concern of stakeholders over the risk to these sites, the seabed impacts from the proposed activities have been considered further within this EA (Section 5.1).
Risk of snagging for fisheries following decommissioning	No	• Operations will be undertaken within the 500 m safety exclusion zone of the platform within a limited time period • Final seabed survey following decommissioning. • Subject to the findings of a separate Decommissioning Programme it is anticipated that the pipeline end will be either trenched and buried or covered with overtrawlable rock protection.

Assessment and Mitigation of Significant Impacts

Seabed disturbance was investigated further as a potential impact due to the proximity to the sensitive seabed habitats of the Dogger Bank SAC and the Southern North Sea SAC. Of key importance is the short-term recovery of habitats and benthos following temporary sediment movement, and the long-term recovery rate of seabed from the potential installation of rock protection/ stabilisation structures.

The following measures have been or will be taken in order to reduce as far as possible potential impacts on the environment from the various decommissioning activities:

- Pre-decommissioning seabed surveys have been undertaken to identify the habitats and species present across the local area;
- Stakeholder consultation has been conducted to identify areas of concern, and to draw on a wider expertise when considering potential sensitivities;

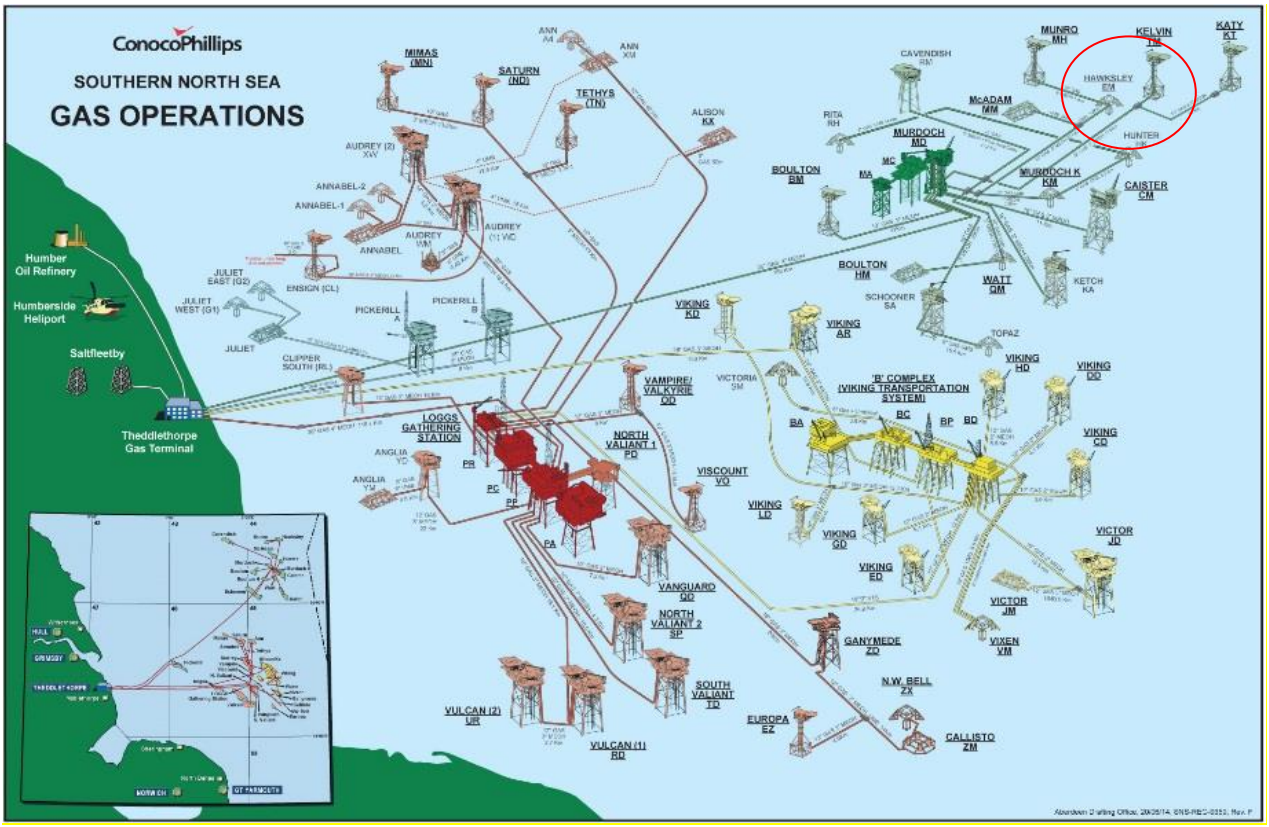
- Cutting and lifting operations will be controlled by Remotely Operated Vehicle (ROV) to ensure accurate placement of cutting and lifting equipment and minimise any impact to the seabed;
- The requirements for further excavation will be assessed on a case-by-case basis and minimised to provide access only where necessary. Internal cutting will be used preferentially where access is available;
- The heavy lift vessel (HLV) is likely to be equipped with dynamic positioning (DP) rather than relying on anchors to remain in position which impact the seabed. By using vessels equipped with DP for lifting, seabed disturbance will be reduced;
- Implementation of Chrysaor's Environmental Management Systems (EMS);
- Visual surveys of the seabed where possible to locate obstructions and to localise (and minimise) any post-decommissioning overtrawl surveys that may be required; and
- Survey data collected in the area will be reviewed for potential sensitive habitats of seabed and mitigated against as appropriate.

Having reviewed the project activities and taken into consideration that the activities are out with any areas of conservation, are in a high energy environment, have a small surface area affected and the natural dynamics such as transportation and backfill, as well as the undertaking of mitigation to limit this impact, there is not expected to be a significant impact on the seabed environment.

1.0 Introduction

Chrysaor Production (U.K.) Limited (Chrysaor) operates three main gas areas in the southern North Sea (SNS), namely; Viking, the Lincolnshire Offshore Gas Gathering System (LOGGS) and the Caister Murdoch Shooner (CMS) complex. The Caister CM platform is located in the CMS and is shown alongside Chrysaor's other southern North Sea (SNS) infrastructure in Figure 1-1.

Figure 1-1 Chrysaor's SNS assets



Note: The Viking area infrastructure is shown in yellow, LOGGS area infrastructure in red and CMS infrastructure in green.

Chrysaor is making progress through a ten-year decommissioning project covering these facilities, a project which began with well plugging and abandonment activities in 2014. For the purposes of planning the decommissioning activities, Chrysaor has divided the facilities associated with the Viking, LOGGS and CMS assets into a number of smaller areas, as follows:

- Four Decommissioning Programme submissions are required for the Viking area:
    - VDP1a: Viking GD, HD, DD, CD, ED installations (approved by BEIS in 2016);
    - VDP1b: Viking GD, HD, DD, CD, ED associated pipelines (approved by BEIS in 2017);
    - VDP2: Remaining Viking area installations and associated pipelines (approved by BEIS Feb 2019); and

- VDP3: Victor area installations and associated pipelines (approved by BEIS Feb 2019).

All Viking area assets are currently in cold suspension with all platform wells abandoned. Eight platforms are scheduled to be fully removed in the 2019 heavy lift campaign (Viking CD, DD, GD, HD, ED, KD, LD and Victor JD).

- Five Decommissioning Programme submissions are required for the LOGGS area:
  - LDP1: Vulcan UR, Vampire OD, Viscount VO installations and associated pipelines (approved by BEIS in 2017);
  - LDP2: Saturn area installations and associated pipelines (to be submitted for approval in 2020/ 2021);
  - LDP3: Jupiter area installations and associated pipelines (to be submitted for approval in 2019);
  - LDP4: North Valiant SP, South Valiant TD, Vanguard QD and Vulcan RD installations and associated pipelines (to be submitted for approval in 2020); and
  - LDP5: LOGGS Complex and North Valiant PD installations and associated pipelines (to be submitted for approval in 2020),

LOGGS area assets are sequentially being transitioned to cold suspension with the Ensco 92 mobile drilling-rig undertaking the final well plug and abandonment. The Seajacks Leviathan Accommodation Works Vessel (AWV) has completed all final clean and disconnect scopes. One platform is scheduled to be removed from the LOGGS area in 2019 (Vulcan UR).

- Four Decommissioning Programme submissions will be required for the CMS area:
  - CDP1a Caister CM installation and associated riser sections (to be submitted for approval in 2019);
  - CDP1b Caister CM associated pipelines (to be submitted for approval in 2020); and
  - CDP2 Boulton BM Boulton HM, Kelvin TM, Munro MH, Katy KT, Watt QM, Murdoch KM, Hawklsey EM and McAdam MM installations and associated pipelines (to be submitted for approval in 2020).
  - CDP3 Murdoch MA, MC and MD Complex installations and associated pipelines (to be submitted for approval in 2020).

This EA supports the decommissioning activities associated with the Caister CM satellite installation which is the first of the Company's Decommissioning Programmes in the Caister Murdoch System (CMS) Area, for which further information is given in the following sections.

1.1 Overview of the Caister Area

The Caister CM platform is a small installation with total combined topsides and jacket weight of 2,559 tonnes, standing in 41 m of water. The Caister CM platform is tied back to the Murdoch Complex via a 16" gas line (PL935) and a 3.5" MeOH line (PL0936) to the Murdoch MD platform, 11 km to the north west.

The focus of this Environmental Appraisal (EA) is the decommissioning activities associated with the Caister CM platform; this platform is shown in the context of the CMS complex and other Chrysaor infrastructure and the SNS in Figure 1-2. Further information on the location of the main facilities and infrastructure surrounding the Caister platform is shown in Figure 1-3. The Caister platform facilities include:

- one platform (topsides and jacket);
- subsea structure (template);
- two riser sections; and
- eight platform wells (Chrysaor, 2019a).

Figure 1-2 Infrastructure in the vicinity of the Caister CM Platform

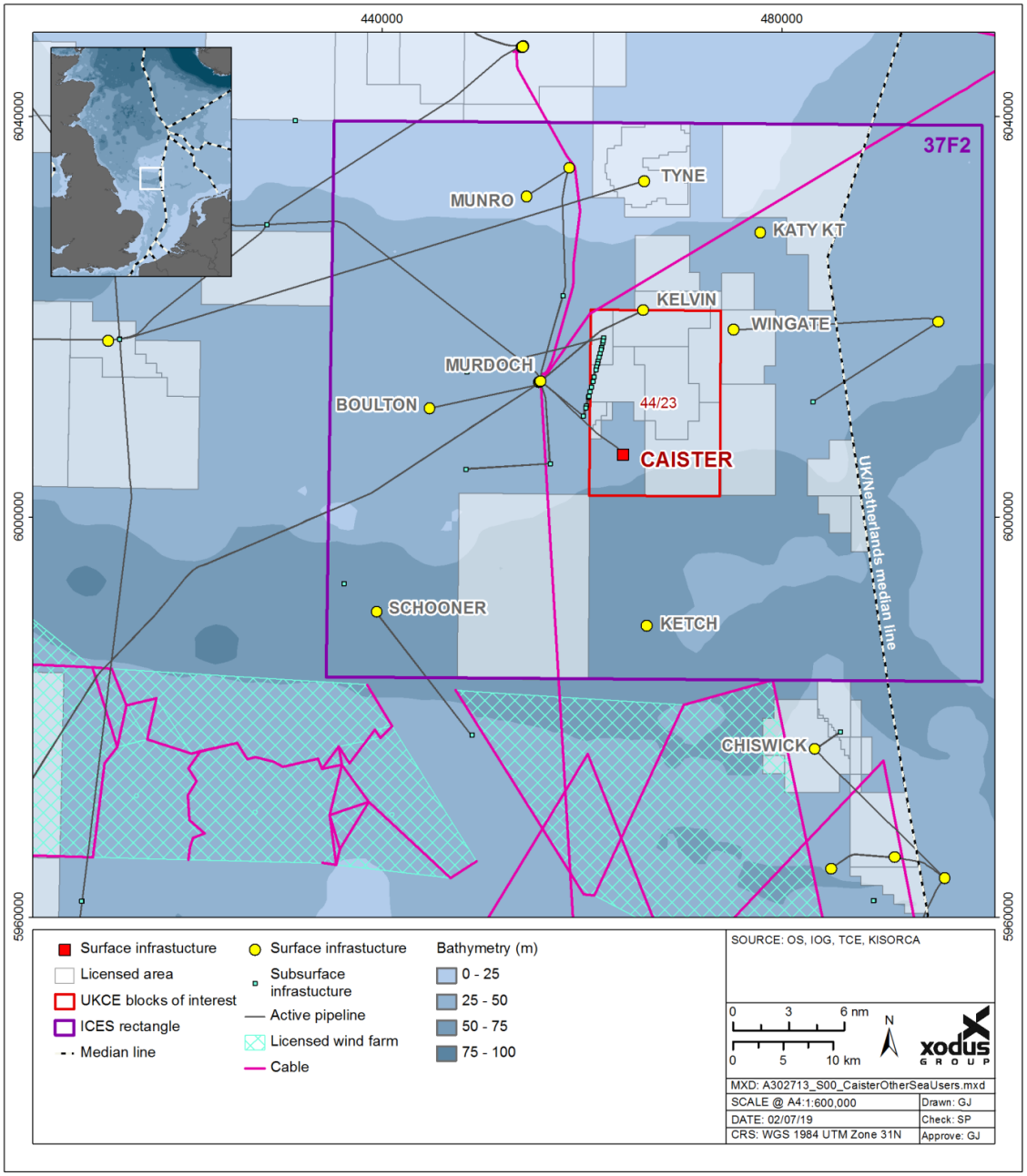
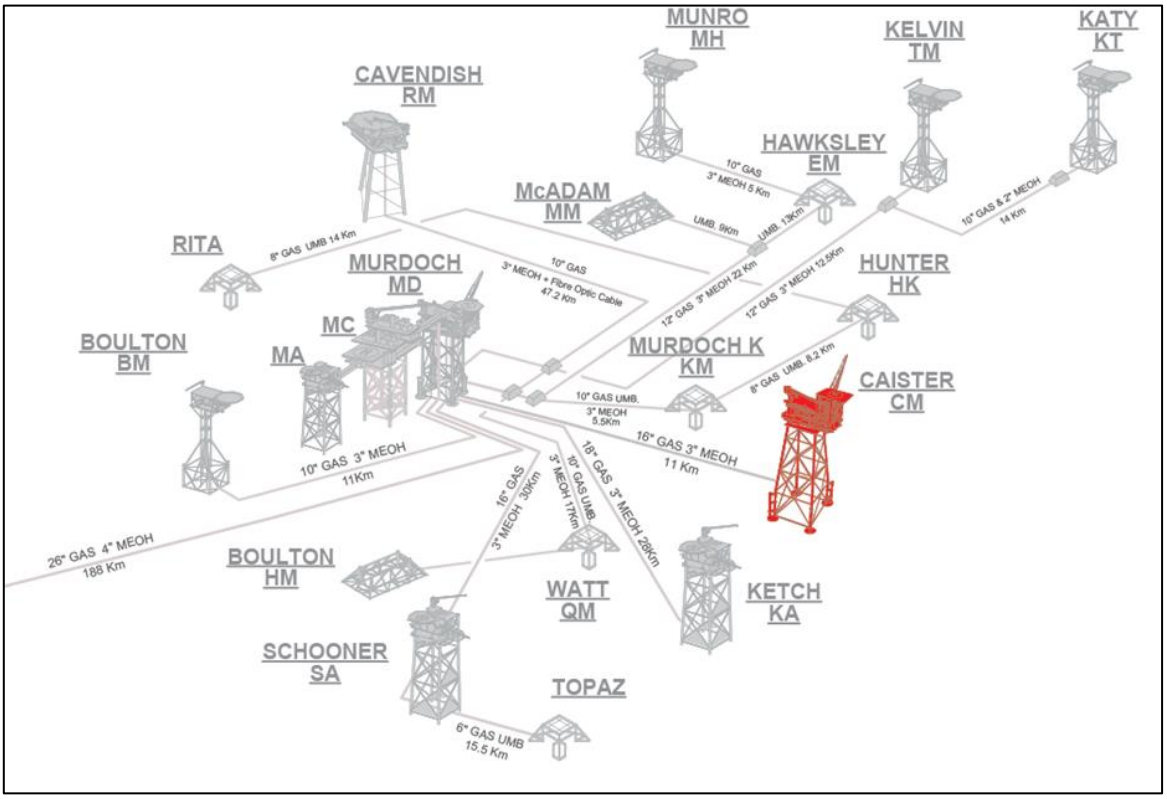


Figure 1-3 Overview of the infrastructure surrounding the Caister CM Platform



1.2 Regulatory Context

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the United Kingdom Continental Shelf (UKCS). The responsibility for ensuring compliance with the Petroleum Act 1998 rests with Department of Business, Energy and Industrial Strategy (BEIS), formerly the Department for Energy and Climate Change (DECC) and is managed through its regulatory body the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED). OPRED is also the Competent Authority on decommissioning in the UK for OSPAR purposes and under the Marine Acts. The Act requires the operator of an offshore installation or pipeline to submit a draft Decommissioning Programme for statutory and public consultation, and to obtain approval of the Decommissioning Programme from the OPRED, part of BEIS, before initiating decommissioning work. The Decommissioning Programme outlines in detail the infrastructure being decommissioned and the method by which the decommissioning will take place. Well plug and abandonment is determined under a different process to the Decommissioning Programme, called the Well Operations Notification System.

Formal EIA to support the Decommissioning Programme is not explicitly required under existing UK legislation. However, the primary guidance for offshore decommissioning that was updated and published by OPRED in 2018, detailed the need for an EA to be submitted in support of the Decommissioning Programme. The new guidance recognises that environmental deliverables to support Decommissioning Programmes were overly lengthy and did not focus in on the key issues, and now describes a more proportionate EA process that culminates in a streamlined EA rather than a lengthy Environmental Statement.

In terms of activities in the SNS, The East Inshore and East Offshore Marine Plans have been developed by the Department for Environment, Food and Rural Affairs to help ensure sustainable development of the marine area. Although the Plans do not specifically address decommissioning

of oil and gas, they do note the challenges that such activities can bring. As part of the conclusions to this assessment (Section 6), Chrysaor has considered the broader aims of the Plans and made a statement on alignment with the aims.

1.2.1 OSPAR Decision 98/3

As a Contracting Party of the OSPAR Convention, the UK is required to implement OSPAR Decision 98/3, which prohibits leaving offshore installations wholly or partly in place. The legal requirement for operators to comply with the OSPAR Convention is transposed through the Petroleum Act 1998 (as amended), as detailed in the guidance notes – Decommissioning of Offshore Oil and Gas Installations and Pipelines (BEIS, 2018) which outline the expectations of the UK regulator in terms of complying with the relevant OSPAR decisions. OSPAR Decision 98/3 states that the topsides of all installations should be removed and returned to shore.

1.2.2 National Marine Plan for the southern North Sea

The aim of the marine plan is to ensure the sustainable development of the marine area through informing and guiding regulation, management, use and protection of the marine plan areas. As the installation is in English offshore waters, the Caister facilities are subject to the National Marine Plan framework developed by the Department for Environment, Food and Rural Affairs (DEFRA) in conjunction with the Marine Management Organisation (MMO) under the Marine and Coastal Access Act 2009. The relevant management plan for the SNS, wherein the project area sits, is the East Offshore Management Plan ("the Plan"), this plan was adopted in April 2014. The Plan takes a holistic approach to guiding sustainable development in the offshore waters of the SNS. Whilst the Plan does not specifically address decommissioning of oil and gas facilities, it does present the policy objectives which Regulators use as a framework to assess offshore developments and their potential impacts on the UK marine area (Crown, 2011). The broad aims and policies outlined in the Plan (specifically policies EC01, BIO1, FISH1, FISH2, CC1 and CC2) have therefore been considered in this EA Report.

1.3 Chrysaor Environmental Policy

Chrysaor is committed to conducting activities in compliance with all legislation and operates an ISO14001 certified Environmental Management System (EMS). The most recent EMS recertification assessment was undertaken between 15th and 18th April 2019. Subject to periodic surveillance assessments, the EMS certification is valid until 22nd May 2022. The EMS covers all aspects of Chrysaor's activities including exploration, drilling and production activities and meets the requirements of OSPAR Recommendation 2003/5 which promotes the use and implementation of EMSs by the offshore industry. All activities associated with the decommissioning of the Caister facilities will be covered by Chrysaor's EMS.

Chrysaor's environmental policies have the underlying principle of conducting business with respect and care for the environment in which the company operates. Chrysaor implements such policies through the EMS. The Chrysaor HSE Policy (Appendix 3) provides a framework for the integrated management of environmental issues related to the company's business activities. It commits the company to comply with environmental legislation and strive for continuous improvement in environmental performance through the implementation of its Core Values and Business principles.

Environmental aspects related to the Caister facilities decommissioning will be integrated into the existing Chrysaor Environmental Aspects Register, using which, areas requiring improvement are subject to annual environmental goals, which are cascaded down through the organisation to specific asset, workgroup and individual employee level. Provision is made within the system to allow goals and programmes to be generated at the operating asset level also. Improvement programmes

allow the company to assign resources to meet any environmental targets set and to operate in an environmentally responsible way.

The Chrysaor HSE Policy states that all personnel and contractors are aware of their heath, safety and environmental responsibilities. The necessary training, knowledge and resources are supplied to contractors by Chrysaor to meet company HSE commitments. Contractor interface documents will be developed to manage environmental commitments during decommissioning. The interface documents will detail the management organisation, the communication and reporting lines and the division of responsibilities during operational and emergency situations.

Decommissioning operations will be conducted under the relevant licences and permits applied for by Chrysaor. Monitoring and reporting to the regulator and internally will be conducted in accordance with relevant legislation and these licences. For example, discharges to sea from chemicals and residual hydrocarbons will be permitted appropriately and any accidental discharges to sea will be reported and investigated through Chrysaor's incident investigation process.

Monitoring will be performed by internal and external parties. The scope and frequency of internal monitoring depends on an assessment of risks performed by line managers, process owners and corporate staff functions. Internal monitoring consists of three main categories: follow-up, verification and internal audit.

1.4 Waste

1.4.1 Waste Overview

The duty of care with regards to appropriate handling and disposal of waste rests with the Caister project team. In order to identify appropriate measures for handling waste safely, it is necessary to understand the regulations under which waste is handled and the key sources of waste. Section 1.4.2 describes the regulatory control of waste material whilst Section 1.4.3 outlines the types of waste material that will be generated as a result of the proposed decommissioning activities. Section 1.4.4 details the measures that will be in place to ensure waste is appropriately managed. It should be noted that waste operations for the Caister Decommissioning Programmes will be managed as one along with Chrysaor's other SNS decommissioning activities.

1.4.2 Regulatory control

The EU's Revised Waste Framework Directive (Directive 2008/98/EC) was adopted in December 2008. The aim of the directive is to ensure that waste management is carried out without endangering human health and without harming the environment. Article 4 of the directive also states that the waste hierarchy shall be applied as a priority order in waste prevention and management legislation and policy.

Decommissioning activities will generate quantities of controlled waste, defined in Section 75(4) of the Environmental Protection Act 1990 as household, industrial and commercial waste or any such waste. The sequence and quantities of controlled waste generated at any one time will depend on the processes used for dismantling and the subsequent treatment and disposal methods.

Two key challenges are associated with waste management for the Caister facilities:

- Potential for "problematic" materials, generated due to cross–contamination of non-hazardous waste with substances that have hazardous properties, which results in the material being classified as hazardous waste. Hazardous waste is defined as material that has one, or more,

properties that are described in the Hazardous Waste Directive (91/689/EEC) as amended by Council Directive 94/31/EC; and

- Problems associated with materials with unknown properties at the point of generation. These quantities of 'unidentified waste' require careful storage and laboratory analysis to determine whether they are hazardous or non-hazardous waste.

In accordance with the BEIS Guidance Notes under the Petroleum Act 1998 (DECC, 2011), the disposal of such installations should be governed by the precautionary principle. Chrysaor will assume the worst-case, especially when dealing with hazardous and unidentified wastes, and choose waste treatment options which would result in the lowest environmental impact.

1.4.3 Sources of waste

Routine vessel waste

The discharge of food waste, bilge water and grey water (water and chemicals from washing and laundry facilities) from vessels to sea during the decommissioning operations has the potential to cause short-term, localised organic enrichment of the water column and an increase in biological oxygen demand. This could contribute to a minor increase in plankton and attract fish to the area. However, food waste is typically macerated to increase the rate of dispersion and biodegradation at sea and waste water will be treated appropriately before being discharged to sea, in accordance with the requirements of the MARPOL convention. Ballast water discharges will be in accordance with the International Maritime Organisation Ballast Water Management Convention, including a ballast water plan and log book.

Radioactive waste and Naturally Occurring Radioactive Waste (NORM)

Radioactive wastes including sources (e.g. smoke detectors) and NORM associated with pipework and sand from vessels will be managed in line with current legislative requirements. Chrysaor has a procedure in place for managing radioactive waste, and the local rules for working with radioactive materials will be revised to include the removal and transportation of radioactive materials during decommissioning in consultation with the relevant authority depending on the location of disposal/treatment site. Any NORM and radioactive materials will be disposed of via a licensed facility capable of taking contaminated material and disposing of it using an appropriate method (e.g. incineration). Chrysaor will work to current NORM procedures in existence for Southern North Sea operations.

Waste generated during preparation for decommissioning

During cleaning, the topside system will be depressurised, purged, flushed and rendered safe for removal. Pipelines and tanks will be drained to remove oil residues and other fluids. Diesel and lubricating oils will be returned to shore for disposal. Waste disposal will be in line with Chrysaor's Waste Management Strategy, as discussed in Section 1.4.4.

Waste from dismantling of offshore structures

Facilities requiring removal as part of the Caister Decommissioning Programmes will be transferred to shore by a HLV for decontamination, dismantlement, disposal, recycling or reuse. OGUK (2019) reported that of the 6,030 tonnes of decommissioning waste generated in 2018, 72% was either reused, recycled or used for power generation.

For materials where reuse or recycling is not an option, these will be sent to appropriate disposal facilities for recovery, or landfill where other options are not viable. In terms of the waste hierarchy, recovery is more beneficial than landfill since it means a waste product is used to replace other materials that would otherwise have been used to fulfil a particular function.

Any hazardous wastes remaining in the recovered infrastructure will be disposed of under an appropriate permit. It is likely that there will be small volumes of residual hydrocarbons, chemicals and naturally occurring radioactive material; such equipment will be disposed of in accordance with relevant Safe Operating Procedures and the Chrysaor Waste Management Strategy with consideration of specific sampling, classification, containment, and consignment conditions.

Most of the marine growth recovered will be soft marine growth (e.g. anemones and the soft coral), but hard marine growth is likely to include tube worms, barnacles and mussels. The receiving dismantling yard will strip the installation into its components before they undergo further processing and it is proposed that marine growth be either disposed of to landfill or composted. An alternative option is to send some of the marine growth to be disposed of at an anaerobic digestion facility for use as a fertiliser on land. However, these facilities can only take limited volumes of material.

1.4.4 Waste management strategy

The onshore treatment of waste from the Caister decommissioning activities will be undertaken according to the principles of the waste hierarchy, a conceptual framework which ranks the options for dealing with waste in terms of sustainability (Figure 1-4). The waste hierarchy is a key element in OSPAR Decision 98/3 and DECC Guidance Notes (2011).

Non-hazardous waste material, such as scrap metal, concrete and plastic not contaminated with hazardous waste, will, where possible, be reused or recycled. Other non-hazardous waste which cannot be reused or recycled will be disposed of to a landfill site. Hazardous waste resulting from the dismantling of the Caister facilities will be pre-treated to reduce hazardous properties or render it non-hazardous prior to recycling or disposing of it to a landfill site. Under the Landfill Directive, pre-treatment is necessary for most hazardous wastes destined to be disposed of to a landfill site.

The management of waste generated from operations and drilling activities has been addressed by Chrysaor through an ISO14001 certified Environmental Management System (EMS). The EMS initially comprised a procedure for waste management designed to ensure that all waste generated during the Chrysaor offshore production and drilling operations are managed according to the Company's Health, Safety and Environment policy (Appendix 3) and relevant legislation. Procedures and processes for waste management are now embedded in the EMS. Furthermore, Chrysaor has prepared a waste management plan in support of the Caister Decommissioning Programmes. The Waste Management Plan will record how handling, storage, transfer and treatment of waste will be conducted by contractors/sub-contractors on behalf of Chrysaor using their own waste management system.

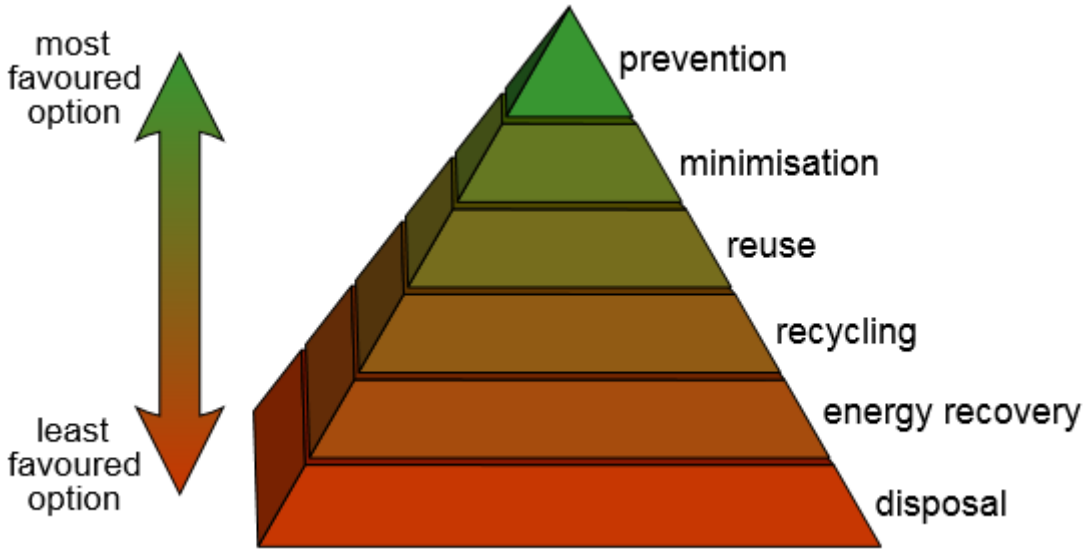


Figure 1-4 Waste management hierarchy

1.5 Learning from Southern North Sea Decommissioning

Cessation of production from Chrysaor SNS facilities was achieved 15th August 2018. Decommissioning of the SNS infrastructure hubs and satellites is currently being carried out in a phased manner. The initial phase of decommissioning works commenced in the Viking area, followed by the LOGGS area ahead of the CMS area. The sequencing of activities within the phased model is subject to change with varying decommissioning works currently being undertaken in all three geographical areas simultaneously. Chrysaor is preparing the Decommissioning Programmes for the CMS area, based on asset partnerships, asset condition, regulatory approvals and Chrysaor priority to decommission.

The CDP1 decommissioning activities are the third set of decommissioning works within Chrysaor's wider decommissioning plans for the southern North Sea. The activities proposed herein, and the assessment that has been undertaken, have incorporated learnings from Chrysaors' other southern North Sea decommissioning activities and from wider decommissioning activities in the North Sea. Following initial decommissioning activities approved under VDP1 and VDP2, Chrysaor has conducted further design work, including micro-siting of the AWV on the basis of further review of the site-specific survey data to minimise the need for additional stabilisation material at this location. This has reduced the quantity of rock required for stabilisation of the AWV, and therefore the potential environmental impact.

Chrysaor will continue to investigate the possibility of streamlining operations to further reduce potential environmental impact as planning for the decommissioning activities progresses.

1.6 Purpose and Structure of the EA

This EA sets out to describe, in a proportionate manner, the potential environmental impacts of the proposed activities associated with the decommissioning of the Caister facilities 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:

- How Chrysaor has arrived at the selected decommissioning strategy (Section 1.0);

- A description of the proposed decommissioning activities (Section 2.0);
- A review of the potential impacts from the proposed decommissioning activities and justification for the assessments that support this EA (Section 3.0);
- A summary of the baseline sensitivities relevant to the assessments that support this EA (Section 4.0);
- Assessment of key issues (Section 5.0); and
- Conclusions (Section 6.0).

This EA has been prepared in line with Chrysaor's EMS 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, 2018).

2.0 Project Description

This section presents a description of the infrastructure in the Caister area, the scope of the decommissioning operations, infrastructure to be decommissioned and alternatives considered for decommissioning these facilities.

2.1 Description of Facilities to be Decommissioned

The Caister CM platform consists of a four-legged, normally unmanned, fixed steel jacket production platform located in 41 m of water approximately 163 km from the nearest landfall (the North Yorkshire coast). The installation supported eight wells. The well decommissioning (plug and abandonment) activities and final engineering down and cleaning activities are excluded and covered under the permitting regime as part of platform operations. Pipeline decommissioning activities are excluded from this EA, with the exception of the riser sections.

The decommissioning of the Caister facilities will include:

- Removal of topsides;
- Removal of jacket;
- Removal of associated truncated riser sections attached to the Caister CM platform; and
- Removal of subsea drilling template.

2.1.1 Topsides

The decommissioning strategy for the Caister facilities will require the removal of the topside structure from its jacket structure via a single lift. The weight for the topsides facilities is presented in Table 2-1.

Table 2-1 Surface Facilities Information

Name	Facility Type	Location	Topsides / Facilities		Jacket			
		WGS84 Decimal Minute	Weight (Te)	No of Modules	Total Weight (Te)	No of Legs	No of Piles	Weight of Piles (Te)*
Caister Murdoch (CM)	Fixed steel jacket	54.2031º N / 54º 12.184' N 02.4498º E / 02º 26.991' E	1,255	1	1,253*	4	4	254**

* Weight includes piles. **The quantity below the mudline (492 Te) has not been included in subsequent weight calculations as it will be decommissioned *in situ* below the seabed.

2.1.2 Jacket and subsea structures

The Caister jacket structure (including the two risers) and subsea structure will also be removed from the seabed via single lift. The piles securing the jacket and drilling tempate will be cut below the natural seabed level at a depth that will ensure they remain covered. The depth of cutting is dependent upon the prevailing seabed conditions and currents (DECC, 2011). Chrysaor estimates this to be in the region of 3 m below the mudline/ natural seabed level. The weights for the jacket and subsea structures are presented in Table 2-1 and Table 2-3.

Table 2-2 Subsea Structures

Subsea installations and stabilisation features	Number	Size / Weight (Te)	Locations	Comments / Status
			WGS84 Decimal Minute	
Risers	2	10 Te	54.2031º N / 54º 12.184' N 02.4498º E / 02º 26.991' E	Disused
Templates	1	9 m x 9 m / 3 piles / 41 Te* (pile weight to -3 m below mudline)	54.2031º N / 54º 12.184' N 02.4498º E / 02º 26.991' E	Disused

*The quantity below the mudline (60 Te) has not been included in subsequent weight calculations as it will be decommissioned *in situ* below the seabed.

2.1.3 Materials inventory

During the decommissioning of the Caister topsides and jacket, there will be a wide range of materials that will need to be processed and, where possible, either reused or recycled. Detailed inventory assessments have been undertaken to characterise and quantify both hazardous and non-hazardous materials to be decommissioned. A summary of the estimated materials inventory to be recovered as a result of the proposed topsides decommissioning operations is provided in Table 2-3 and Figure 2-1.

Table 2-3 Estimated inventory of recovered materials

Material weight	Materials to be returned to shore (Te)
Hazardous Mat/ NORM	165
Concrete	49
Ferrous Metal	2,186
Non-ferrous Metal	32
Plastic	15
Other Non-Hazardous*	112
Total	**2,559**

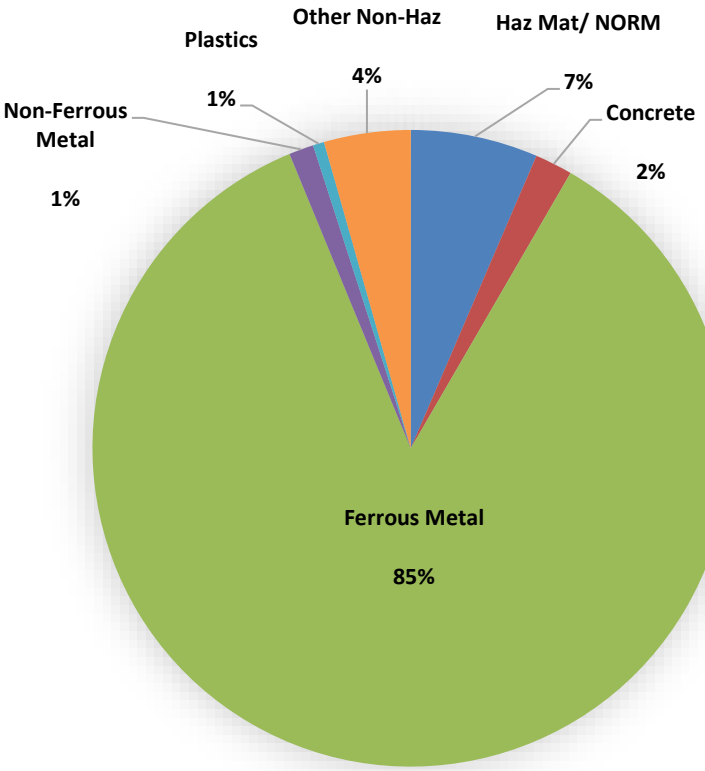


Figure 2-1 Caister CM: Estimated inventory of materials to be returned to shore

2.2 Consideration of Alternatives and Selected Approach

2.2.1 Decision-making context

As a Contracting Party of the Convention for the Protection of the Marine Environment of the North-East Atlantic ('OSPAR'), the UK has agreed to implement OSPAR Decision 98/3, which prohibits leaving offshore installations wholly or partly in place. The OSPAR Convention is affected through the Petroleum Act 1998 (as amended by the Energy Act 2008), the Guidance Notes for which outline the expectations of the UK regulator in terms of complying with the relevant OSPAR decisions. OSPAR Decision 98/3 states that the topsides of all installations should be returned to shore and that all jackets with a weight of less than 10,000 tonnes are completely removed for reuse, recycling or final disposal on land. This applies to the Caister CM as the platform weighs less than 10,000 tonnes.

2.2.2 Alternative to decommissioning

No economic hydrocarbon developments local to any of the Caister facilities were identified. The Caister facilities are past their design life, require refurbishment and contain obsolete control systems and components. Their re-use is uneconomical. Therefore, it is considered unlikely that any opportunity to re-use the Caister infrastructure will be feasible and, as such, there is no reason to delay decommissioning of the infrastructure in a way that is safe and environmentally and socio-economically acceptable (and the 'do nothing' approach to the infrastructure is thus rejected).

2.3 Proposed Schedule

Chrysaor anticipates completing the Caister activities by 2023; an indicative schedule for the work is shown in Figure 2-2. However, the specific timing of decommissioning activities will be agreed with OPRED and with the Health and Safety Executive (HSE) and applications for all relevant permits and consents will be submitted and approval sought prior to activities taking place.

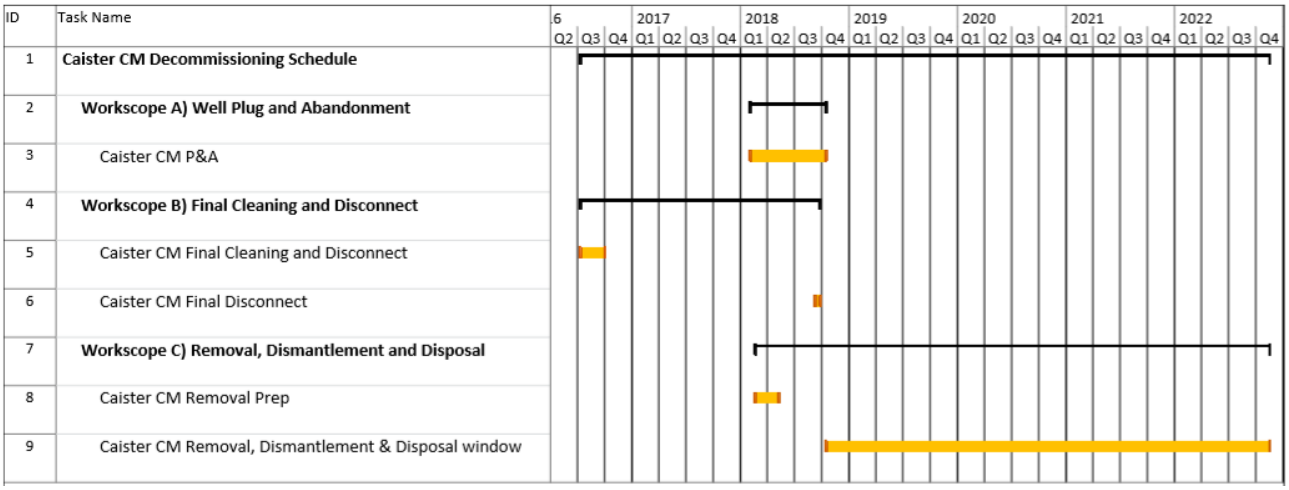


Figure 2-2 Indicative decommissioning schedule

The following sections provide a high-level description of the activities required to execute the decommissioning schedule; full detail can be found in the Decommissioning Programmes for the Caister facilities.

2.4 Decommissioning Activities

2.4.1 Preparation for decommissioning

Well plug and abandonment

Note: as stated in Section 2.1, well plug and abandonment is not within the scope of this EA, and it has been or will be assessed as part of well intervention and Well Operations Notification System (WONS) consent. A description is included here to describe the activities leading up to the point that the decommissioning activities that are assessed here begin.

The eight wells associated with the Caister facilities were plugged and abandoned prior to any of the platform and subsea decommissioning activities progressing. Each well was systematically and permanently closed through the placement of cement plugs in the well in accordance with well abandonment best practice (e.g. OGUK Guidelines Well Decommissioning Guidelines - issue 6 June 2018).

Flushing and cleaning operations

Note: Flushing and cleaning operations are not within the scope of this EA, and they have been or will be assessed as part of ongoing operations of the facilities.

Chrysaor has flushed all the infield production pipelines with seawater, followed by plugs of gel or foam called 'pigs' propelled through the lines. This activity was designed to remove mobile hydrocarbons and achieve a cleanliness of less than 30mg/l oil in pipeline flush fluids. Chemical

pipelines were subjected to a turbulent seawater flush to displace all contents. The pipeline contents and flush fluids were transferred to a clean-up package and discharged overboard in accordance with operational permit applications. The pipelines have been left flooded with seawater.

2.4.2 Platform decommissioning

Cold suspension

Specialist engineering contractors have prepared the infrastructure for removal. The installation is currently hydrocarbon free, isolated from hydrocarbon sources and without a routine power source, tin a phase called 'cold suspension'. During this time, the platform is equipped with solar powered aids to navigation and an automatic identification system (AIS) to maintain the standard offshore marking schedule until topsides and jacket removal takes place.

Topsides removal

The topsides structure will need to be removed prior to removal of the jacket. The topsides will be prepared for this by a combination of securing and structural strengthening of the topsides module/ facilities. The topsides will be removed by an HLV capable of lifting them in a single lift. They will then be transported to shore by HLV or cargo barge where they will be transferred to the quayside and taken to Veolia Petersons Outer Harbour Great Yarmouth Decommissioning Facility for decontamination, demolition and recycling or disposal.

Jacket removal

The jacket is secured to the seabed by four piles. All piles will be cut below the natural seabed level at a depth that will ensure they remain covered. The depth of cutting is dependent upon the prevailing seabed conditions and currents. Chrysaor is estimating this to be in the region of 3.0 m below the natural seabed level.

The removal process for the jacket is expected to be:

- Cutting of the lines (risers) that connect the platform to the subsea infrastructure (completed in 2018);
- Cutting of the piles that secure the jacket and the drilling template to the seabed; and
- Removal of platform jacket by HLV (including risers).

A HLV capable of lifting the entire jacket in one lift will be used. The topsides will then be transferred to the quayside and taken to Veolia Petersons Outer Harbour Great Yarmouth Decommissioning Facility for decontamination, demolition and recycling or disposal.

2.5 Post-decommissioning

Following decommissioning activities, a seabed clearance survey will identify any debris on the seabed within a 500 m radius of the platform. An ROV support vessel may be deployed to recover large items of debris whilst chain mats are likely to be deployed to clear smaller items of debris (or owing to the environmental sensitives of the location an alternative method maybe selected to demonstrate that the remaining infrastructure does not present a risk to other users of the sea). Any significant oil and gas related seabed debris will be recovered for onshore recycling and disposal. Subject to certification of seabed clearance by an appropriate body and to acceptance of the

Decommissioning Programme Close-out Report by OPRED, the 500m safety exclusion zone will be removed.

3.0 EA Methodology

3.1 Identification of Environmental Issues

An EA in support of a Decommissioning Programme should be focused on the key issues related to the specific activities proposed; the impact assessment write-up should be proportionate to the scale of the project and to the environmental sensitivities of the project area. This does not mean, however, that the impact assessment process should be any less robust than for a statutory EIA or consider any fewer impact mechanisms. To this end, Chrysaor undertook an environmental impact identification (ENVID) workshop early in the EIA process. This workshop identified the key environmental sensitivities, discussed the sources of potential impact and identified those sources which required further assessment. The decision on which issues required further assessment was based on:

- Specific proposed activities and environmental sensitivities;
- A review of industry experience of decommissioning impact assessment; and
- An assessment of wider stakeholder interest (informed in part by the stakeholder engagement described in Section 3.2).

Table 3-1 summarises the findings of the impact identification workshop, providing justification for the inclusion and exclusion of impact mechanisms. More information regarding industry standard and project-specific mitigation and controls can be found in the ENVID tables in Appendix 1.

Table 3-1 Summary of findings of impact identification workshop

Impact	Further Assessment	Rationale
Operational discharges to sea	No	Prior to decommissioining, all pipelines will have been flushed to within the 30 ppm discharge limit for reservoir hydrocarbon content of seawater. The topsides will have been cleaned and all wells abandoned. Any decommissioning-related discharges will be limited to small volumes of relatively 'clean' fluids, or those that will be assessed in more detail as part of the environmental permitting process (e.g. through Master Application Templates/Subsidiary Application Templates). Controls will be in place, as relevant, through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations. Considering the above, operational discharges to sea are not assessed further herein.
Dropped objects	No	There exists the possibility that jackets and/or topsides could be transported by a vessel using a crane. Where these would be suspended over the side of the vessel for the transfer, the possibility of dropping a large object cannot be discounted. However, dropped object procedures are industry standard and there is only a very remote probability of any interaction with any live infrastructure. All efforts will be made to recover any materials that are dropped. Considering the above, accidental events are not assessed further herein.

Impact	Further Assessment	Rationale
Underwater noise emissions from vessels and cutting operations	No	The location of project activities 163 km from shore and 10 km south east of the Southern North Sea SAC, designated for harbour porpoise, puts the operations outside of any sensitive areas. Since field measurements undertaken to record cutting emissions in the context of potential effects on marine life are otherwise limited (Chrysaor, 2019b; Pangerc *et al*., 2016; Anthony *et al*., 2009) a worst-case assumption has been made in this assessment that noise emissions from diamond-wire cutting and abrasive water jetting may extend up to 195 dB re 1 µPa @ 1 m. In the absence of recorded field measurements, it seems likely that this form of cutting would not generate a great deal of noise and may not be detectable above other sources operating simultaneously (i.e. vessels). On this basis, hydraulic shearing for jacket removal is not assessed further. As operations are generally classed as not significant (such as cutting and vessel noise) and will be limited in duration, this aspect has not been considered further. This area of the SNS (including much of the Southern North Sea SAC) is moderate to high in vessel traffic, creating a cumulative noise impact. Any marine mammals are likely to be habituated to vessel traffic noise of the type posed by the decommissioning vessels.
Waste: resource use, energy consumption and use of landfill space	No	Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use and will therefore contribute to atmospheric emissions, which have been assessed separately. Material will be returned to shore as a result of project activities, and the majority of what is returned is expected to be recycled, minimising the amount of waste required to go to landfill, in line with the waste hierarchy (Figure 1-4). Components will be re-used where appropriate, reducing the energy use associated with recycling. In the context of Chrysaor's 10-year decommissioning programme, there will be a positive impact on both socioeconomic and environmental receptors as a result of returning resource to shore, making materials available for re-use. It should also be noted that the cessation of production associated with all of Chrysaor's SNS assets due for decommissioning (Section 1.0) represents an in-combination decrease in energy and resource use in the long-term. It is waste management, not generation, that is the issue for these Decommissioning Programmes and previous Chrysaor Decommissioning Programmes, with capacity to handle waste within the UK often cited as a stakeholder concern. The limited waste to be brought to shore, which will be routine in nature, will be managed in line with the Chrysaor Waste Management Strategy as part of the project Active Waste Management Plan, using suitably permitted decontamination, dismantlement and disposal facilities and competent contractors. Considering the above, resource use and landfill take is not assessed further herein.
Waste: including non-hazardous,	No	There may be instances where infrastructure returned to shore is contaminated with heavy metals or potentially Naturally Occurring

Impact	Further Assessment	Rationale
hazardous, radioactive and marine growth		Radioactive Material (NORM) and cannot be recycled, but the weight/volume of such material is not expected to result in substantial landfill use. The duty of care with regards to appropriate handling and disposal of waste rests with the decommissioning project teams for each asset included in the wider Chrysaor SNS decommissioning plan. As the projects evolve, the decommissioning teams will liaise with their approved waste management teams, to assess whether alternatives to landfill (e.g. digestion plant) are an alternative option. On this basis, no further assessment of waste is necessary.
Waste: onshore decontamination, dismantlement and disposal facility activities including airborne noise, odour, light, dust and aesthetics	No	The onshore waste management process is likely to have negligible consequences for the human population in terms of an increase in dust, noise, odour and reduced aesthetics. All onshore facilities to which decommissioned material will be consigned are currently operational with systems in place to manage environmental impacts as part of their existing site management plans. Chrysaor aim to identify these facilities based on proximity to the landing site to minimise the distance travelled on road, thereby minimising traffic and emissions. Chrysaor's procedures require waste facilities to be approved for use prior to the consignment of the waste. 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. Chrysaor understands that dismantling sites will also require consents and approvals from onshore regulators such as the Enviroment Agency, who apply conditions relating to mitigation, management and who are responsible for the provision of permits for such work. Considering the above, onshore interactions are not assessed further herein.
Gaseous emissions to atmosphere and energy use.	No	During planned operations, power generation by the decommissioning vessels will result in the emission of combustion gases. The main combustion product resulting from power generation is carbon dioxide (CO_2) with small quantities of methane (CH_4), volatile organic compounds (VOCs), nitrogen oxides (NOx), carbon monoxide (CO) and very small quantities of nitrous oxide (N_2O) and sulphur dioxide (SO_2). Emissions during decommissioning activities will occur following the cessation of production. Almost all operational emissions (from Project operations and vessels) will cease at this time. In the context of Chrysaor's 10-year decommissioning programme, it is unlikely that there will be a significant adverse cumulative impact from energy use as resultant emissions will be significantly lower than those produced during the operational phase of the assets in question. In the context of vessel emissions, the Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008 implement MARPOL Annex VI in the UK and establish controls on marine engines and marine fuel in order to limit emissions, in particular NOx and SOx. All vessels used during the decommissioning of the Caister facilities will have the appropriate UK Air

Impact	Further Assessment	Rationale
		Pollution Prevention Certificate (UKAPP) or International Air Pollution Prevention Certificate (IAPP) in place, as required. The estimated CO_2 emissions to be generated by the proposed decommissioning options for the Caister jacket and topsides is 5,374 Te (Appendix 2). Of this total, recycling of materials accounts for 2,990 Te CO_2, the replacement of material decommissioned *in situ* accounts for 1,086 Te CO_2 and Vessel emissions account for 2,198 Te CO_2. Vessel emissions associated with this project equate to less than 0.02% of the total UKCS vessel emissions in 2017 (7,800,000 te; BEIS, 2019a). As such, atmospheric emissions are not considered to present a significant environmental impact.
Loss of containment	No	Well plugging and abandonment is outside of the scope of this specific impact assessment, since it not dependent on approval of the Decommissioning Programmes. The possibility of a well blowout therefore does not require consideration in this assessment (it is assessed as part of separate well intervention and marine licence applications). Pipelines will have been flushed and cleaned prior to the decommissioning activities described herein being carried out. Pipeline decommissioning is also not a component of these Decommissioning Programmes. Release of a live hydrocarbon and chemical inventory is therefore also out of scope of this assessment. Chrysaor expect that the HLV will have an accompanying Communication Interface Plan (CIP) and SOPEP. Oil spill modelling is included in the relevant field OPEP. Chrysaor also have a Dismantlement Safety Case in place.
Routine vessel discharges (e.g. grey water, blackwater, ballast)	No	Routine discharges from vessels are typically well-controlled activities that are managed on an ongoing basis the Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008. The Regulations implement MARPOL Annex IV (control sewage discharges from any vessel or ship). Considering the above, routine discharges to sea during decommissioning activities are not assessed further herein.
Physical presence of vessels during operations.	No	The presence of vessels for decommissioning activities will be relatively short term in the context of the life of the Caister facilities. Activity will occur using similar vessels to those currently deployed for oil and gas operations across the SNS. Vessels will also generally be in use around existing infrastructure and will not occupy 'new' areas. Chrysaor have commissioned both a Vessel Traffic Survey (VTS) and a Navigational Risk Assessment (NRA) which cover the wider CMS area (Anatec, 2019a and 2019b). With standard mitigation measures such as Notice to Mariners, the presence of a 500m safety exclusion zone around the platform, the short term nature of these operations and use of navigation aids and safety standby vessels, this risk is not expected to be significant. No sites of cultural heritage have been identified in the area. Given the distance of the proposed operations from shore, no impacts to coastal landscape and onshore visual receptors are

Impact	Further Assessment	Rationale
		expected. The proposed operations will not result in significant changes to the offshore seascape. Therefore, physical presence has not been assessed as part of this application.
Seabed disturbance: Disturbance to the seabed, including to features of conservation importance during removal	Yes Section 5.1	The Caister decommissioning facilities are located 5 km from Dogger Bank SAC and 10 km from the Southern North Sea SAC. Given the proximity to these sites and the concern of stakeholders over the risk to these sites, the seabed impacts from the proposed activities have been considered further within this EA (Section 5.1).
Risk of snagging for fisheries following decommissioning	No	All operations will be undertaken within the 500 m safety exclusion zone of the platform within a limited time period and a final seabed survey will be undertaken of the safety exclusion zone to ensure that the seabed is cleared and safe for other sea users following decommissioning. Subject to the findings of a separate Decommissioning Programme it is anticipated that the pipeline end will be either trenched and buried or covered with overtrawlable rock protection. Thus, no additional impacts to other users of the sea are expected. Therefore, the impact on other users has not been assessed as part of this application.

3.2 Stakeholder Engagement

Throughout the SNS decommissioning planning, Chrysaor has continually engaged with a range of stakeholders; Chrysaor recognises the importance of active and appropriate engagement, to ensure that all concerns are addressed through the planning and execution stages of decommissioning. Specifically, Chrysaor has involved stakeholders, including the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), The National Federation of Fishermen's Organisations (NFFO), The Scottish Fishermen's Federation (SFF), the Oil and Gas Authority (OGA) and the Joint Nature Conservation Committee (JNCC), within the Environmental Appraisal process. stakeholders have received a briefing letter outlining SNS decommissioning activities, and OPRED have been engaged in informal discussion on the content of the Environmental Appraisal. With respect to the Environmental Appraisal, key concerns raised included:

- Cumulative impact – considering Chrysaor's SNS decommissioning activities will extend over a ten-year period and result in some infrastructure decommissioned *in situ*, stakeholders expressed concern over the potential cumulative impact. In particular, potential impacts on the seabed were highlighted. Chrysaor has considered this within the EA, and the impact assessment presented in Section 5.0 includes consideration of cumulative impact; and
- Protected sites – the Chrysaor SNS decommissioning activities will take place within or close to a number of sites designated for protection of various environmental sensitivities. Considering the temporal scale and the nature of the proposed activities, along with the other potential activities occurring within the protected sites, stakeholders raised concern around the potential

impact on the integrity of the protected sites. Consideration of these sites has been an integral part of the Environmental Appraisal process, and the impact assessment presented in Section 5.0 includes a specific assessment of protected sites (Note: protected sites are dealt with within specific impact assessments rather than a standalone protected sites section – this is because each impact assessment requires a specific consideration of whether there could be significant negative interaction with protected sites before a conclusion can be made).

3.3 Environmental Significance

For the sources of impact that were assessed further in the EA, it is important that a conclusion is reached regarding whether the impact is likely to result in a substantive change to environmental and societal conditions. During EIA, there are many ways this can be done; a common approach is to define 'significance', and this approach is taken here. However, it is equally appropriate to employ some other method; the key is that the methods used for identifying and assessing significance are transparent and verifiable. The methodology for assigning significance to the impacts assessed further in Section 5 is described as follows. The significance of the environmental and societal impacts were assessed according to pre-defined criteria, which Chrysaor has successfully used in the EIA/ EAs that have supported the three Viking and LOGGS Decommissioning Programmes previously approved by OPRED. The first step is to assign a consequence of environmental and societal impact, based on the criteria presented in Table 3-2. These criteria recognise the likely effectiveness of planned mitigation measures to minimise or eliminate potential impact; as such, they represent an impact where mitigation has been taken into account. Next, a prediction of likelihood is assigned as per Table 3-3; this indicates the frequency of the impact mechanism occurring during the project activities (as opposed to the likelihood of a subsequent impact occurring). The consequence and likelihood criteria are then combined as per Table 3-4, to give an overall risk score. This risk score is compared against the criteria presented in Table 3-5 to give a conclusion regarding significance. In cases where the impact is considered significance, further measures to remove, reduce or manage the impact to a point where the resulting residual significance is at an acceptable level must be adopted and the steps above repeated

Table 3-2 Definition of consequence

Category	Socio-cultural economic impact	Biodiversity impact	Remediation cost	Negative public image exposure
5	- Permanent loss of access or use of area with permanent reduction in associated community; - Major economic impact to surrounding community; Irrevocable loss of culture resources; - Irrevocable loss of culture resources; - Scale typically widespread (national or greater level).	**Very High:**- Catastrophic loss of natural resources or biodiversity typically over a widespread area, with permanent or long-term consequences; and/or - Irrevocable loss of regionally unique habitat, legally designated conservation site or intact ecosystems; - No mitigation possible	<$10,000,000	International Coverage
4	- Permanent partial restriction on access or use, or total restriction >10 years in duration; - Temporary reduction in quality of life >10 years durations; -Harm to cultural resources requiring major mitigation; -Scale typically regional to national level.	**High:** - Persistent environmental degradation within and beyond the project area, typically with prospects of short-to-medium term recovery if the cause of the impact is removed or by natural abatement process and/or; - Serious loss (>50%) of unique habitat or legally designated conservation site or intact ecosystems within area of study; - Mitigation only possible through prolonged and resource intensive effort (>50 years).	$1,000,000 to $10,000,000	National Coverage
3	- Temporary restriction <10 years in duration with a moderate reduction in usage levels or quality of life; - Harm to cultural resources recoverable through moderate mitigation efforts; - Scale typically local to regional level.	**Medium:** - Persistent environmental degradation within and close to the project area, localised within defined areas, typically with prospects of rapid recovery if cause of the impact is removed or by natural abatement processes and/or; - Temporary, but reversible loss (>25% to 50%) of unique habitat or legally designated conservation site or intact ecosystems within area of study; - Moderate mitigation efforts required (>1 to 50 years).	$100,000 to $10,000,000	Regional Coverage
2	- Best restriction <5 years in duration with a minor reduction in usage levels or quality of life; - Minor harm to cultural resources that is recoverable through minor mitigation efforts; - Scale typically localised.	**Low:** - Temporary environmental degradation, typically within and close to project area, with good prospects of short-term recovery; and/or - Brief, but reversible loss (>10% to 25%) of unique habitat or legally designated conservation site or intact ecosystems within area of study; - Minor mitigation efforts required (<1 year).	$10,000 to $100,000	Local Coverage
1	- Restrictions on access without loss of resources; Temporary but fully reversible impacts on quality of life; - Minor impact on cultural resources; - Typically transient and highly localised.	**Negligible:** - Highly transitory or highly localised environmental degradation typically contained within the project area and noticeable/measurable against background only within or in very close proximity to the project area; and/or - Some minor loss (<10%) of unique habitat or legally designated conservation site or intact ecosystems within area of study; - Naturally and completely reversible.	$0 to $10,000	No Outside Coverage

Table 3-3 Definition of likelihood

Likelihood (most likely down to least likely)			
Category	**One-word descriptor**	**Description**	**Quantitative range per year**
5	**Frequent**	- Likely to occur several times a year; - Very high likelihood or level of uncertainty	$<10^{-1}$
4	**Probable**	- Expected to occur at least once in 10 years; - High likelihood or level of uncertainty	10^{-3} to 10^{-1}
3	**Rare**	- Occurrence considered rare; - Moderate likelihood or level of uncertainty.	10^{-4} to 10^{-3}
2	**Remote**	- Not expected nor anticipated to occur; - Low likelihood or level of uncertainty.	10^{-6} to 10^{-4}
1	**Improbable**	- Virtually impossible and unrealistic; - Very low likelihood or level of uncertainty	$<10^{-6}$

Table 3-4 Risk matrix

Risk matrix						
Likelihood	**5**	**II 5**	**II 10**	**III 15**	**IV 20**	**IV 25**
	4	**I 4**	**II 8**	**III 12**	**III 16**	**IV 20**
	3	**I 3**	**II 6**	**II 9**	**III 12**	**III 15**
	2	**I 2**	**I 4**	**II 6**	**II 8**	**II 10**
	1	**I 1**	**I 2**	**I 3**	**I 4**	**II 5**
		1	**2**	**3**	**4**	**5**
		Consequence Category Note: Biodiversity and/or socioeconomic considerations take precedence: for all other factors, worst case score is assumed from severity descriptions				

Table 3-5 Definition of significance

Score	Risk category	Significance
IV: 17-25	**High Risk.** Manage risk utilising prevention and/or mitigation **with highest priority**. Promote issues to appropriate management level with commensurate risk assessment detail.	**Significant**
III: 12-16	**Significant Risk.** Manage risk utilising prevention and/or mitigation **with priority**. Promote issue to appropriate management level with commensurate risk assessment detail.	**Significant**
II: 5-10	**Medium Risk** with controls verified. No mitigation required where controls can be verified as functional.	**Not significant**
I: 1-4	**Low Risk.** No mitigation required.	**Not significant**

3.4 Cumulative Impact Assessment

Although the scope of this impact assessment is restricted to the decommissioning of the Caister facilities as outlined in Section 2.0, it is recognised that the decommissioning work-scope is one part of the Chrysaor's wider SNS Decommissioning Project and the possibility of cumulative impact with other elements of the project exists. The activities will also occur in the context of other oil and gas and non-oil and gas activities, with which there is the potential to interact. To this end, the impact assessments presented in the following sections specifically consider the potential for cumulative impact within the definition of significance.

3.5 Transboundary Impact Assessment

For most potential impacts from decommissioning, the likelihood of transboundary impact is low. However, where impacts on mobile receptors such as marine mammals are of concern, the likelihood of 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.

4.0 Environmental Baseline

The environmental baseline describes the current conditions of the receiving environment within the project area. This informs the potential interactions between project activities and environmental receptors and allows the evaluation of potential impacts discussed in Section 5.

4.1 Summary of Receptors

The baseline environment in the project area is summarised in Table 4-1. For most receptors, the summarised information provided is considered sufficient to inform the environmental assessment of potential impacts within this EA. The receptor identified during the ENVID and during consultation as of interest to stakeholders (seabed and benthic environment) is assessed in more detail in Section 4.2.

Table 4-1 Environmental Baseline Summary

Environmental Receptor	Description
Conservation Interests and sites	
Special Areas of Conservation (SACs)	The closest protected site to the Caister facilities is the Dogger Bank SAC which lies 5 km to the north west. This site is designated for Annex I habitat sandbanks which are slightly covered by sea water all the time. The Southern North Sea SAC is located 10 km south east of the Caister CM platform at its nearest point. This site is designated for the protection of the harbour porpoise. Additionally, the North Norfolk Sand Banks and Saturn Reef SAC is located 54 km south of the platform. This site is designated for the presence of two Annex I habitats: biogenic reefs; and sandbanks which are slightly covered by sea water all the time.
Special Protection Areas (SPAs)	The Flamborough and Filey Coast SPA is the closest SPA, located approximately 162 km from the platform.
Marine Protection Area (MPAs)	The closet MPA to the Caister facilities is the Markham's Triangle MCZ located 26 km to the south east of the Caister CM platform. This site is designated for protected features including subtidal coarse sediments, subtidal mixed sediments, subtidal mud and subtidal sand.
Coastal and Offshore Annex II species most likely to be present in the project area:	
Harbour porpoise	Harbour porpoise are frequently found throughout UK waters. They usually occur in groups of one to three individuals in shallow waters, although they have been sighted in larger groups and in deep water. It is not thought that the species migrates.
Minke whale	Minke whales usually occur in water depths of 200 m or less and occur throughout the North Sea. They are usually sighted in pairs or in solitude; however, groups of up to 15 individuals can be sighted feeding. Minke whales tend to return to the same seasonal feeding grounds.
White-beaked dolphin	White-beaked dolphins are usually found in water depths of between 50 and 100 m in groups of around 10 individuals, although large groups of up to 500 animals have been seen. They are present in UK waters throughout the year, but sightings are more frequent between June and October.
Pilot whale	Pilot whales mostly occur in large pods. The distribution map of pilot whale highlights its deep-water habitat, the species occurring in greatest number to the north of Scotland and south-east of the Faroes as well as along the shelf edge from southern Ireland south to the Bay of Biscay. Sightings peak in the south-west English Channel and North Sea between November and January when pods are frequently seen fishing for mackerel.
Grey seal Harbour seal	As the project area is located approximately 163 km offshore, these species may be encountered in the vicinity from time to time, but the project area is not of specific importance for these species. The presence of grey and harbour seals in the project area is between 0 – 1 individual per 25 km^2 (Jones *et al.,* 2015).
Benthic Environment	
Bathymetry	The Caister CM platform stands in 41 m of water.
Seabed sediments	Seabed surveys of the location described the seabed at Caister as being generally homogeneous, consisting of silty fine to medium sands with shell fragments throughout. All survey stations were classed with EUNIS level 4 category as the habitat 'deep circalittoral sand (EUNIS habitat code A5.27). Occasional boulders were noted in side scan sonar data (Gardline, 2015a).
Benthic fauna	Visible fauna observed throughout stations surveyed (Gardline, 2015a) consisted of; Annelida (Polychaeta including *Oxydromus flexuosus*), Arthropoda (Paguridae), Bryozoa, Chordata (*Limanda limanda, Pleuronectes platessa*), Cnidaria (Hydrozoa) and Echinodermata (Asteroidea including *Asterias rubens*).

	Total hydrocarbon (THC) concentrations ranged from 6.4 µg g^{-1} to 10.6 µg g^{-1} with the highest concentrations being found close to the platform. The threshold for significant environmental impacts (SEI) to macrofauna is 50 µg g^{-1}. There was no conclusive evidence of any Annex I habitats protected under the Habitats Directive (1992). Seven juvenile ocean quahog (*Arctica Islandica*) were found 200 m east of the Caister CM platform (Gardline, 2015b). When found in more extensive aggregations, these species are protected on the OSPAR list of threatened and/ or declining species.

Fish – Spawning and Nursery Grounds

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anglerfish	N	N	N	N	N	N	N	N	N	N	N	N
Blue whiting	N	N	N	N	N	N	N	N	N	N	N	N
Cod	SN	S*N	S*N	SN	SN	N	N	N	N	N	N	N
European hake	N	N	N	N	N	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	SN	SN	SN	SN	N
Lemon sole	N	N	N	SN	SN	SN	SN	SN	SN	N	N	N
Ling	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	SN	S*N	S*N	N	N	N	N	N
Norway lobster	SN	SN	SN	S*N	S*N	S*N	SN	SN	SN	SN	SN	SN
Plaice	SN	S*N	S*N	N	N	N	N	N	N	N	N	SN
Sandeel	SN	SN	N	N	N	N	N	N	N	N	SN	SN
Sole	N	N	SN	S*N	SN	N	N	N	N	N	N	SN
Sprat	N	N	N	N	SN	SN	SN	SN	N	N	N	N
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
Tope shark	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	N	SN	SN	SN	SN	SN	N	N	N	N	N	N

S = Spawning, N = Nursery, SN = Spawning and Nursery; * = peak spawning; Species = High nursery intensity as per Ellis *et al*, 2012; Species = High intensity spawning as per Ellis *et al* (2012); Species = High concentration spawning as per Coull *et al.*, 1998;

Spawning grounds	The project area is located within the spawning grounds of herring *Clupea harengus* (August to November), cod *Gadus morhua* (January to April [peak spawning February – March]), whiting *Merlangius merlangus* (February to June), mackerel *Scomber scombrus* (May to July [peak spawning June-July]), plaice *Pleuronectes platessa* (January to March [peak spawning February-March)], sole *Solea solea* (March to May [peak spawning April]), lemon sole *Microstomus kitt* (April to September), Norway lobster *Nephrops norvegicus* (all year [peak spawning April-June]), sandeel *Ammodytes tobianus* (November to February) and sprat *Sprattus sprattus* (May to August). High intensity spawning occurs for plaice and sandeel. Of the species listed, herring and sandeel spawn demersally (on the seabed).
Nursery grounds	The following species have nursery grounds in the vicinity of the project: anglerfish *Lophiiformes*, cod, lemon sole, ling *Molva molva*, Norway lobster, sprat, whiting *Merlangius merlangus,* tope shark *Galeorhinus galeus*, plaice, sandeel, blue whiting *Micromesistius poutassou*, spurdog *Squalus acanthias*, herring *Clupea harengus*, European hake *Merluccius merluccius*, mackerel *Scomber scombrus* and sole. High intensity nursing occurs for plaice and sandeel.

Seabirds

The project area is important for northern fulmar *Fulmarus glacialis*, northern gannet *Morus bassanus*, great black-backed gull *Larus marinus*, Atlantic puffin *Fratercula arctica*, black-legged kittiwake *Rissa tridactyla*, common guillemot *Uria aalge,* razorbill *Alca torda*, little auk *Alle alle* and black-backed gull *Larus marinus* for the majority of the year.
In Block 44/23, the sensitivity of seabirds to oil is high from November to January and in July. Where data are available, low vulnerability occurs throughout the rest of the year (see table below).

Seabed Oil Sensitivity Index (SOSI)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

44/23	3*	5*	5	5*	5*	5	3	5	5	5*	3*	3
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											

Socio-economic Receptor	Description

Commercial Fishing

ICES divides the North Sea and surrounding waters into fishing areas. The UKCS Block 44/23 lies in ICES statistical rectangle 37F2. Fishing intensity in the project area is moderate in comparison to other areas in the North Sea. The table below describes the fishing effort, the weight and value of fish landed from ICES rectangle 37F2 and UK rectangle (see table below).

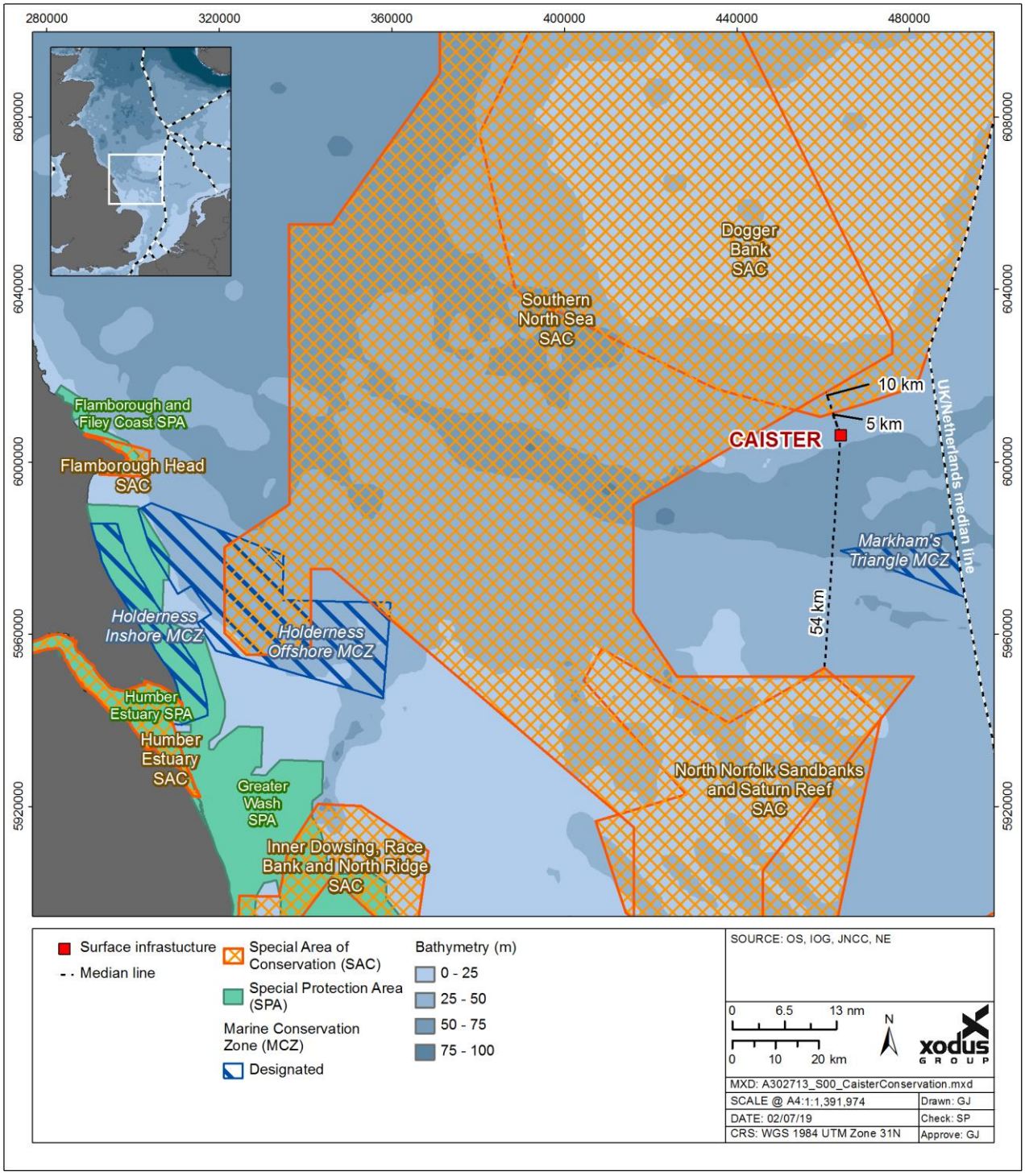
Year	Within ICES Rectangle 37F2			Average Rectangle Values Throughout the UK	
	Total fishing effort (days)	Average value of landings (£)	Average quantity (Te)	Average value of landings (£)	Average quantity (Te)
2014	567	£2,617,039	498	£103,052	108
2015	635	£2,514,490	484	£92,248	88
2016	949	£3,522,308	590	£ 110,594	86
2017	574	£1,756,194	285	£ 108,202	85
2018	224	£658,460	114	£ 113,551	85
Annual average	**590**	**£2,213,698.20**	**394**	**£105,529**	**90**

Scottish Government (2018) data for 2018 for ICES rectangle 37F2 states that 342 tonnes of fish were landed with a value of £658,460. The area is predominantly targeted for demersal and shellfish species with the relative importance of each depending on the conditions each year.
Fishing effort amounted to 224 days in ICES rectangle 37F2 in 2018, and 574 days in 2017. This represents a significant decline in effort compared to the three preceding years, particularly compared to the 949 days spent fishing in 2016. Effort within 37F2 has been recorded as disclosive or no data for most of the winter months each year between 2014 and 2018, indicating very low levels of fishing effort. Fishing effort is generally highest between May and September. Demersal trawls were the most utilised gear type in ICES rectangle 37F2 over all the years.
The value of fish landed from ICES rectangle 37F2 between 2014 and 2018 is above average for the UK.

Other Users

Shipping activity	Block 44/23 has moderate shipping density areas (OGA, 2016).
Oil and Gas	There are numerous offset wells, pipelines and platforms in the region. Third Party installations within 50 km of the CMS field include Trent, Cavendish, Wingate, Tyne, Chiswick, Windermere, Markham, Ketch and Schooner. Windermere, Markham, Ketch, Schooner are currently undergoing Decommissioning Programmes.
Telecommunications	The closest cable to the Caister facilities is the TAMPNET telecommunication cable (active) which passes 7.5 km NW. The MCCS telecommunication cable passes approximately 10 km to the Northwest (KIS-ORCA, 2018). Finally, the BT UK-Germany 6 Seg 4 cable runs 50 km to the Northeast of the Caister facilities.
Military activities	There are no charted military Practice and Exercise Areas (PEXAs). There is a Ministry of Defence submarine exercise area to the south of the Caister facilities.
Renewables	The Hornsea Project Heron East windfarm, which is currently under construction, is located 37 km to the southeast of the Murdoch MD platform (which forms part of the CMS complex). Hornsea Project Three (HOW03) and Hornsea Project Two (HOW02) are located 25 km and 34 km from the platform respectively. Hornsea Project Four (HOW04) is located 57 km from the platform.
Wrecks	There are seven dangerous wrecks close to the project area ranging in distance between 29 and 40 km from the Caister platform.

Figure 4-1 Conservation areas in the vicinity of the Caister platform



4.2 Seabed and Benthic Environment

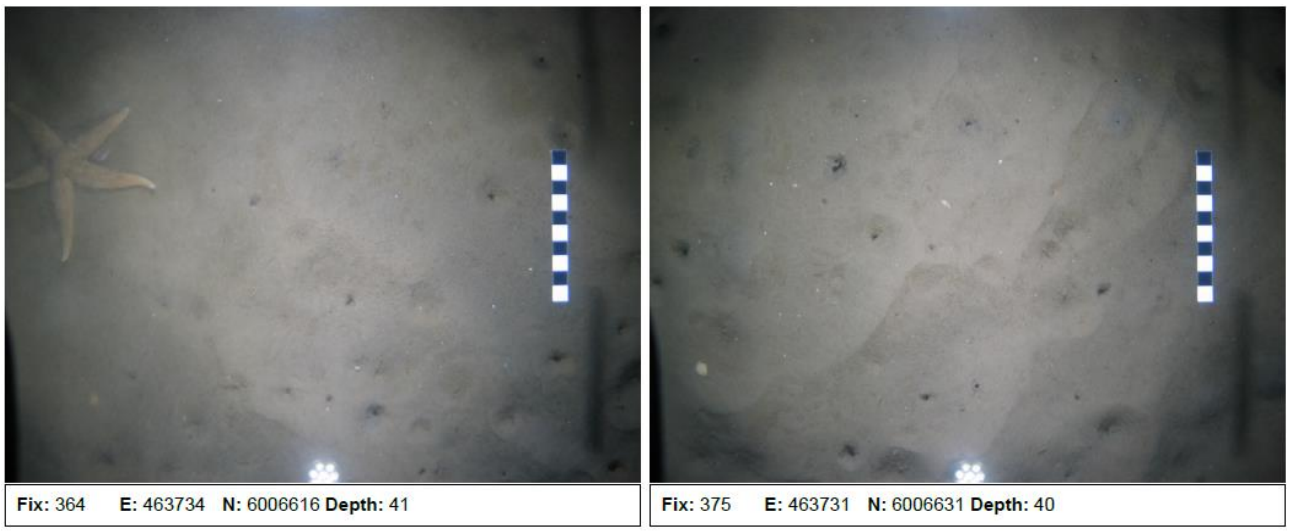
The North Sea is a large shallow sea with a surface area of around 750,000 km^2. The SNS is particularly shallow, with water depths of approximately 50 m or less (DECC, 2009). Benthic sediments in the SNS consist largely of sand or muddy sand, with significant areas of coarse sediment, the latter mostly closer to shore (DECC, 2016; JNCC, 2010). Seabed features in the SNS include active sandbanks and sand waves which are maintained by the tidal and current regimes. All Caister survey stations were categorised within EUNIS Level 4 categories of deep circalittoral

sand (EUNIS habitat type code A5.27). On closer inspection (Gardline, 2015a), the surface sediment at the Caister facilities were found to comprise of fine to medium rippled sand with shells, shell fragments and occasional gravel. This may provide some suitable habitat for spawning fish species found in the area, such as herring and sandeel (Ellis et al., 2012).

Benthic organisms are collectively termed benthos; the term infauna refers to those species living predominantly within the sediment, whilst the term epifauna refers to those species living predominantly on or just above the sediment. The type, diversity and biomass of the benthos is dependent on a number of factors including substrata (e.g. sediment, rock), water depth, salinity, the local hydrodynamics and degree of organic enrichment. From the most recent site-specific survey conducted around the Caister CM platform (Gardline, 2015a) the epifauna was similar at all stations and consisted of sightings of; Annelida (Polychaeta including *Oxydromus flexuosus*), Arthropoda (Paguridae), Bryozoa, Chordata (*Limanda limanda, Pleuronectes platessa*), Cnidaria (Hydrozoa) and Echinodermata (Asteroidea including *Asterias rubens*). There was no conclusive evidence of any Annex I habitats protected under the Habitats Directive (1992). However, seven juvenile ocean quahog (*Arctica Islandica*) were found 200 m east of the Caister CM platform (Gardline 2015b). The ocean quahog is a bivalve that can be found from just below the low water level to depths of about 500m. They live buried in sand and muddy sand, often with their shells entirely hidden with a siphon extending up to the surface of the seabed for feeding, breathing and to expel waste. When found in more extensive aggregations, these species are protected on the OSPAR list of threatened and/ or declining species (JNCC, 2019).

The Caister facilities are located 5 km from the boundary of the Dogger Bank SAC but exhibit different seabed characteristics. Gardline (2015a) surveys also collected data from Chrysaor's Murdoch Hub, 11 km to the north west, which is located within the Dogger Bank SAC. All survey stations at the Murdoch Hub are characterised within the two EUNIS level 4 categories of circalittoral coarse sediment and circalittoral fine sand (EUNIS habitat type codes A5.14 and A5.25 respectively) and exhibit more variation than the seabed at the Caister CM platform. This is in accordance with previous EUNIS habitat classification conducted for the Dogger Bank in the same area (JNCC, 2009). Despite the proximity of the Murdoch Hub and the Dogger Bank SAC, the seabed surrounding the Caister CM platform exhibits a different, more homogeneous seabed. Figure 4-2 provides an example of the seabed imagery collected on the Gardline (2015a) surveys from a station 500 m west-northwest from the Caister CM platform.

Figure 4-2 Example seabed imagery from a station 500 m WNW of the Caister platform.
Note: The left-hand image shows the starfish *Asterias rubens*



5.0 Impact Assessment

A scoping study (Section 3.1) has identified those impacts deemed to be significant and those eligible to be scoped out of impact assessment. The impact considered to be of significance, namely seabed interaction (Section 5.1) is addressed below in further detail alongside any mitigation measures in place.

5.1 Seabed Disturbance

This section discusses the potential short and long-term environmental impacts associated with seabed disturbance resulting from the proposed Caister decommissioning activities. To properly understand and assess the impacts of the proposed decommissioning activities on the seabed and environmentally important features, the area of potential disturbance – the footprint, must be quantified with the receiving environment understood. Areas where decommissioning activities overlap have been considered, ensuring that the extent of impact is not unrealistically overestimated.

5.2 Potential sources of seabed disturbance

The Caister decommissioning activities will require work below, at or near the seabed, which may result in either short-term or long-term disturbance to the seabed sediments and marine organisms. The longevity of any disturbance and the associated environmental impact is outlined in Table 5-1, which indicates that most impacts are expected to be short-term and low impact in nature. The installation of stabilisation material (rock-placement) presents a long-term, permenant impact on the seabed structure and habitats. This is presented in line with the potential that rock stabilisation may be required for the safe locating of the jack-up AWV.

Table 5-1 Summary of potential sources of seabed disturbance and resultant environmental impacts

Activity	Source of disturbance	Environmental Impact (Risk)				
		Suspended Sediments impact on fauna	Release of contaminants impact on fauna	Burial and Smothering impact on fauna	Change in seabed Habitat	Impact on the Dogger Bank SAC
Vessel Activity	Installation of spudcans on the seabed (AWV)	Short-term	Short-term	Short-term	Short-term	Short-term
		Negligible	Negligible	Negligible	Negligible	Negligible
		Probable	Probable	Probable	Probable	Improbable
	Installation of rock-placement for vessel stabilisation (AWV)*	Short-term	Short-term	Short-term	Long-term	No impact
		Negligible	Negligible	Negligible	Low**	Negligible
		Probable	Probable	Probable	Probable	Improbable
	Anchoring of HLV	Short-term	Short-term	Short-term	Short-term	No impact
		Negligible	Negligible	Negligible	Negligible	Negligible
		Probable	Probable	Probable	Probable	Improbable
Jacket Removal Activity	Cutting of piles	Short-term	Short-term	Short-term	Short-term	No impact
		Negligible	Negligible	Negligible	Negligible	Negligible

Activity	Source of disturbance	Environmental Impact (Risk)				
		Suspended Sediments impact on fauna	Release of contaminants impact on fauna	Burial and Smothering impact on fauna	Change in seabed Habitat	Impact on the Dogger Bank SAC
		Probable	Probable	Probable	Probable	Improbable
	Removal of subsea template	Short-term	Short-term	Short-term	Short-term	No impact
		Negligible	Negligible	Negligible	Negligible	Negligible
		Probable	Probable	Probable	Probable	Improbable
	Cutting of riser sections	Short-term	Short-term	Short-term	Short-term	No impact
		Negligible	Negligible	Negligible	Negligible	Negligible
		Probable	Probable	Probable	Probable	Improbable
Post-decommissioning overtrawl of the 500m safety exclusion zone* **		Short-term	Short-term	Short-term	Short-term	No impact
		Negligible	Negligible	Negligible	Negligible	Negligible
		Rare	Rare	Rare	Rare	Improbable

Note: Impacts have been defined using the environmental significance in section 3.3. Low significance items are highlighted in green. Medium significance items are highlighted in yellow.
*Rock is considered here with regard to any cumulative impact.**low ranking based on extent of habitat loss.***Visual surveys and removal/ overtrawl of individual obstructions will be used if required. Overtrawl of the entire 500 m safety exclusion zone is considered here as a worst-case scenario.

Vessel Activities

A HLV will be in position adjacent to the Caister CM platform during removal operations. Although it is anticipated that the vessel will use DP to maintain position, anchors may required for positioning. As there may be a seabed impact from the vessel's anchors and anchor chains, this scenario is presented here as a worst-case scenario. Table 5-1 outlines the potential disturbance associated with the vessel positioning (two deployments of the anchors/ spudcans). As a worst-case scenario, the length of each chain is assumed at 250 m.

The AWV will be in position adjacent to the Caister platform throughout decommissioning operations and up to four spud cans may be used to support the vessel on the seabed. The spudcans would be estimated to impact a maximum area of 120 m^2 of seabed (approximately 40 m^2 per spud can). Whilst there will be no requirement for rock placement underneath the spud cans, it is possible that stabilising rock may be required to be placed on the seabed to provide stabilisation for the vessel when working at the platform location. This stabilisation material, which is considered as a contingency only, will be approximately 1,000 tonnes of clean gravel or rock (size ranging from 5 to 20 cm in diameter) and will be placed immediately around the spud cans by a fall pipe vessel. Such rock placement will only be enacted in the event that the seabed surface is not stable enough to secure the spudcans. The worst-case deposits profile suggests a total area of approximately 1,100 m^2 (275 m^2 per spud can) would be directly affected by rock placement activities the Caister CM platform.

Jacket Removal Activities

As the weight (in air) of the Caister CM jacket is <10,000 Te, it falls within the OSPAR 98/3 category of steel structures for which derogation cannot be sought. Therefore, the only option available for

this platform is full removal. The subsea template will also be removed in conjunction with jacket removal activities.

The piles on the jacket and drilling template will be removed to approximately 3 m below the seabed and should be suitable for removal via internal cutting methods. However, access will only be confirmed when internal camera inspections are completed and external excavation of the piles to allow external cutting may still be required. If internal cutting is possible, the piles will be cut from within using a high pressure abrasive water jet cutter, with garnet as the abrasive. Should this method be used, this will result garnet settling on the seabed. Chrysaor estimates the garnet use to be circa 20 Te based on 5 Te per leg cut. If the internal cutting operations encounter problems, excavation of an area around each jacket pile may be required to permit external cutting. During excavation, sediment would be removed by a mass-flow excavator and would be deposited down-current of the jacket piles to undergo natural dispersal with minimal/ short-term impact on surrounding seabed area. The garnet deposit would be located within the excavation footprint of the jackets therefore it has not been considered as a separate impact event. Excavation of the footings has therefore been considered as a worst-case scenario. This seabed disturbance will be further assessed and permitted via the Portal Environmental Tracking System (PETS) process in the form of a marine licence. Excavation of the jacket members, drilling template and associated risers would impact a maximum seabed area of approximately 0.001 km^2 (Table 5-2). Due to the close proximity of these various excavations it is likely that these disturbances to the seabed will overlap to a considerable degree. This footprint is therefore an overestimate.

Table 5-2 Structures and materials with the potential to impact on the seabed as part of Caister decommissioning activities

Decommissioning Activity	Source of Disturbance	Description of Disturbance	Marine Licensable Category	Seabed Impact (km^2)
HLV Activities*	Anchoring	(9 m^2 x 4 anchors) x 2	Temporary Deposits	0.00007
	Anchor chains	(250 m with lateral movement of 2 m) x 4 chains x 2	Temporary Deposits	0.004
AWV Activities**	Installation of rock-placement for vessel stabilisation	275 m^2 x 4 spud cans	Permanent Deposits	0.001
Installation Removals Activities	Sand deposits from soil plugs within piles	It is assumed that all piles are filled with soil.	Permanent Deposits	N/A
	The temporary placement on the seabed of debris baskets	4 placements	Temporary Deposits	0.000065
	Cutting and excavation of jacket piles***	154 m^2 x 4	Removal of Articles from the Seabed	0.0006
	Cutting and excavation of template piles***	154 m^2 x 3	Removal of Articles from the Seabed	0.0005
	Removal of the template	9 m x 9 m	Removal of Articles from the Seabed	0.00008
	Cutting of riser sections	15 m x 5 m	Removal of Articles from the Seabed	0.000075
	Marine growth removal	6 m^3 surface area of marine growth per leg to be removed	Permanent Deposits	N/A

Decommissioning Activity	Source of Disturbance	Description of Disturbance	Marine Licensable Category	Seabed Impact (km^2)
Total impact				**0.006**
Post-decommissioning overtrawl of the 500m exclusion zone****				**0.79**

*It is anticipated that DP will be used by the HLV. Anchoring activities are included here as a worst-case scenario. **Spudcans are not included as an impact as the placement of rock stabilisation material on the seabed would represent the worst-case scenario. Rock placement is also considered here for the purposes of assessing cumulative impact. *** Based on worst-case of external excavation. ****Considered to overlap all other activities. Visual surveys and removal/ overtrawl of individual obstructions will be used if required. Overtrawl of the entire 500 m safety exclusion zone is considered here as a worst-case scenario.

The potential area of seabed affected by operations amounts to approximately 0.006 km^2 (Table 5-2). This is the worst-case area of seabed disturbance assuming no overlap of seabed impacts caused by the decommissioning activities listed in Table 5-1. In the event of a complete overtrawl (rather than visual) survey of the 500 m safety exclusion zone, the area of impact would be approximately **0.79 km^2**.

5.2.1 Short-term impacts on sensitive receptors

Short-term disturbance impacts are those where recovery to the environment is expected to take place within 1 year without remediation. Most of the proposed decommissioning activities will be transient and will have a short-term impact on the local benthic environment in the Caister facilities (Table 5-1). The likely impacts arising from these activities can be summarised as sediment and fauna disturbance. Any impacts on the Dogger Bank SAC have been ruled out of futher consideration due to the improbability of any of the decommissioning work adjacent to the Caister platform impacting the seabed within the SAC (Table 5-1).

Sediment Disturbance

Throughout the Caister CM survey area (Gardline, 2015a) the seabed was featureless, with the exception of occasional boulders with a maximum height of 0.5 m and the presence of the rock-covered 16" pipeline (PL935). The surface sediment at the survey area comprised fine to medium rippled sand with shells, shell fragments and occasional gravel and was well sorted (Gardline 2015b). The seabed within the whole area surveyed around Caister CM was categorised as the habitat 'deep circalittoral sand' (EUNIS habitat type code A5.27) indicating a homogeneous seabed environment (Gardline, 2015a).

The activities at the Caister CM platform will lead to some degree of disturbance of seabed sediment with associated increases in suspended solid concentrations in the water column and on the seabed, with the potential to change the physical-chemical characteristics of the seabed. This will be temporary in nature. Sediments that are redistributed and mobilised as a result of the proposed decommissioning activities will be transported by the seabed currents before settling out over adjacent seabed areas. The marine environment in the SNS is dynamic in nature, with wave energy at the seabed shown to be between 0.21 – 1.2 N/m^2 and increasing above 1.2 N/m^2 towards shore (McBreen et al., 2011). The dynamic environment will result in suspended sediment, in particular any fines, being transported away from the source of the disturbance. The natural settling of the suspended sediments is such that the coarser material (i.e. the sands which characterise the area around the Caister CM platform) will quickly fall out of suspension with the finer material being the last to settle. This natural process will ensure that all the suspended sediment is not deposited in one location. Based on the mobility of the seabed in the area (Thompson et al., 2011, McBreen et al., 2011), as indicated by the lack of drill cuttings piles around wellheads within the nearby Dogger Bank SAC (Gardline, 2015a), the the physical sediment disturbance resulting from the

decommissioning activities is therefore likely to be comparable to the background sediment redistribution processes.

A recent study by Cotterill, et al. (2018) however, found that the nearby Dogger Bank sub-units are composed of generally stiff to very stiff clays, with multiple sand-rich layers. Although this is described as a high energy area, the presence of stiff clays below the unconsolidated surface layers could result in a higher degree of seabed disturbance and longer recovery time where decommissioning activities (e.g. anchoring) interact with the clay layers. Studies carried out on the physical impacts to the seabed caused by towed fishing gear (e.g. Løkkeborg, 2005), which could be likened to anchoring activities, indicate that the longevity of the physical scars in the seabed left in the wake of towed gear depends on the sediment type and the energy of the local seabed environment. A clay substrate is presented here as a worst-case scenario and in all likelihood the substrate will be more of a sandy composition, as identified in the Gardline (2015a) survey.

In such a high energy area, the expected sediment recovery time from dredging activities is approximately a year (Hill et al., 2011). For example, areas of dredging on sandbanks which are subject to naturally high sediment mobility may disappear within a few tidal cycles (Hill et al., 2011). Published calculations of wave and tidal current-induced bed shear stress, clearly show that the large waves have the capability to mobilise seabed sediments, increasing sediment suspension particularly for those sizes of coarse sands and smaller (ABPmer, 2010). As described in Section 4.3, the Caister CM platform area is characterised by sand (Gardline, 2015a) and falls within the relatively dynamic sandbank environment of the SNS.

Fauna Disturbance

Seabed disturbance can present a risk to fish and shellfish species which use the seabed for spawning and/or nursery grounds. According to Ellis et al., 2012, low intensity herring spawning is likely to occur within UKCS Block 44/23 (Table 4-1). Herring spawn is usually deposited demersally, on marine vegetation or on a substrate with a high percentage of gravel and a low fine sediment component (e.g. Maravelias et al., 2000; Ellis et al., 2012). Based on the patches of gravelly/ shelly substrate identified around the Caister platform it is possible that small-scale herring spawning grounds could be present. It is thought that remote and historic spawning grounds (such as those on parts of the Dogger Bank and around the Caister platform) currently have no, or very little, spawning activity, and that most current important spawning grouds have been identified in high-energy coastal locations (Ellis., et al 2012) . Nevertheless, it should be recognised that spawning grounds can be 'recolonised' over time (e.g. Corten, 1999).

As shown in Table 4-1 there is the potential for demersal species such as sandeel and plaice to be present within the Caister facilities over the duration of the planned operations; however, considering that the Caister facilities are located 163 km from shore and that the preference for plaice nursery grounds are sandy beaches and coastal estuaries, plaice are unlikely to be found within the Caister facilities. Sandeels may use the area for nursery during the period of operations (Ellis *et al*, 2012) however the duration of the operations will be short, occurring within the 500 m safety exclusion zone that has already been subject to disturbance. Given the very localised area of decommissioning activities and the transient nature of the disturbance to benthic sediments in this naturally energetic area with very good recovery potential, the disturbance to fish and shellfish is not expected to be significant.

The operations could have an impact on any demersal fauna, including ocean quahog juveniles identified in the Gardline (2015b) survey, 200 m east of the Caister CM platform. Ocean Quahog (where found in aggregations) are protected within Marine Protected Areas (MPAs) in the North Sea under OSPAR (1992) Annex V '*on the protection and conservation of the ecosystems and biological diversity of the maritime area*.' It is possible that disturbance to individual ocean quahog (and to other

benthic species) will occur, however, the disturbance associated with the removal of the Caister CM jacket is not expected to significantly affect the population(s) in this area as a whole.

Although operations will be undertaken near the Dogger Bank SAC, it is considered that this is a very small area compared to other areas of similar habitat available within the region. The area is unlikely to be used by benthic spawners during the proposed operational period (April to June) and no evidence of Annex I habitats has been found in recent surveys in the Caister facilities (Gardline, 2015a). Furthermore, due to the dynamic nature of the SNS, benthic species are well adapted to a dynamic seabed environment. It is therefore considered that seabed disturbance from the proposed operations will recover quickly and will not result in a significant environmental impact.

5.2.2 Long-term impacts on sensitive receptors

The introduction of of approximately 0.001 km^2 of new hard substrate in the form of rock-placement would have a permenant but very localised impact on the surrounding environment, and has therefore been assigned a medium level of impact (Table 3-5).

The proposed decommissioning activities will cause some direct impact to fauna living on and in the sediments. Mortality is more likely in non-mobile benthic organisms, whereas mobile benthic organisms are more sparsely distributed and may be able to move away from the area of disturbance. Whilst the introduction of a new substratum into the area may be influenced by scour from tides and mobile sediments and it may even become partially buried in places from time to time, it is likely that parts of it will eventually support a low-diversity epifaunal community similar to that present on naturally occurring stones and boulders in the area. This will occur as a result of natural settlement by larvae and plankton and through the migration of animals from adjacent undisturbed benthic communities (Dernie *et al*., 2003). In a series of large-scale field experiments, Dernie *et al*., (2003) investigated the response to physical disturbance (sediment removal down to 10 cm) of marine benthic communities within a variety of sediment types (clean sand, silty sand, muddy sand and mud). Of the four sediment types investigated, the communities from clean sands had the most rapid recovery rate of between 0.45 – 0.6 individuals per day following disturbance.

The operations could have an impact on any benthic fauna, such as the ocean quahog juveniles identified in the Gardline (2015b) survey. Ocean quahog (where found in aggregations) are protected within Marine Protected Areas (MPAs) in the North Sea under OSPAR (1992) Annex V '*on the protection and conservation of the ecosystems and biological diversity of the maritime area*.' However, given the localised nature of the individuals observed during the Gardline (2015) the disturbance associated with the removal of the Caister CM jacket is not expected to significantly affect the population(s) in this area as a whole.

Survey work (Gardline, 2015a) has indicated that the benthic community here is characterised by Annelida (Polychaeta including *Oxydromus flexuosus*); Arthropoda (Paguridae); Bryozoa; Chordata (*Limanda limanda*, *Pleuronectes platessa*), Cnidaria (Hydrozoa) and Echinodermata (Asteroidea including *Asterias rubens*). The introduction of the proposed rock will cover a very small area (0.001 km^2) and will not change the character of the species typically present in the area as a whole.

5.2.3 Cumulative impact

Note: This section outlines the seabed footprint related to potential cumulative impact. It describes project activities, those associated with Chrysaor's wider SNS decommissioning activities, and those outwith the control of Chrysaor (e.g. other oil and gas activity). The activities undertaken during the Caister platform decommissioning are not anticipated to have any impact on any nearby SACs, including the Dogger Bank SAC.

Considering Chrysaor's SNS decommissioning activities will extend over a ten-year period and could see some infrastructure left *in situ* for the longer-term, stakeholders expressed concern over the potential cumulative impact. Considering the temporal scale and the nature of the proposed activities, along with the other potential activities occurring within the protected sites, stakeholders raised concern around the potential impact on the integrity of the protected sites. Chrysaor's current and planned decommissioning projects are located outwith any protected areas. However, given the proximity to the Dogger Bank SAC (5 km from the Caister CM platform), there is likely to be consistency in sediment type between the Caister Decommissioning area and this SAC, therefore cumulative impacts on these protected areas have been assessed.

Well P&A activities at Caister will include the deployment of a drill rig vessel and seabed stabilisation for safe locating of the drilling rig in the Caister Decommissioning area. The footprint of well P&A activities will be 0.0034 km^2. This is based on three spud cans, associated anchors/chains arrangement for the drilling rig, contingency rock placement and conductors footprint.

Cumulative Impact on the Dogger Bank SAC

Future decommissioning work in the Chrysaor CMS area, in particular around the Murdoch Hub, will also have an impact on the Dogger Bank SAC, located 5 km from the Caister CM platform, which is protected for the Annex I habitat '*Sandbanks which are slightly covered by sea water all the time*'. The Dogger Bank SAC is the largest sandbank in offshore waters and is home to a number of oil and gas fields that went into production prior to its designation as a SAC in 2017 and are now ready for decommissioning. Currently, 13 installations, 40 wells and 457.7 km of pipeline are due for decommissioning. The Dogger Bank SAC also encompasses four proposed offshore windfarm sites.

All current and future oil and gas decommissioning activities are expected to have an impact of approximately 20.48 km^2 and the proposed windfarms are expected to impact an area of 18.0 km^2. In total, this would account for approximately 0.3% of the total area of the Dogger Bank SAC (12,331 km^2; BEIS, 2019b). Given the small area of impact, Chrysaor do not anticipate that the current and future work on the Dogger Bank SAC will have an adverse effect on its integrity.

The HRA has been conducted with the best available information at the time of writing, any changes to the proposed decommissioning activities or scientific knowledge will require a review of this assessment.

Cumulative Impact Summary

It is recognised, however, that it is not only other Chrysaor activities or decommissioning activities of other operators that could act cumulatively with the proposed activities – indeed, any other licensable activities which could interact with the seabed require consideration. This includes other oil and gas activity aside from decommissioning, aggregate extraction, and renewables development. For most of these projects it is not possible to state whether there will be long term impacts from infrastructure being left *in situ*, since the projects are not at the stage of making such decisions.

The Caister CM Platform Decommissioning operations are completely outside any SACs. There are not envisaged to be any direct impact to any of the designated sites in the SNS, however, given the proximity to the Dogger Bank SAC (5 km), the sediments and habitats present at Caister are likely to be consistent to that of the Dogger Bank SAC. Following assessment and given the highly localised nature of the Decommissioning activities, there will be no risks to the integrity of the Dogger Bank SAC from these operations.

5.2.4 Transboundary impact

The Caister CM decommissioning activities are located approximately 18 km east of the UK/Netherlands median line. Decommissioning activities are not anticipated to create any transboundary impacts with regards to seabed.

5.2.5 Control and mitigation measures

Seabed disturbance has been investigated further as a potential impact given the proximity to the sensitive seabed habitats of the Dogger Bank SAC (5 km) and the Southern North Sea SAC (10 km). The following measures have been or will be taken in order to reduce as far as possible potential impacts on the environment from the various decommissioning activities:

- Pre-decommissioning seabed surveys have been undertaken to identify the habitats and species present across the local area;
- Survey data collected in the area has been reviewed for potential sensitive habitats of seabed and mitigated against as appropriate.
- Stakeholder consultation has been conducted to identify areas of stakeholder concern and draw on a wide expertise with regard to potential sensitivities;
- Cutting and lifting operations will be controlled by ROV to ensure accurate placement of cutting and lifting equipment and minimise any impact on seabed sediment;
- The requirements for further excavation will be assessed on a case-by-case basis and will be minimised to provide access only where necessary. Internal cutting will be used preferentially where access is available;
- HLVs are likely to be equipped with dynamic positioning (DP) rather than relying on anchors to remain in position which interact with the seabed. By using vessels equipped with DP for lifting, seabed impact will be reduced;
- Implementation of the Chrysaor's EMS; and
- Visual surveys of the seabed where possible to locate obstructions and to localise (and minimise) any post-decommissioning overtrawl surveys that may be required.

5.2.6 Residual impact

The residual impact to seabed habitat and benthic communities due to the planned decommissioning activities is summarised in Table 5-3.

Table 5-3 Residual impact to seabed habitat and benthos

Receptor	Consequence	Likelihood	Ranking
Sessile seabed organisms	Negligible	Probable	Low Risk
Mobile organisms	Negligible	Probable	Low Risk
Seabed habitat	Low	Probable	Medium Risk
Dogger Bank SAC	Negligible	Improbable	Low Risk
Rationale			
• Decommissioning activities at the Caister CM facilities will cause a physical disturbance to the local seabed environment due to subsea infrastructure removal. Physical disturbance not including overtrawl surveys is predicted to be limited to 0.006 km^2. Recovery of the benthic			

community is predicted to be relatively quick due to the activities being in a high energy environment combined with the limited spatial and temporal scale of impact. On this basis the consequence, to mobile and sessile benthic organisms is considered to be low. • The decommissioning activities will also cause direct habitat loss and habitat change due to the remaining footprint of subsea infrastructure and rock placement introducing hard substrata to the seabed. Additional rock placement will add approximately 0.001 km^2 of new hard substratum. Whilst this will be influenced by scour from tides and mobile sediments and may even become partially buried in places from time to time, it is likely that it will eventually support a low-diversity epifaunal community typical of that already present in the area. • Visual surveys of the seabed where possible to locate obstructions and to localise (and minimise) any post-decommissioning overtrawl surveys that may be required, preventing damage to any sessile benthos such as the ocean quahog. • Given the distance to the adjacent Dogger Bank SAC (5 km) and the localised nature of the Caister CM decommissioning activities, it is very unlikely that they will have any influence on the seabed habitats and benthos of this protected area. • The Southern North Sea SAC is located 10 km from the Caister CM platform. The noise disturbance generated during decommissioning activities will be localised and therefore is unlikely to impact harbour porpoise in this SAC. • As the decommissioning activities are planned to occur in the near-future, therefore the likelihood of impact occurring is considered frequent for all receptors. Combining the consequence and likelihood rankings, the risk significance is defined as medium and thus not significant.	
Risk significance	**Impact significance**
Medium	Not significant

6.0 Conclusions

Following review of the project activities, the environmental sensitivities of the project area, industry experience with decommissioning activities and of stakeholder concerns, it was determined that assessment of seabed disturbance was required to define the potential impact of decommissioning activities:

Seabed disturbance was investigated further as a potential impact due to the proximity to the sensitive seabed habitats of the Dogger Bank SAC and the Southern North Sea SAC. Of key importance is the short-term recovery of habitats and benthos following sediment temporary sediment movement and the potential long-term recovery rate of the seabed from the potential installation of rock placement/ stabilisation structures.

Having reviewed the project activities and having taken into consideration that the activities are outwith any areas of conservation, are in a high energy environment, are very localised and the natural dynamics such as transportation and backfill, as well as the undertaking of mitigation to limit this impact, there is not expected to be a significant impact on the seabed environment.

A review of the potentially significant environmental impacts has been completed and, considering the mitigation measures that will be built into the project activities (and will be captured in Chrysaor's Environmental Aspects Register), there is expected to be no significant impact on receptors. As part of this review, cumulative and transboundary impacts were assessed and determined to be not significant.

Chrysaor has also considered the objectives and marine planning policies of the East Inshore and East Offshore Marine Plans across the range of policy topics including biodiversity, natural heritage, cumulative impacts and oil and gas. Chrysaor considers that the proposed decommissioning activities are in broad alignment with such objectives and policies.

In summary, the proposed operations have been rigorously assessed resulting in a set of selected decommissioning options which are thought to present the least risk of environmental impact whilst satisfying safety risk, technical feasibility, societal impacts and economic requirements. Based on the findings of this EA and the identification and subsequent application of the mitigation measures identified for significant environmental impacts (which will be managed through the Chrysaor EMS), it is concluded that the proposed activities will result in no significant environmental impact.

7.0 References

ABPmer Ltd (2010). A Further Review of Sediment Monitoring Data. Commissioned by COWRIE Ltd (project reference ScourSed-09).

Anatec (2019a). Vessel Traffic Survey – Cms Area Decommissioning. Rev A1

Anatec (2019b). Navigational Risk Assessment – CMS Area Decommissioning. Document Number ANA-SNS-C-XX-X_HS-91-00001

Anthony, T.G., Wright, N.A. and Evans, M.A. (2017). Review of diver noise exposure. Prepared by QinetiQ for the Health and Safety Executive. Research Report No. RR735.

BEIS (2019a). 2017 UK Greenhouse Gas Emissions, Final Figures. Statistical Release: National Statistics. Online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776085/2017_Final_emissions_statistics_-_report.pdf

BEIS (2019b). Record of the Habitats Regulations Assessment undertaken under Regulation 5 of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (As Amended). Dogger Bank SAC Oil and Gas Decommissioning Strategic HRA.

BEIS (2018). Decommissioning of Offshore Oil and Gas Installations and Pipelines – Guidance notes. Online at: https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines

BMT Cordah (2016). Lincolnshire Offshore Gas Gathering System (LDP2, LDP3, LDP4 and LDP5) Pipeline Burial and Stabilisation Material Report. Document Number: BMT-SNS-L-XX-P-HS-02-00001. Revision Control: Rev C1.

Centrica (2017a). A-Fields Decommissioning. Ann and Alison Fields. Environmental Impact Assessment. Online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/623813/Ann_and_Alison_Environmental_Impact_Assessment.pdf [Accessed 12/06/2019].

Centrica (2017b). A-Fields Decommissioning. Saturn (Annabel) and Audrey Fields Environmental Impact Assessment. Online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/642132/Saturn__Annabel__and_Audrey_Fields_EIA.pdf [Accessed 12/06/2019].

Chrysaor (2019a). Caister Decommissioning Programmes CDP1a. Revision 3.

Chrysaor (2019b). LOGGS Area Decommissioning: Environmental Appraisal LOGGS Decommissioning Programme LDP2 - LDP5

ConocoPhillips (2017a). LOGGS Satellites Vulcan UR, Viscount VO, Vampire OD & Associated Infield Pipelines. Document No. COP-SNS-L-XX-X-PM-12-00001.

ConocoPhillips (2017b). Commercial Fisheries Baseline Characterisation: LOGGS South, LOGGS North and CMS Areas. Report No. BMM-SNS-P-XX-S-HS-02-00001.

ConocoPhillips (2015). SNS Phase 1 Decommissioning Programme. Environmental Statement for the SNS Decommissioning Project: Viking 1 and LOGGS LDP1. September 2015. Revision C3. Report No. BMT-SNS-P-XX-X-HS-02-00006.

ConocoPhillips (2018). SNS Decommissioning Programme. Environmental Assessment for the SNS Decommissioning Project: Viking VDP2 and VDP3. November 2018. Revision C2. Report No. BMT-SNS-V-XX-X-HS-02-00003.

Corten, A. (1999). The reappearance of spawning Atlantic herring (Clupea harengus) on Aberdeen Bank (North Sea) in 1983 and its relationship to environmental conditions. Canadian Journal of Fisheries and Aquatic Sciences, 56: 2051–2061.

Cotterill, C. J, Phillips, E. James, L. Forsberg, C. F. Tjelta, T. I. Carter, G. and Dove, D. (2018). The evolution of the Dogger Bank, North Sea: A complex history of terrestrial, glacial and marine environmental change. Quaternary Science Reviews, 171, Pages 136-153.

DECC (2009). UK Offshore Energy Strategic Environmental Assessment. Future leasing for offshore wind farms and licensing for offshore oil and gas storage. Environmental Report. Online at https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-oesea [Accessed 11/09/2019].

DECC (2011). Guidance notes. Decommissioning of offshore oil and gas installations and pipelines under the Petroleum Act 1998. Version 6. March 2011.

DECC (2016). UK Offshore Energy Strategic Environmental Assessment 3. UK offshore waters and territorial waters of England and Wales. Online at https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3-oesea3 [Accessed 11/09/2019].

Decom North Sea (2018). Environmental Appraisal Guidelines. Available at: http://decomnorthsea.com/about-dns/projects-update/environmental-appraisal-guidelines [Accessed 11/09/2019].

DEFRA (Department for Environment Food & Rural Affairs, (2010). UK Ship Emissions Inventory Final Report. Entec. Available online http://naei.beis.gov.uk/reports/reports?report_id=636.

DEFRA (2017). Holderness Offshore rMCZ Post-survey Site Report. Contract Reference: MB0120. Report Number: 44, Version 4.

DEFRA (2019). Holderness Offshore Marine Conservation Zone: factsheet. Available at: https://www.gov.uk/government/publications/marine-conservation-zones-holderness-offshore [Accessed 11/09/2019].

Dernie, K. M., Kaiser, M. J., and Warwick, R. M. (2003) Recovery rates of benthic communities following physical disturbance. *Journal of Animal Ecology*, 72(6), 1043-1056.

DTI, (2001). Report to the Department of Trade and Industry. Strategic Environmental Assessment of the Mature Areas of the Offshore North Sea SEA 2. Consultation Document.

Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N. and Brown, M. (2012). Mapping the spawning and nursery grounds of selected fish for spatial planning. Report to the Department of Environment, Food and Rural Affairs from Cefas. Defra Contract No. MB5301.

Forewind (2013). Dogger Bank Creyke Beck Environmental Statement. Prepared by Royal Haskoning. Published August 2013.

Fugro (2017). Debris Clearance Survey Caister CM OD. June 2017. Fugro Report No.: 175351.13V13.1.

Gardline (2015a). SNS Decommissioning Survey Caister Murdoch System (Murdoch Hub and Caister CM). Habitat Assessment Report. August 2015. Report No. 10554.1.

Gardline (2015b). SNS Decommissioning Survey Caister Murdoch System (Murdoch Hub and Caister CM). Pre-decommissioning Survey Report. August 2015. Report No. 10554.2.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J. and Øien, N. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Available at: https://synergy.st-andrews.ac.uk/scans3/files/2017/05/SCANS-III-design-based-estimates-2017-05-12-final-revised.pdf [Accessed 12/06/2019].

Hill, J. M., Marzialetti, S. and Pearce, B. (2011). Recovery of Seabed Resources Following Marine Aggregate Extraction. Marine ALSF Science Monograph Series No. 2. MEPF 10/P148. (Edited by R.C. Newell & J. Measures). 44pp. ISBN: 978 0 907545 45 3.

Health & Safety Executive (1997). The abandonment of offshore pipelines: Methods & procedures for abandonment. Offshore technology report. HSE Books, Norwich. ISBN:7176-1421-2.

IUCN (2019). The IUCN Red List of Threatened Species. Online at https://www.iucnredlist.org/resources/grid

JNCC (2019) Ocean quahog. Online at http://archive.jncc.gov.uk/default.aspx?page=5661

JNCC (2010). UKSeaMap – Predictive mapping of seabed habitats. Online at http://jncc.defra.gov.uk/page-5534

JNCC (2009). Understanding the marine environment – seabed habitat investigations of the Dogger Bank Offshore draft SAC. Online at http://nora.nerc.ac.uk/id/eprint/11742/1/JNCCreport429.pdf

JNCC and DEFRA (2012). UK Post-2010 Biodiversity Framework. Online at https://jncc.gov.uk/our-work/uk-post-2010-biodiversity-framework/

Jones, E., McConnell, B., Sparling, C and Matthiopoulos, J. (2015). Marine Mammal Scientific Support Research Programme MMSS/001/11. At-sea usage and activity. Available at: http://www.smru.st-andrews.ac.uk/files/2015/10/MR5-1_at-sea_usage_and_activity_VF2.pdf [Accessed 11/09/2019].

Kastak, D., Southall, B.L., Schusterman, R.J. and Reichmuth Kastak, C. (2005). Underwater temporary threshold shift in pinnipeds: Effects of noise level and duration. Journal of the Acoustical Society of America, 118(5), 3–54 - 3163.

KIS-ORCA (2018). Submarine cable routes of the central North Sea. Kingfisher Cable Awareness Chart. Available online at: http://www.kis-orca.eu/map.

Løkkeborg, (2005). Impacts of trawling and scallop dredging on benthic habitats and communities. FAO Fisheries Technical Paper 472.

Maravelias, C.D., Reid, D.G. and Swartzman, G. (2000). Seabed substrate, water depth and zooplankton as determinants of the prespawning spatial aggregation of North Atlantic herring. Marine Ecology Progress Series, 195: 249–259.

McBreen, F., Askew, N., Cameron, A., Connor, D., Ellwood, H. and Carter, A. (2011). UK SeaMap 2010. Predictive mapping of seabed habitats in UK waters. JNCC Report No. 446. Online at http://jncc.defra.gov.uk/PDF/jncc446_web.pdf [Accessed 11/09/2019].

MIS (Marine Information System) (2019). Available online at: http://defra.maps.arcgis.com/apps/webappviewer/index.html?id=3dc94e81a22e41a6ace0bd.

NMPi (2019). Scottish Government Interactive Marine planning tool. Online at https://marinescotland.atkinsgeospatial.com/nmpi/ [Accessed 11/09/2019].

OGUK (2019). Environment Report 2019. Online at https://oilandgasuk.cld.bz/Environment-Report-2019 [Accessed 15/10/19].

OGUK (2018). Well Decommissioning Guidelines, Issue 6, June 2018.

OGUK (2016). Decommissioning insight 2016. Online at http://oilandgasuk.co.uk/decommissioninginsight.cfm [Accessed 15/10/19].

Oil and Gas Authority (2016). Information of levels of shipping activity. 29th Offshore Licensing Round information and resources. Available online at: https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/offshore-licensing-rounds [Accessed 04/07/2019].

OSPAR (2008). List of threatened and/or declining species & habitats. Online at https://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats [Accessed 11/09/2019].

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

Reid, J., Evans, P.G.H. and Northridge, S. (2003). An atlas of cetacean distribution on the northwest European Continental Shelf. Joint Nature Conservation Committee, Peterborough.

Scottish Government (2018). Scottish Sea Fisheries Statistics, 2017. Scottish Government. Available online at http://www.gov.scot/Topics/marine/marine-environment/species/fish [Accessed 11/09/2019].

Thompson, C. E. L., Couceiro, F., Fones, G. R., Helsby, R., Amos, C. L., Black, K., Parker, E. R., Greenwood, N., Statham, P. J., and Kelly- Gerreyn, B. A. (2011). In situ flume measurements of resuspension in the North Sea. *Estuarine Coastal and Shelf Science*, 94, 77–88.

Webb, A., Elgie, M., Irwin, C., Pollock, C. & Barton, C. (2016). Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK. Document No HP00061701. Available online at http://jncc.defra.gov.uk/page-7373.

Appendix 1. ENVID Results

General Activity	Detailed Activity	Summary of Environmental Impact	Controls, Mitigations and Ranking							Actions	
			Existing controls - Industry Standard, Legislative or Prescriptive	Initial Ranking taking into account existing controls and mitigation			Project Specific and Chrysaor Best Practice	Final Ranking taking into account project-specific controls and mitigation			Comments?	Taken Forward for Further Assessment?
				Consequence	Likelihood	Initial Risk / Impact Ranking		Consequence	Likelihood	Final Risk / Impact Ranking		
Recovery of infrastructure by Single Lift	Engineering down and cleaning	**Operational discharges to sea** Flushing/ cleaning operations - overboard discharge targeted 30mg/l	**Planned** : - Controls were in place, as relevant, through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations. - Work was undertaken within permit consent agreement limits.	1	5	5	- Procedural cleaning and/or containment process. - Maintenance procedures. - Bulk handling procedures and personnel training. - Vessels will be selected which comply with IMO/MCA codes for prevention of oil pollution. - Preferred operational procedures in place onboard vessels including use of drip trays under valves, use of pumps to decant lubricating oils, use of lockable valves on storage tanks and drums. - Chemical storage areas contained to prevent accidental release of chemicals. - Pre-mobilisation audits carried out including a comprehensive review of spill prevention procedures - Arrangements in place to track spills.	1	4	4	These routine operations were conducted within the agreed permit conditions and using Chrysaor's procedural cleaning and containment processes.	**No**
		Dropped objects Behavioural modifications to marine mammals and potentially fish. Potential to compromising live pipelines in the vicinity of the platform	**Unplanned** : - Industry-standard procedures in place to make sure that the location of any lost material is recorded and that significant objects are recovered where practicable. '-Debris clearance surveys will be undertaken within the existing 500m exclusion zone post installation removal. The scope of the surveys will be agreed with OPRED.	1	3	3	- All pipelines in the vicinity of the installation have been flushed and cleaned and will not be live at the time of decommissioning '- Chrysaor's Environmental Management System. - Procedures will be in place to reduce the potential for dropped objects. - Training and awareness of contractors will be required. - Lift planning will be undertaken to manage risks during lifting activities, including the consideration of prevailing environmental conditions and the use of specialist equipment where appropriate. - All lifting equipment will be tested and certified. '-Dropped objects which present a potential risk to other users of the sea shall be recovered.	1	3	3	Chrysaor procedures will reduce the potential for dropped objects. A risk of dropped object on live infrastructure during transportation cannot be discounted albeit with a very remote likelihood of occurrence.	**No**
		Underwater Noise from vessels and cutting operations 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. Proximity to the Southern North Sea SAC which is designated for harbour porpoise DP vessels may be used. Thruster noise when initially deploying anchors and if DP used. Cutting operations.	**Planned :** -Comparable with background vessel noise.	1	5	5	- Noise studies undertaken for infrastructure close to and within the Southern North Sea SAC indicated that the subsea noise levels generated by surface vessels used during the decommissioning operations are unlikely to result in physiological damage to marine mammals (e.g. BMT Cordah, 2014). '- Machinery and equipment will be in good working order and wellmaintained. '- Helicopter maintenance will be undertaken by contractors in line with manufacturers and regulatory requirements. '- The number of vessels utilising DP would be minimised where possible, taking into account mitigation proposed for other receptors. '- Campaign, logistics, sharing vessels (across Chrysaor's SNS decommissioning portfolio) optimising vessels to minimise use - Main potential impact likely to be from disturbance rather than injury - Contractor selection - Suitable technology for cutting will be selected to ensure the effectiveness of the cutting (conductors and guideframes likely to be cut using diamond wire or similar mechanical form of cutting, and not water jetting) - Minimising the duration, disturbance and risk of requiring the activity to be repeated.	1	3	3	Not deemed to be significant in relation to current vessel activity already being moderate, activities are far from shore and not in the vicinity of key areas for receptors and that the planned activities will be short in duration.	**No**
Waste Management		**Waste** Resource use Energy consumption Use of landfill space	**Planned :** '-In accordance with the BEIS Guidance Notes under the Petroleum Act 1998, the disposal of such installations should be governed by the precautionary principle. '-Waste Heirarchy				-All waste will be handled and disposed of in line with the Chrysaor Waste Management Strategy as part of the project Active Waste Management Plan. '-Approximately 97% of material recovered will be recycled. A target of less than 3% to go to landfill. '-Potential positive impact from recycling of steel. '-Selected contractor performance will be monitored throughout the wider SNS Decommissioning Programme				Not scored as all will be managed through Chrysaor's waste management strategy and recorded through the project materials inventory. All waste will be managed in line with current legislation.	**No**
		Waste Waste, including non-hazardous, hazardous, radioactive and marine growth.	**Planned :** '-In accordance with the BEIS Guidance Notes under the Petroleum Act 1998, the disposal of such installations should be governed by the precautionary principle. '-Waste Heirarchy '-As per the Landfill Directive, pre-treatment will be necessary for most hazardous wastes which are destined to be disposed of to landfill site.				'-All waste will be handled and disposed of in line with the Chrysaor Waste Management Strategy as part of the project Active Waste Management Plan. '-There will be an inventory of hazardous waste compiled (including asbestos) to aid the segregation and recycling of waste. '-NORM and any other hazardous waste will be dealt with by specialist contractors who will be selected for competence. Quantity of hazardous waste is not expected to be significant. '-Inventory of waste - tracking materials to final place					**No**
		Waste Onshore decontamination, demolition and dismantling facility activities including airborne noise, odour, light, dust and aesthetics	**Planned;** '-In accordance with the BEIS Guidance Notes under the Petroleum Act 1998, the disposal of such installations should be governed by the precautionary principle. '-Waste Heirarchy -Onshore yards already deal with potential environmental issues as part of their existing site management plans.				Chrysaors procedures require waste facilities to be approved for use prior to the consignment of the waste. 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.					**No**

General Activity	Detailed Activity	Summary of Environmental Impact	Controls, Mitigations and Ranking								Actions	
			Existing controls - Industry Standard, Legislative or Prescriptive	Initial Ranking taking into account existing controls and mitigation			Project Specific and Chrysaor Best Practice	Final Ranking taking into account project-specific controls and mitigation			Comments?	Taken Forward for Further Assessment?
				Consequence	Likelihood	Initial Risk / Impact Ranking		Consequence	Likelihood	Final Risk / Impact Ranking		
Physical Presence	Vessel Spread	**Gaseous emissions to atmosphere and energy use** Increased degradation of local/regional air quality (NOx and particulates). Transboundary air pollution. Contributing to global warming (CO2).	**Planned:** Emissions during decommissioning activities will occur in the context of the cessation of production. As such, almost all future emissions (from Project operations and vessels) will cease. - MARPOL compliance. - UKAPP compliance for vessels.	1	5	5	- Low sulphur diesel. '- Contractor selection - maintenance programmes and audits. '- Campaign, logistics, sharing vessels (across Chrysaor's Southern North Sea portfolio) optimising vessels to minimise use.	1	4	4		**No**
		Loss of containment Pollution of the marine ecosystem with hydrocarbons Project will introduce new diesel inventory to the site with additional inherent spill / pollution risk e.g. from heavy lift vessel.	**Unplanned:** Well P&A is outside of the scope of this specific impact assessment, since it not dependent on approval of the DP. The possibility of a well blowout therefore does not require consideration in this here. Pipeline decommissioning is also not a component of this DP. Release of a live hydrocarbon and chemical inventory is therefore also out of scope of this assessment. '- OPEP/SOPEP, including modelling and appropriate response planning - Collision risk assessment - Communication Interface Plan	3	2	6		3	1	3	Reduced to 'as low as reasonably practicable'	**No**
		Routine vessel discharges (e.g. grey water, blackwater, ballast)	**Planned:** Routine discharges from vessels are typically well-controlled activities that are managed on an ongoing basis under MARPOL Annex IV.	1	5	5	'- Procedural cleaning and/or containment process. - Maintenance procedures - Bulk handling procedures and personnel training	1	4	4	These are routine operations and will be conducted within the agreed permit conditions and using the vessel procedural cleaning and containment processes.	**No**
		Physical presence of vessels during operations.	**Planned:** - Limited duration. - Stakeholder engagement. - Existing controls through the Consent to Locate process. - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings.	1	5	5	Campaign logistics and sharing vessels (across Chrysaor's SNS decommissioning portfolio) - Collision risk assessment. - Stakeholder consultation. - Logistics plan.	1	3	3	Not expected to be significant and implementation of notifications etc.	**No**
	Jacket Removal and remediation activities	**Seabed disturbance** Disturbance to the seabed, including to features of conservation importance during removal	**Planned:** **'-** Pre-decommissioning seabed surveys '-Stakeholder consultation	2	5	10	'- Review of survey data for potential sensitive habitats of seabed. ' - Cutting and lifting operations controlled by ROV. ' - Internal cutting will be used preferentially where access is available. ' - Heavy lift vessels are likely to be equipped with dynamic positioning (DP) rather than relying on anchors to remain in position. Promotion of natural seabed recovery and pipeline burial in preferenceto the use of rock placement. ' - A rock-placement vessel or ROV support vessel will be used. The rock mass will be carefully placed over the pipeline end by the use of an ROV to minimise the quantity of rock deposited. '•Implementation of Chrysaor's Environmental Management Strategy. '•Visual surveys of the seabed where possible to locate obstructions and to localise (and minimise) any post-decommissioning overtrawl surveys that may be required.	2	3	6	Stakeholder concern and proximity (5 km) to Dogger Bank SAC (protected for *'Sandbanks which are slightly covered by seawater all the time'*) and impact on features of conservation importance including sessile and mobile organisms.	**Yes**
		Risk of snagging for fisheries following decommissioning	**Planned:** - seabed clearance certificate required before the 500 m safety zone is opened up for use.	4	2	8	- Final visual and/ or overtrawl seabed survey will be undertaken of the 500 m safety zone to ensure that the seabed is cleared for use following decommissioning. Survey scope to be agreed with OPRED. '- The profile of the rock-placement over the pipeline on the seabed will allow fishing nets to trawl over the rock unobstructed. Suitably graded rock will be used to minimise the risk of snagging fishing gear.	4	1	4	Not expected to be significant	**No**

Appendix 2. Energy and Emissions Values

Planned activity	Operations energy (GJ)	Operations CO_2 (Te)
Onshore transportation of materials	3	0.2
Onshore deconstruction	3,102	No data available
Onshore recycling of materials	19,566	2,090
New manufacture to replace recyclable materials	15,242	1,086
Offshore survey vessel(s)	4,008	298
Vessels for single lift of jacket	12,882	956
Vessels for single lift of topsides	12,710	944
Total	**67,513**	**5,374**

Appendix 3. Chrysaor HSE Policy

Health, Safety & Environment Policy

CHRYSAOR

Chrysaor will conduct its operations in such a way as not to harm people and minimise any impact on the environment. Chrysaor is fully committed to continuously improving its health, safety and environmental performance by the successful implementation of this Policy.

Chrysaor commits it will:

- Ensure compliance with all applicable legislation and standards;
- Ensure an effective management organisation is in place and all personnel and contractors are aware of their health, safety and environmental responsibilities;
- Create a safe and healthy working environment for our employees, contractors and all other persons who could be affected by its activities;
- Identify, evaluate and control the risks and impacts associated with its activities, including where the potential exists for major accident events;
- Ensure that energy and resource management are an integral part of the business;
- Promote resource and energy conservation, waste minimisation and pollution prevention;
- Recognise and respond to employee and community concerns regarding the health, safety and environmental aspects of the company's operations;
- Ensure all employees and contractors are competent to perform their health, safety and environmental roles; and
- Achieve continuous improvement of its business processes through the implementation of its Core Values and Business Principles.

Chrysaor will ensure that the necessary resources are provided to fully support this Policy and will ensure that it is subject to audit and review as part of the Management System goal of continuous improvement in performance.

Phil Kirk
Chief Executive Officer

October 2018

CHRY-UKO-HSEQ-PLCY-0055 (formerly CHRY-BMS-PLCY-HSEQ-1167) Revision 2