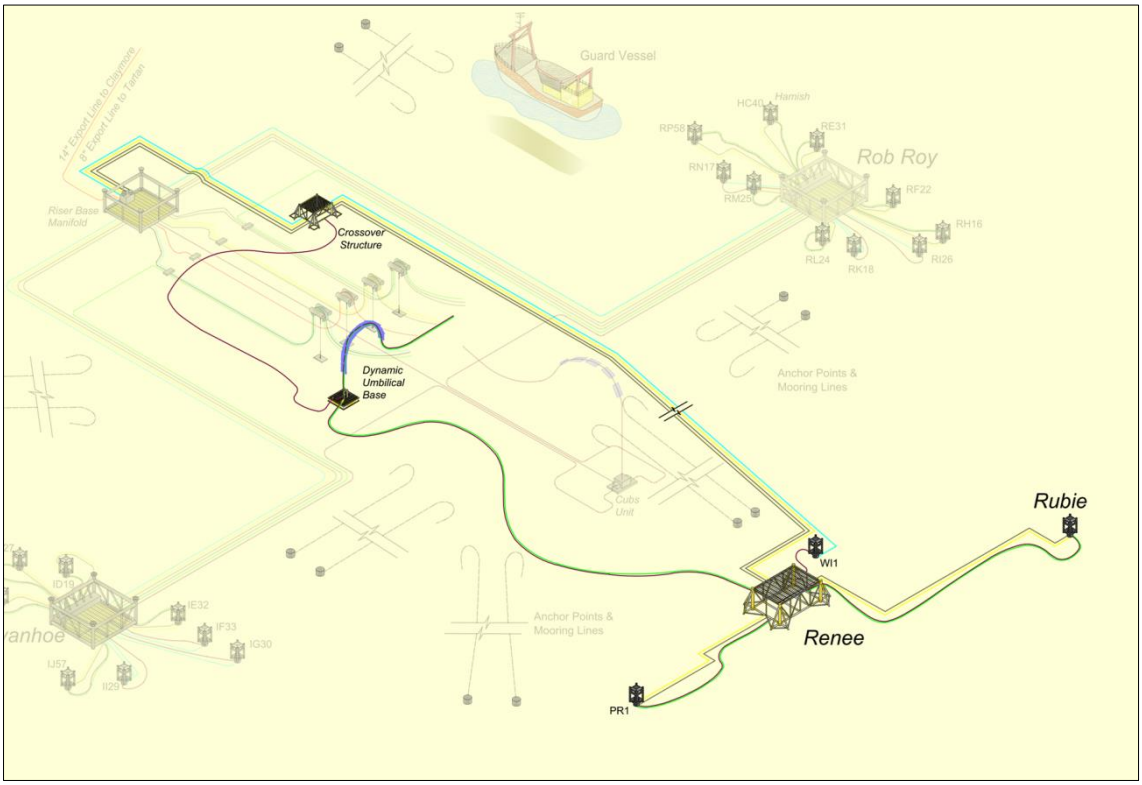
Endeavour



ENVIRONMENTAL STATEMENT FOR THE DECOMMISSIONING OF THE RUBIE/ RENEE FACILITIES

Version B

November 2013

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Abbreviations

Definition	
%	Percentage
°C	Degrees Celsius
µg/g	Micrograms per gram
µm	micrometre
AC1	Atlantic Crossing Cable
AoS	Area of Search
Ba	Barium
$BaSO_4$	Barium Sulphate
BAT	Best Available Technique
BC	Background Concentration
BEP	Best Environmental Practice
BGS	British Geological Society
BOD	Biological Oxygen Demand
BSI	British Standards Institute
BT	British Telecom
BWM	Ballast Water Management
CA	Comparative Assessment
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	The Co-ordinated Environmental Monitoring Programme
Cd	Cadmium
CFCs	Chlorofluorocarbon
CH_4	Methane
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNS	Central North Sea
CO_2	Carbon Dioxide
COP	Cessation of Production
COS	Cross Over Structure
CPR	Continuous Plankton Recorder
cSAC	Candidate Special Area of Conservation
CSV	Construction Support Vessel
Cu	Copper
dB	Decibel – the logarithmic measure of sound intensity/ pressure
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DP	Dynamic Positioning
dSAC	Draft Special Area of Conservation
DSV	Diving Support Vessel
DTI	Department of Trade and Industry
DUBS	Dynamic Umbilical Base Structure
DWT	Dead Weight Tonnes
EA	Environment Agency
EC	European Community

EEC	European Economic Community
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EPS	European Protected Species
ERT	Environment Resource Technology
ES	Environmental Statement
EU	European Union
EUNIS	European Nature Information Service
EU ETS	European Union Emissions Trading Scheme
Fe	Iron
FEPA	Food and Environment Protection Act
FPF	Floating Production Facility
FSU	Floating Storage Unit
GJ	GigaJoule (10^9 Joules)
GMS	Global Marine Systems Ltd
GRT	Gross Register Tonnage
HASS	High Activity Sealed Source
HCFCs	Hydrochlorofluorocarbons
Hg	Mercury
HSE	Health, Safety and Environment
HSEQ	Health, Safety, Environment and Quality
HSEQ-MS	Health, Safety, Environment and Quality Management System
Hz	Hertz
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organisation
IoP	Institute of Petroleum
IOPP	International Oil Pollution Prevention Certificate
IPPC	Integrated Pollution Prevention and Control
ISO	International organisation for Standardisation
ITOPF	The International Tanker Owners Pollution Federation Ltd
IVRRH	Ivanhoe-Rob Roy, Hamish
JNCC	Joint Nature Conservation Committee
KPI	Key Performance Indicator
km	kilometres
LSA	Low Specific Activity
m	metres
m^2	Square metres
m^3	cubic metres
mg/g	Milligrams per gram
MAFF	Ministry of Agriculture, Fisheries and Food
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MMO	Marine Management Organisation
MODU	Mobile Drilling Unit

MPA	Marine Protected Area
MS	Marine Scotland
MSA	Marine Scotland Act
m/s	Metres per second
nmiles	Nautical miles
Ni	Nickel
NFFO	National Federation of Fishermen's Organisation
NIFPO	Northern Ireland Fish Producers Organisation
NORBRIT	Norway-UK Joint Contingency Plan
NORM	Naturally Occurring Radioactive Material
NO_x	Mono-nitrogen oxides (nitric oxide and nitrogen dioxide)
NSTF	North Sea Task Force
NTS	Non-technical Summary
OBF	Oil Based Fluid
OBM	Oil Based Mud
OCNS	Offshore Chemical Notification Scheme
ODL	Offshore Design Ltd
ODS	Ozone Depleting Substances
OHSAS	Occupational Health Safety Assessment Series
OPF	Organic Phase Fluid
OPEP	Oil Pollution Emergency Plan
OPPC	Oil Pollution Prevention and Control
OPRC	Oil Pollution Preparedness, Response and Co-operation
OSCAR	Oil Spill Contingency and Response
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OSRL	Oil Spill Response Limited
OVI	Offshore Vulnerability Index
PAH	Polyaromatic Hydrocarbon
PARCOM	Paris Commission
Pb	Lead
PLONOR	Poses No or Low Risk
PON	Petroleum Operation Notification
POPA	Prevention of Oil Pollution Act
PPC	Pollution Prevention and Control
PPD	Public Participation Directive
ppm	Parts per million
pSAC	Possible Special Area of Conservation
PTS	Permanent threshold shift
P&A	Plug and Abandonment
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RBM	Riser Base Manifold
ROTACS	Russian Optical Trans-Arctic System
ROV	Remotely Operated Vehicle
ROVSV	Remotely Operated Vehicle Service Vessel

RPM	Renee Production Manifold
SAC	Special Area of Conservation
SAST	Seabirds at Sea Team
SBF	Synthetic Base Fluid
SCANS	Small Cetacean Abundance in the North Sea
SCI	Sites of Community Importance
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation
SMRU	Sea Mammal Research Unit
SNH	Scottish Natural Heritage
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSREP	Secretary of State for Energy and Climate Change
SO_2	Sulphur dioxide
SO_x	Sulphur oxides
SPL	Sound Pressure Level
SSB	Spawning Stock Biomass
SUT	Subsea Umbilical Termination
THC	Total Hydrocarbons
TMS	Training Management System
TTS	Temporary threshold shift
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKDMAP	United Kingdom Digital Marine Atlas
UKOOA	United Kingdom Offshore Operators Association
UKOPP	United Kingdom Oil Pollution Prevention
UNCLOS	United Nations Convention on the Law of the Sea
UNECE	United Nations Economic Commission for Europe
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
WBM	Water Based Mud
WFD	Water Framework Directive
WIMS	Well Integrity Management Systems
WWF	World Wildlife Fund
XOS	Crossover Structure
Zn	Zinc

NON-TECHNICAL SUMMARY

This non-technical summary outlines the findings of the Environmental Impact Assessment (EIA) conducted by Endeavour Energy (UK) Ltd (Endeavour) as part of the planning and consents process for the decommissioning of the Rubie/ Renee Facilities. The purpose of the EIA is to identify, understand and communicate the likely significance of the environmental impacts and risks associated with the proposed project to inform the decision making process. The EIA also addresses any concerns or issues raised by stakeholders during the consultation process. The detailed assessment is presented within the Environmental Statement (ES). The ES has been prepared in conjunction with Hess Services UK Limited's IVRRH Decommissioning Programmes which were submitted to DECC in February 2013.

The Endeavour operated Rubie/ Renee Facilities are currently being considered for decommissioning. The facilities are located in the central North Sea approximately 115 km east of Scotland (Figure i).

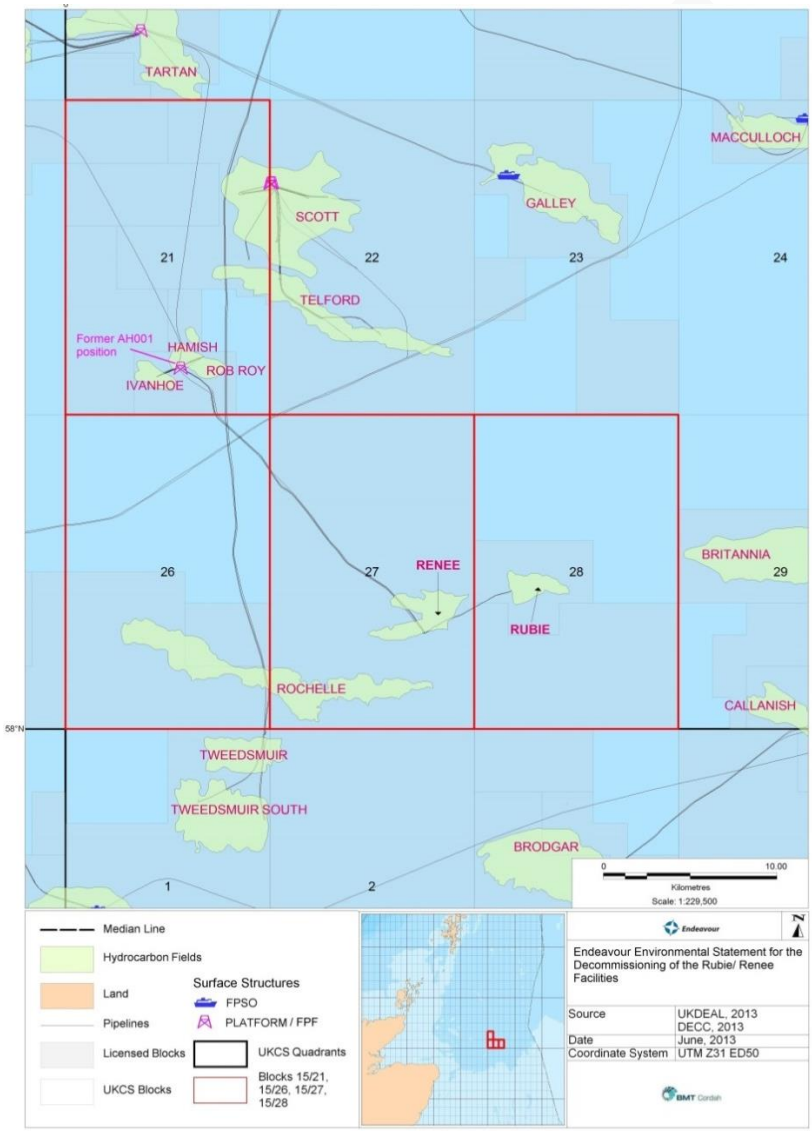

Figure i: Location of the Rubie/ Renee Facilities

Production at the Rubie and Renee facilities started in 1999, and comprised of two drilling centres (Rubie and Renee) connected by infield pipelines, umbilicals and subsea structures to the Hess operated floating production facility, AH001. The produced fluids from Rubie/ Renee were comingled with the produced fluids and gas from the Ivanhoe, Rob Roy and Hamish (IVRRH) fields and exported via the AH001 to the Claymore Alpha and Tartan Alpha platforms, respectively. Following production suspension in 2008, preparatory work has been undertaken by Endeavour and Hess for the decommissioning of the Rubie/ Renee Facilities (Figure ii).

Regulatory Context

The decommissioning of offshore oil and gas infrastructure in the UKCS is principally governed by the Petroleum Act 1998, as amended by the Energy Act 2008, which sets out the requirements for a formal Decommissioning Programme and the approval process. Under the Department of Energy and Climate Change (DECC) Guidance Notes on Decommissioning of Offshore Oil and Gas Installations and Pipelines, the Decommissioning Programme must be supported by an EIA.

The DECC Guidance Notes state that an EIA should include an assessment of:

- All potential impacts on the marine environment including exposure of biota to contaminants, biological impacts arising from physical effects, and conflicts with the conservation of species and their habitats.
- Potential impacts on environmental compartments, including emissions to the atmosphere, discharges to water, leaching to groundwater and effects on the soil.
- Consumption of natural resources and energy associated with re-use and recycling.
- Interference with other legitimate uses of the sea and other consequential effects on the physical environment.
- Potential impacts on amenities, the activities of communities and on future uses of the environment.

In addition under the Marine and Coastal Access Act 2009 and the Marine (Scotland) Act 2010 a licence application, supported by an EIA/ ES updated to reflect detailed engineering design and specific mitigation measures, will be required at the time of decommissioning.

The Petroleum Act 1998 provides the framework for the orderly decommissioning of offshore pipelines. The ‘DECC Guidance Notes’ requires that all feasible pipeline decommissioning options should be considered and a comparative assessment made.

Overview of the Rubie/ Renee Facilities Decommissioning Programmes

The decommissioning programmes will encompass the following subsea infrastructure:

- Subsea structures including wellheads, manifold and crossover structure.
- Concrete mattresses.
- Pipelines, umbilicals and connectors.

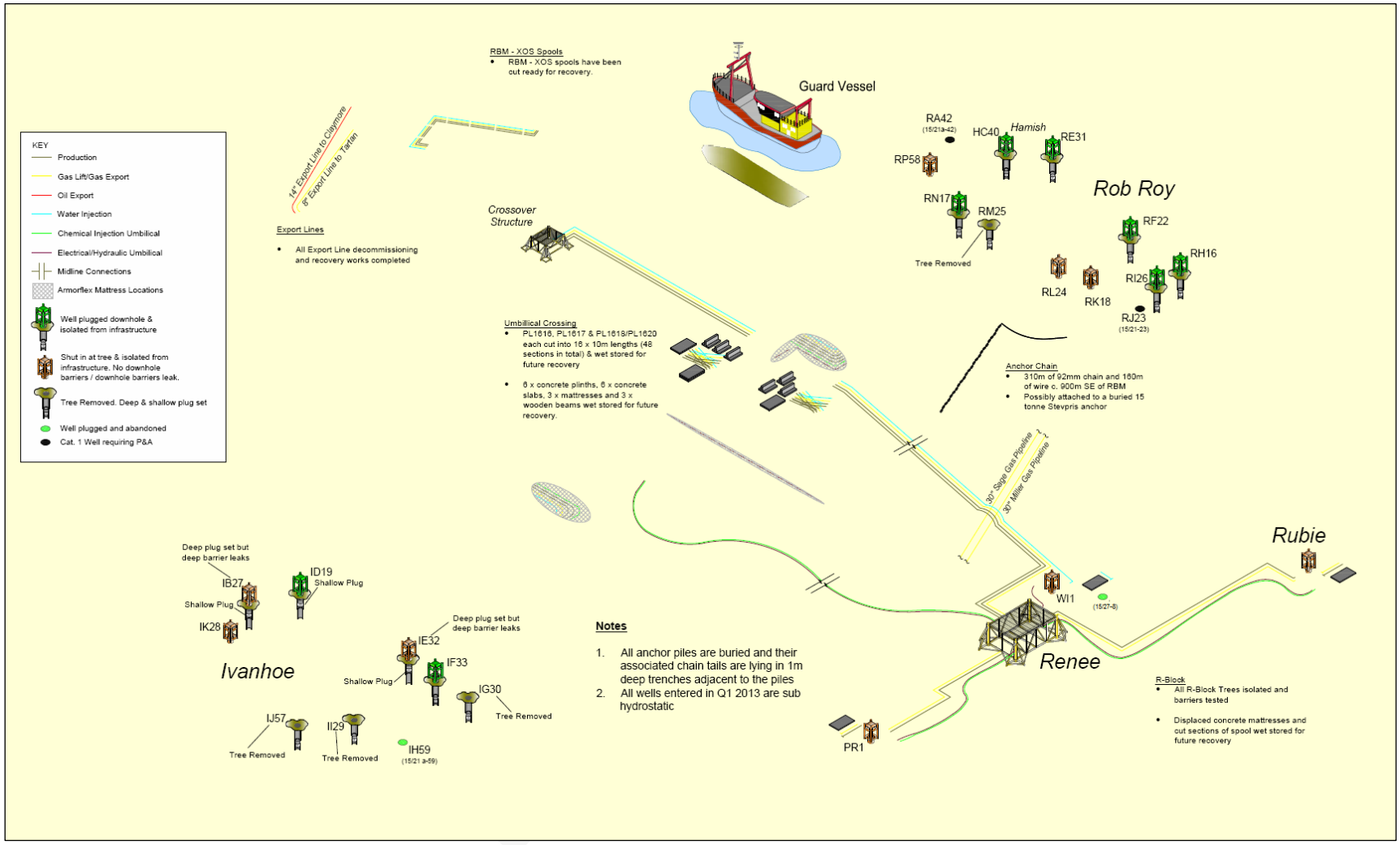

Figure ii: Schematic diagram of the current Rubie/ Renee Facilities layout after the commencement of decommissioning preparatory operations

Decommissioning options for the Rubie/ Renee pipeline and umbilicals were subject to a formal Comparative Assessment (CA) to determine which decommissioning options should be selected in view of the status, condition and environmental setting of those facilities. These options are summarised in Table i.

Table i: Overview of short-listed decommissioning options for each of the Rubie/ Renee Facilities

Rubie/ Renee Facility	Decommissioning Option	Method
Subsea Wellheads: • Renee production • Renee water injection • Rubie production	Full removal	
Subsea infrastructure: • RPM • COS	Full removal	
Pipelines and umbilicals: • PL1616 • PL1617 • PL1618 • PL1620 • PL1624 • PL1625 • PL1619.1 to PL1619.8 • PL1623.1 and PL1623.2 • PL1626.1 to PL1626.8	Leave *in situ*	No removal; burial of pipeline ends.
	Recovery by reverse reel	Cut and lift
	Recovery by reverse S-lay	Cut and lift
	Long section recovery	Cut and lift
	Removal by tow recovery	Cut and lift
	Short section recovery	Cut and lift
	J-lift recovery	Cut and lift
Jumpers/ spools, including PL1621 and PL1622	Full removal	
Mattresses	Full removal	
Rock placement	Leave *in situ*	

Based on the outcomes of the Comparative Assessment (CA), Endeavour have selected to leave the trenched and buried pipelines and umbilicals *in situ,* but cut, lift and fully remove the surface laid pipelines, umbilicals and connectors and fully remove the subsea structures and concrete mattresses.

Surveys will be carried out of the areas where infrastructure has been removed and a carefully planned and structured monitoring regime will be implemented to ensure that the pipelines and umbilicals that remain *in situ* are maintained in a safe condition.

Environmental Setting and Sensitivities

The Rubie/ Renee Facilities are located in water depths ranging between 113 to 150 m, in an area that is typical of the offshore regions of the central North Sea, where hydrographical, meteorological, geological and biological characteristics are relatively uniform over large areas. Users of the area are mainly associated with oil and gas exploration and development, shipping and fishing. Table ii highlights the key physical, chemical, biological and socioeconomic sensitivities relevant to the Rubie/ Renee Facilities area.

Table ii: Key Environmental Sensitivities

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Habitats Directive: Annex I Habitats											
There are no known Annex I habitats in the Rubie/ Renee Facilities area. Marine conservation areas (SACs and MPAs) exist in UKCS to the east, north and west of the facilities. Some of these have qualifying features that meet those stated in Annex I.											
Habitats Directive: Annex II Species											
Of the Annex II species, only the harbour porpoise has been sighted in the Rubie/ Renee Facilities area, with very high sightings in May, high abundance in July and December, with low to moderate abundance January, February, April, June, August, September and October (UKDMAP 1998).											
Benthic Fauna											
Benthic communities in the Rubie/ Renee Facilities area are similar to those found throughout a large surrounding area of the central North Sea. No rare species are known to occur in this area (Fugro ERT, 2011; Fugro Survey Limited, 2008).											
Plankton											
Peak productivity occurs in spring and summer throughout the central North Sea.											
Finfish and Shellfish											
The Rubie/ Renee Facilities are located in spawning grounds for cod (Jan to Apr), Norway pout (Jan to Apr) and *Nephrops* (Jan to Dec); and in nursery grounds for anglerfish, blue whiting, cod, European hake, herring, ling, mackerel, *Nephrop*s, Norway pout, sandeels, spotted ray, sprat, spurdog and whiting (Coull *et al.,* 1998; Ellis *et al.,* 2010).											
Marine Mammals											
Marine mammals sighted in and around the Rubie/ Renee Facilities area include minke whales, killer whales, white-beaked dolphins, white-sided dolphins, harbour porpoises, common dolphin and Risso's dolphin. Peak sightings generally occur from May to September (Reid *et al*., 2003; UKDMAP, 1998).											
Seabirds											
Seabird vulnerability to oil pollution in the Rubie/ Renee Facilities area is "very high" in October and November, "high" in January, July, August and September and moderate or Low for the remainder of the year except for December where there is no data. The overall vulnerability in the Rubie/ Renee Facilities area is "moderate" (JNCC, 1999).											
Fisheries											
The Rubie/ Renee Facilities area "medium" relative value for whitefish gear and a "very high" *Nephrops* relative value. Fishing effort is "low" for whitefish gear and "very high" for *Nephrops*. Historically, shellfish dominate the landings in the vicinity of the Rubie/ Renee Facilities area targeting mostly *Nephrops* (Marine Scotland, 2012b, 2011).											
Shipping											
The majority of shipping volume comprises offshore industry shipping activity and cargo voyages.											

Key

- Very high sensitivity
- High sensitivity
- Moderate sensitivity
- Low sensitivity
- Not surveyed / No data available

Key Environmental Concerns

Following the identification of the interactions between the proposed decommissioning activities and the local environment, the assessment of all potentially significant environmental impacts during the risk assessment process and initial stakeholder consultation, the following key environmental impacts were identified as requiring further assessment.

Energy use and atmospheric emissions

Energy use and consequent atmospheric emissions from the decommissioning activities will have a localised effect on air quality. The impact on air quality is unlikely to affect any receptors in the Rubie/ Renee Facilities area as the impact is expected to be limited to the immediate vicinity of the operations. For this reason, there is also unlikely to be a significant transboundary or cumulative impact on air quality.

Emissions from the decommissioning activities will contribute to greenhouse gas emissions but will be kept to a practicable minimum. Power generation emissions during decommissioning activities will be minimised by advanced planning to ensure efficient operations through well maintained equipment and generators and regular monitoring of fuel consumption. Total CO_2 emissions generated from the proposed decommissioning operations will represent a very small proportion (0.16%) of the of the total annual CO_2 offshore emissions from the UKCS.

Underwater noise

Man-made underwater noise has the potential to impact marine mammals. Several activities associated with the Rubie/ Renee Facilities decommissioning operations will generate underwater noise. Records indicate previous sightings of seven cetacean species within the study area over the period when decommissioning activities are scheduled to take place. These species are all subject to regulatory protection from injury and disturbance.

Underwater cutting operations may be a significant source of sound associated with the decommissioning activities. However, the proposed cutting operations will be short in duration, lasting a few hours each over a period of days to weeks. Depending on ambient noise levels, sensitive marine mammals may also be locally disturbed by noise from a vessel in its immediate vicinity.

Broadband source levels for these activities rarely exceed about 190 dB re 1 µPa m and are typically much lower. This does not exceed the thresholds for injury to cetaceans (Southall *et al*., 2007). Overall any potential impact to marine mammals is not significant for any of the decommissioning methods and will only result in minimal disturbance.

Seabed footprint

Decommissioning operations at Rubie/ Renee will result in work being undertaken at or near the seabed. Therefore, there is the potential for short-term localised seabed disturbance during the decommissioning of the subsea structures, pipelines, umbilicals, connectors and concrete mattresses.

Localised disturbance will affect a relatively small seabed area (estimated at 0.09 km^2) and occur mainly from removal of the structures from the seabed. The effects will be short-term and will be followed by natural re-colonisation by organisms that live within or on the seabed sediments in a widespread area of the northern North Sea. These

activities will be planned and controlled to ensure accurate cutting and lifting thereby minimising the area affected.

The placement of rock over the ends of the pipelines and umbilicals left in situ will create a long-term modification to a 0.012 km^2 of localised seabed. The rock dumped area will provide a habitat that will be colonised by organisms which occur in the North Sea but typically live on, around or within crevices in rocky, rather than sedimentary substrata. These include animals such as anemones, soft corals, tubeworms, hydroids, sponges, bryozoan, tunicates, molluscs and a variety of fish, and shellfish. This impact would be limited to the relatively small area and will lie within an extensive area of mainly sedimentary seabed.

The protective rock dump footprint will be minimised by; creating a seabed profile appropriate for the long-term protection of the pipeline and umbilical ends. Deposition of the rock will be controlled via the vessel's manoeuvrable fall-pipe and continual monitoring during placement using a remotely operated vehicle.

Societal impacts

Long term presence of the pipelines and umbilical left *in situ* could potentially create an obstruction to fishing vessels using gear to catch species that are found on or near the seabed. The pipelines and umbilicals could also potentially become a source of marine debris and pollutants when it eventually loses its structural integrity.

In relation to fishing, the purpose of the protective rock dump is to ensure that fishing gear will not be impeded if it travels across the buried pipelines and umbilicals or any material that remains when the pipelines and umbilicals eventually corrode and collapse.

Trawling over sections of a pipeline or umbilical with rock-placement, graded rock could be dragged off by bottom-towed fishing gear and spread over the seabed. In addition, the rock may cause wear and tear on the net, damage fish when caught and damage or crush the fish when unloaded. Fishermen trawling trials with heavy net trawl gear have towed their gear without reported difficulty.

The pipelines and umbilicals will eventually collapse in their trenches and the rock and backfill sediments will fill the small void. Throughout the period of disintegration, and after collapse, the whole length of the pipelines and umbilicals will remain trenched, covered with backfill and rock and be overtrawlable. In the longer-term, therefore, it is likely that seabed profile along the length of the *in situ* pipelines and umbilicals will be reduced as a result of erosion and sediment deposition processes.

Discharges to sea

Discharges to sea of treated water, hydraulic fluid, residual oil, as well as discharges from operating vessels during decommissioning activities will result in localised effects which will have negligible impact on the wider marine environment.

Accidental events

The worst case single trajectory modelling suggests oil will not beach, but will cross the UK/ Norwegian median line after 2 days, and would become insignificant after 7 days. The likelihood of a hydrocarbon spill occurring at the Rubie/ Renee Facilities is remote. However if there is a release there would be a potential risk to organisms in the immediate marine environment**.** As the potential spill is likely to be on the surface, fish,

birds and marine mammals may be impacted. Endeavour's OPEP for the Rubie/ Renee Facilities will ensure that all hydrocarbon spills are dealt with efficiently.

Environmental Management

Endeavour is committed to conducting activities in compliance with all legislation and operates an ISO14001 certified Environmental Management System (EMS). The EMS covers all aspects of Endeavour's activities including exploration, drilling and production activities. All activities associated with the decommissioning of the Rubie/ Renee Facilities will be covered by the EMS.

Conclusions

Overall, the ES has evaluated the environmental risk reduction measures to be taken by Endeavour and concludes that Endeavour have, or intend to, put in place sufficient safeguards to mitigate environmental risk and to monitor the implementation of these safeguards.

Therefore, it is the conclusion of the Environmental Statement that the recommended options to decommission the Rubie/ Renee Facilities can be completed without causing significant impact to the environment.

1.0 INTRODUCTION

This Environmental Statement (ES) presents the findings of the environmental impact assessment (EIA) undertaken by Endeavour Energy (UK) Ltd (Endeavour) for the decommissioning of the Rubie/ Renee Facilities including associated pipelines, umbilicals, spoolpieces and subsea infrastructure. The ES has been prepared in conjunction with Hess Services UK Limited's IVRRH Decommissioning Programmes which were submitted to DECC in February 2013 (Hess, 2013).

1.1 Location of the Renee/ Rubie Facilities

The Rubie/ Renee Facilities are located in UK Continental Shelf (UKCS) Blocks 15/21, 15/26, 15/27 and 15/28 of the central North Sea, approximately 115 km east of the UK coastline and approximately 60 km west of the UK/Norway median line. The Rubie and Renee fields are located in Blocks 15/28 and 15/27 respectively, and lie approximately six kilometres apart. Water depth ranges between 113 to 150 m. (Figure 1.1).

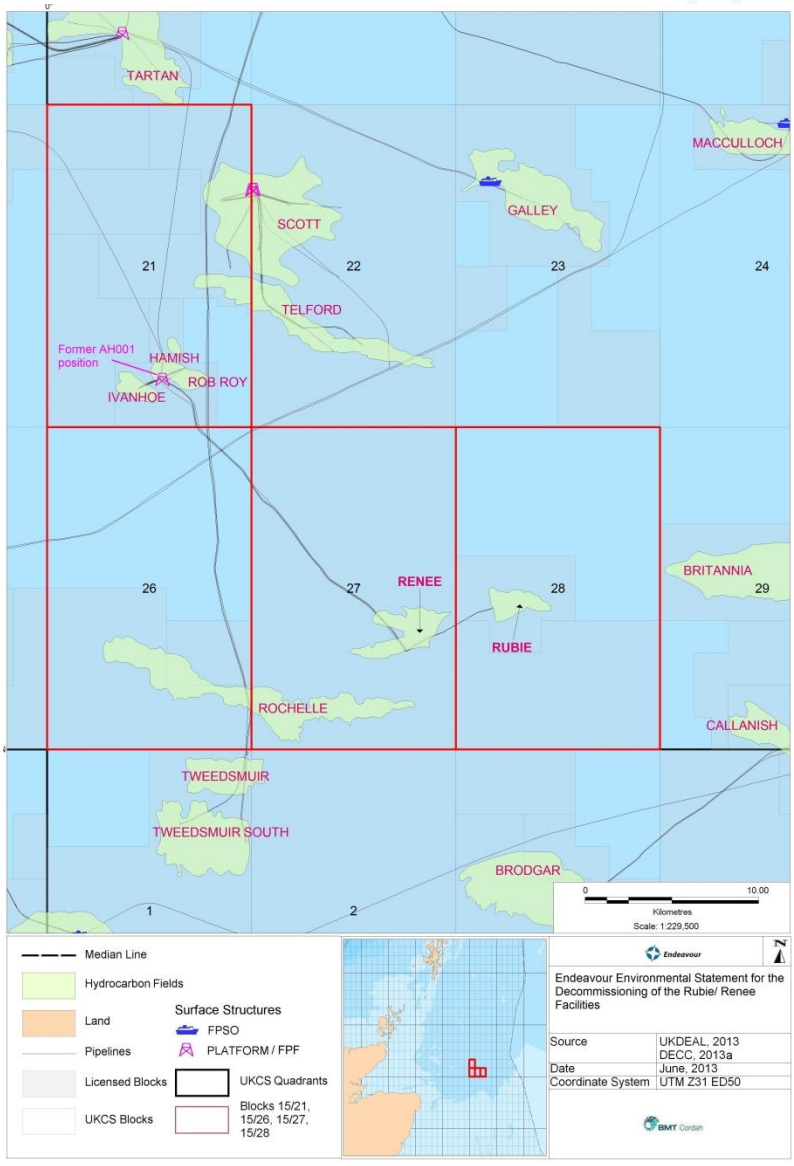

Figure 1.1: Location of the Rubie/ Renee Facilities

1.2 Project Background

The Renee field was first discovered in 1976, while the Rubie field was discovered in 1985. Production at both fields commenced in 1999. Peak oil production at the Renee field occurred during 1999, with approximately 850,000 m^3 of oil produced during the year. Peak oil production at the Rubie field occurred during 2000, with approximately 412,000 m^3 of oil produced during the year. Annual production at both fields subsequently decreased until production at Renee was suspended in 2008 and production at Rubie was suspended in 2009.

Decommissioning preparatory work for Rubie/ Renee was completed by Hess in 2011 and involved the disconnection of the in-field pipelines and jumpers from the wells which were laid on the seabed. Endeavour had originally anticipated redeveloping the Rubie/ Renee fields once Endeavour's Rochelle Development became operational. However, during 2012, they determined that the redevelopment of the Rubie/ Renee fields was no longer viable and, as a result, took the decision to decommission the facilities and fields.

Table 1.1 provides a breakdown of the co-ventures for the Rubie and Renee fields. Hess operated the Rubie/ Renee Development on behalf of the co-venturers.

Table 1.1: Rubie/ Renee Fields Partner Equity

Co-venturer	Rubie Field	Renee Field
Endeavour North Sea Limited	40.78%	77.5%
Hess Limited	19.22%	14%
Marubeni Oil & Gas Limited	40%	8.5%

1.3 Purpose of the Environmental Impact Assessment

The EIA process was conducted in accordance with the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) to support the Rubie/ Renee Facilities Decommissioning Programme (Section 1.4).

The purpose of the EIA process is to understand and communicate the significant environmental impacts associated with the project options to inform the decision making process (Section 2). The ES presents the findings of the EIA and has been prepared as part of the planning and consents process for the future decommissioning of the Rubie/ Renee Facilities.

1.4 Regulatory Context

The decommissioning of offshore oil and gas infrastructure in the UKCS is principally governed by the Petroleum Act 1998, as amended by the Energy Act 2008. The Petroleum Act sets out the requirements for a formal Decommissioning Programme which must be approved by the Department of Energy and Climate Change (DECC) before the owners of an offshore installation or pipeline may proceed with decommissioning.

At present there is no statutory requirement to undertake an EIA for decommissioning. However, under the DECC Guidance Notes on the Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998 (DECC Guidance Notes) the Decommissioning Programme must be supported by an EIA. The DECC Guidance Notes state that an EIA should include an assessment of the following:

- All potential impacts on the marine environment including exposure of biota to contaminants associated with the decommissioning of the installation; other biological impacts arising from physical effects; conflicts with the conservation of species and their habitats.
- All potential impacts on other environmental compartments, including emissions to the atmosphere, leaching to groundwater, discharges to surface fresh water and effects on the soil.
- Consumption of natural resources and energy associated with reuse and recycling.
- Interference with other legitimate uses of the sea and consequential effects on the physical environment.
- Potential impacts on amenities, the activities of communities and on future uses of the environment.

In addition, DECC have advised the Oil and Gas Industry that under the Marine and Coastal Access Act 2009 (MCAA) and the Marine (Scotland) Act 2010 an EIA/ ES will be required for all licence applications relating to decommissioning operations. The MCAA licence application will be made at the time of decommissioning.

OSPAR Decision 98/3 (the Decision) does not include the decommissioning of pipelines. There are no international guidelines on the decommissioning of disused pipelines. However, the UK Petroleum Act and Pipeline Safety regulations 1996 provide a framework for the safe decommissioning of disused pipelines. The DECC Guidance Notes state that 'because of the widely different circumstances of each case, it is not possible to predict with any certainty what may be approved in respect of any class of pipeline'. Therefore all feasible pipeline decommissioning options should be considered and a comparative assessment (CA) made.

A summary of the environmental legislation applicable to this project is provided within Appendix A.

1.5 Report Structure

The ES structure is detailed within Table 1.2.

Table 1.2: The Rubie/ Renee Facilities Decommissioning ES Structure

Section		Contents
NTS	Non-Technical Summary	A non-technical summary of the ES.
1	Introduction	An introduction to the project and the scope of the ES
2	Methodology	The methodological approaches used in the EIA process and a summary of the supporting reports and studies undertaken
3	Project Description	A description of the decommissioning options and the recommended decommissioning option determined by a formal Comparative Assessment (CA) process
4	Environmental Description	A description of the environment and sensitive receptors in the vicinity of the project area
5	Consultation	Details of the consultation process and outcomes
6	Risk Assessment	A detailed description of the risk assessment approach and findings
7	Energy Use and Atmospheric Emissions	Identification of potential sources of impact to environmental and societal receptors, and details of practicable mitigation strategies
8	Underwater Noise	
9	Seabed Footprint	
10	Societal Impact	
11	Discharges to Sea	
12	Accidental Events	
13	Waste	Details the waste likely to be generated and the management processes to be implemented during decommissioning activities
14	Environmental Management	A description of Endeavour's environmental management procedures and how these will apply to the decommissioning of the Rubie/ Renee Facilities. The section also includes a Register of Commitments made within the ES
15	Conclusions	Key findings and conclusions
16	References	Sources of information used to inform the assessment
	Appendix A: Legislation	A summary of relevant environmental legislation
	Appendix B: Non-significant impacts	A summary of the non-significant impacts
	Appendix C: Energy Use and Atmospheric Emissions Supporting Information	Additional information to support the Energy Use and Atmospheric Emissions Assessment

2.0 METHODOLOGY

The EIA systematically identifies significant environmental impacts and risks (potential impacts) associated with the project and assesses the requirement for impact/ risk mitigation measures. The objective of the EIA process is to incorporate environmental considerations into project planning and design to ensure that best environmental practice is achieved.

This section of the ES describes the methods used to:

- identify and evaluate the potential environmental (including social) impacts arising from the decommissioning of the Rubie/ Renee Facilities;
- ensure an appropriate level of assessment is applied to the identified impacts, particularly those impacts identified as being significant; and
- identify actions needed, through design or management control, to avoid or mitigate the key anticipated impacts.

2.1 Environmental Impact Assessment Process

An overview of the EIA process to identify and assess the impacts associated with the Rubie/ Renee Facilities decommissioning programme is provided within Table 2.1 and Figure 2.1.

Table 2.1: Key stages of the EIA process for decommissioning

EIA Stage	Description
Scoping	Scoping of the EIA allows the study to establish the key issues, data requirements and impacts to be addressed in the EIA and the framework or boundary of the study.
Consideration of alternatives	Demonstrates that other feasible approaches, including alternative uses, end points and decommissioning methods have been considered.
Description of project actions	Provides clarification of the purpose of the project and an understanding of its various characteristics – including stages of decommissioning, location and processes.
Description of environmental baseline	Establishes the current state of the environment on the basis of data from literature and field surveys and may involve discussions with the authorities and other stakeholders.
Identification of key impacts and prediction of significance	Seeks to identify the nature and magnitude of identified change in the environment as a result of project activities and assesses the relative significance of the predicted impacts.
Impact mitigation and monitoring	Outlines the measures that will be employed to avoid, reduce, remedy or compensate for any significant impacts. Mitigation measures will be developed into a project environmental management plan. Aspects of the project which may give rise to a significant impact and which cannot be mitigated to an acceptable level of impact may need to be redesigned. This stage will feed back into project decommissioning activities.
Presentation of the ES	Reporting of the EIA process, through the production of an ES, which clearly outlines the processes above. The ES provides a means to communicate the environmental considerations and environmental management plans associated with the project to the public and stakeholders.
Monitoring	Monitoring will continue beyond the decommissioning phase at a periodicity agreed with DECC.

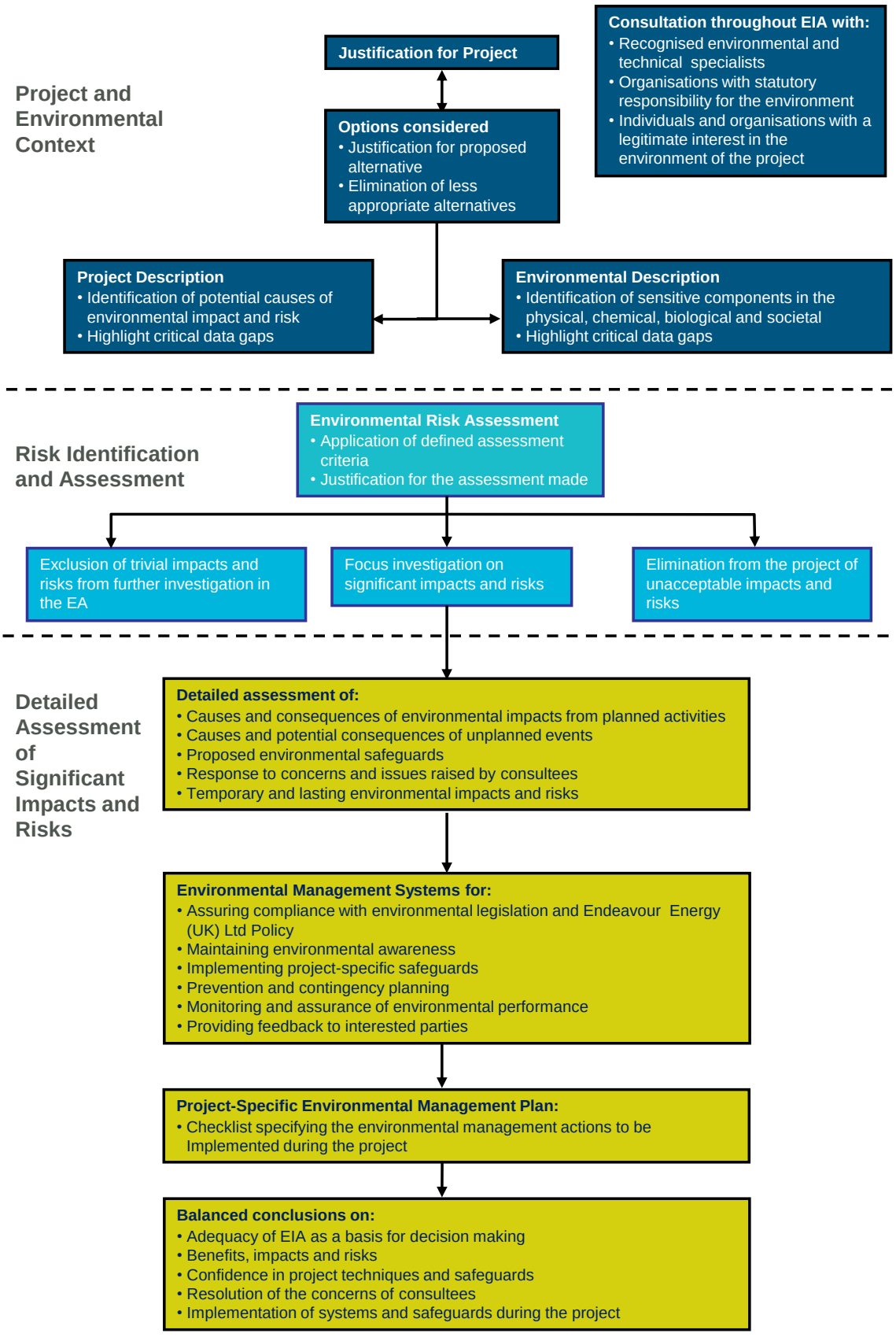

Figure 2.1: Principal stages in the EIA process

2.1.1 Scoping

Scoping is an integral part of the impact assessment process, the aim of which is to identify potential impacts to be assessed in greater detail within the ES. Scoping is a two-stage process comprising:

- an initial identification of potential impacts; and
- a preliminary evaluation of significance based on available information.

A Scoping Assessment was undertaken as part of the Environmental Impact Assessment and it identified the potential environmental receptors and other considerations which may be impacted by the proposed decommissioning operations (Figure 2.2).

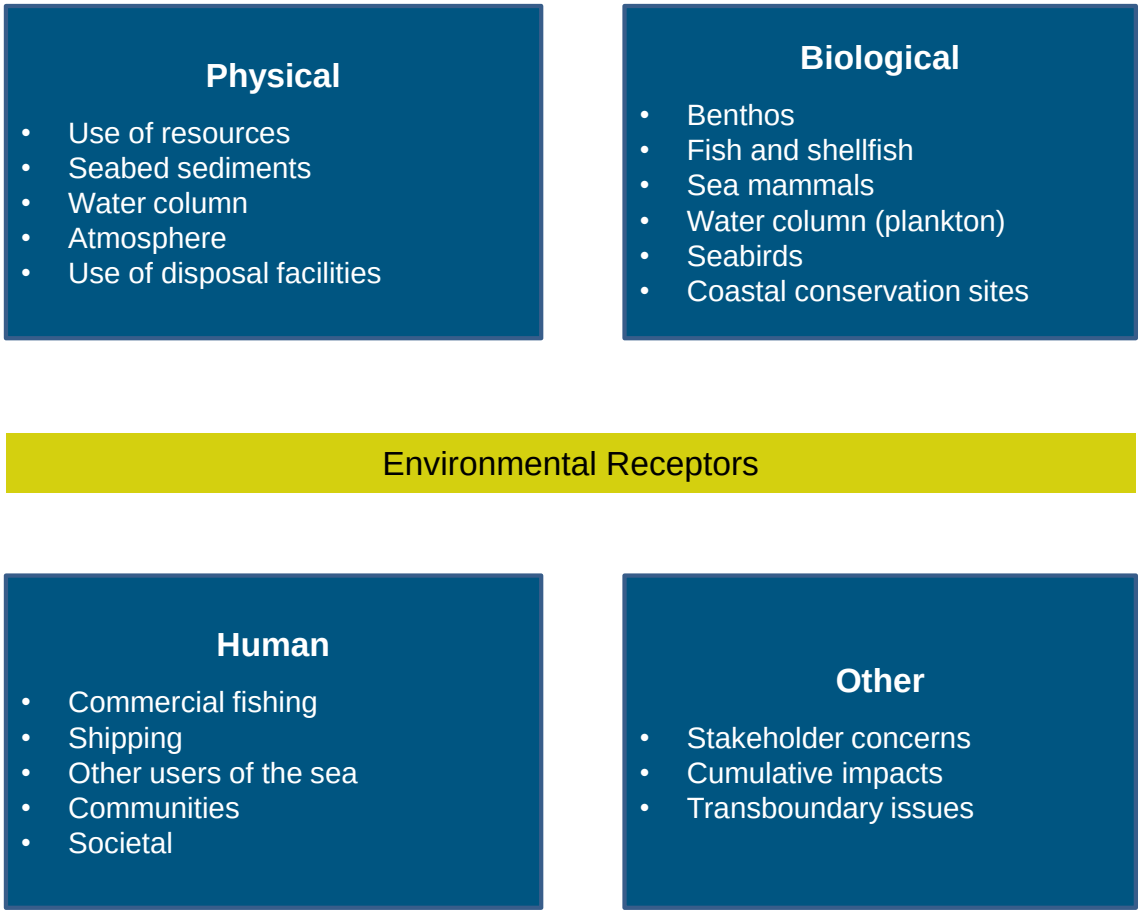

Figure 2.2: Environmental receptors

A summary of the issues identified during the scoping exercise for further assessment during the EIA includes:

- effects of seabed disturbance during decommissioning operations – vessel anchoring, rock-placement;
- effects of energy use and atmospheric emissions;
- effects of underwater noise generated during decommissioning activities;
- safety risk to fishermen from pipelines, rock-placement and dropped objects;

- societal impact to fishermen from the pipelines and physical presence of decommissioning vessels; and
- non-routine events – spillage of hydrocarbons and other fluids.

The above issues were further validated and assessed through baseline assessments, modelling studies, stakeholder engagements and the detailed ES.

2.1.2 Cumulative and Transboundary Impacts

The EIA process also includes the identification of any potential cumulative or transboundary impacts that could be caused by the proposed decommissioning programme. Cumulative impacts occur as a result of a number of activities (e.g. discharges or emissions) combining or overlapping and potentially creating a new impact. Even where impacts do not overlap, it is important to consider the incremental effect of many small areas of impact on a particular environment or its use.

Transboundary impacts are those which could have an impact on the environment and resources beyond the boundary of UK waters. The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) addresses the need to enhance international co-operation in assessing transboundary environmental impacts.

2.2 Comparative Assessment

The pipelines at the Rubie/ Renee Development are subject to a CA to identify the optimal decommissioning solution under the Petroleum Act 1998. In order to determine the recommended decommissioning option Endeavour conducted a formal CA of possible decommissioning options to establish whether there was a difference between options and if so which option performed the best.

Each decommissioning option was assessed against the five main DECC criteria – safety, environment (informed by the EIA process), cost, technical and societal. All decommissioning options and the subsequent recommended option are described within Section 3. The EIA process assessed the impacts of all decommissioning options, with assessment sections 8 to 12 of the ES considering only the recommended option as identified within the CA process.

3.0 PROJECT DESCRIPTION

This section presents the Project Description of the ES for the decommissioning of the Rubie/ Renee Facilities.

3.1 Overview

The Rubie and Renee fields were developed as subsea wells tie-backed to the Hess operated Floating Production Facility (FPF) AH001, located 21 km to the northwest of the Renee field. Hess disconnected and removed the AH001 FPF as part of the IVRRH Decommissioning Programme in 2009.

The Renee field consists of one production well, one water injection well and the Renee production manifold (RPM) tied back a crossover structure (COS). The RPM was also tied back to the COS via the dynamic umbilical base structure (DUBS). The single Rubie production well is tied back to the RPM, via a 5.6 km 8" pipeline (PL1624).

Table 3.1 provides a summary of the co-ordinates for the key Rubie/ Renee Facilities.

Table 3.1: Co-ordinates of the main Rubie/ Renee Facilities

Rubie/ Renee Facility	Latitude and Longitude	UTM*
Rubie production well (15/28b-7z)	58º 04' 24"N 00º 26' 10"E	6 439 889.66 N 348 771.20 E
Renee production well (15/27-6y)	58º 02' 59.9"N 00º 20' 58.2"E	6 437 553.6 N 343664.77 E
Renee appraisal well (15/27-8)	58º 03' 6.39"N 00º 21' 4.016"E	6 437 541.5 N 343 677.1 E
Renee water injection well (15/27-7)	58º 03' 2.78"N 00º 21' 5.72"E	6 437 610.9 N 343 710.35 E
Renee Production Manifold (RPM)	58º 03' 2.78"N 00º 21' 5.72"E	6 437 574.8 N 343 692.34 E
Crossover Structure (COS)	58º 11' 39.978" N 0º 6' 41.553" E	6 454 005.32 N 330 220.88 E
Dynamic Umbilical Base Structure (DUBS)	58º 11' 32.752" N 0º 6' 36.748" E	6 453 776 N 330 136 E

**UTM projection zone 31 (central meridian 3 degrees East) International spheroid ED50*

Reservoir pressure support at the Renee field was provided by a single water injection well and gas lift. The Renee produced fluids were transported through a wellhead production jumper spool connected to the RPM. The RPM included valves, subsea control modules, manifold and pigging equipment.

Production fluids from the Renee and Rubie wells were commingled in the 8" production header. The RPM was configured to permit individual well testing through either the 8" test production pipeline (PL1616) or the oil production pipeline (PL1617). The RPM also distributed the lift gas provided by AH001 to the Renee and Rubie production wells.

From the RPM, two 21.6 km 8" production pipelines (PL1616 and PL1617) transported the fluids to the COS.

Prior to production suspension in 2008, production from the Rubie/ Renee wells was routed through the IVRRH riser base manifold (RBM; Figure 3.1), then through a flexible riser (PL516) from the RBM to AH001. The produced fluids were comingled with the produced fluids and gas from the IVRRH fields and exported from the AH001 via the RBM through two export pipelines. Produced oil was transported through a 14" steel pipeline to the Claymore Alpha platform, with processed gas exported through an 8" steel pipeline to the Tartan Alpha platform.

Following production suspension in 2008, the preparatory work has been undertaken by Endeavour and Hess for the decommissioning of the Rubie/ Renee Facilities:

- The DUBS was removed by Hess from the seabed in June 2013.
- The three wells were disconnected in 2013. The spools connecting the wells to the production pipelines were disconnected, cut and wet stored on the seabed along with the protective mattresses for future recovery. There is a fourth well at the Renee Field, appraisal well 15/27-8 which was plugged and abandoned (P&A) in 1999.
- During 2011, the spools connecting the COS to Hess' RBM were disconnected, cut and wet stored on the seabed for future recovery.
- Pipelines PL1616, PL1617, PL1618 and PL1620 crossing the Ivanhoe to Rob Roy electrical / hydraulic umbilical were cut into 16 x 10 m sections in June 2013. The 48 sections have been cut and wet stored on the seabed for future recovery.

Figure 3.1 presents a schematic illustration of the Rubie/ Renee facilities' current status.

The Rubie/ Renee facilities which remain in-field and require decommissioning by Endeavour include (Figure 3.1):

- Renee Production Manifold (RPM).
- Crossover Structure (COS).
- Rubie production well.
- Renee production well.
- Renee water injection well.
- Renee 15/27-8 P&A'd well
- In-field pipelines, umbilicals, jumpers and spools.
- Wet stored spools cut and ready for recovery.
- Concrete mattresses wet-stored on the seabed ready for recovery.
- Wet stored pipeline sections cut and ready for recovery.
- Other concrete mattresses currently *in situ*.

3.2 Description of Facilities to be Decommissioned

The facilities which are included in the Rubie/ Renee Facilities Decommissioning Programme are shown in Figure 3.1 and detailed in Table 3.2 with the proposed schedule for decommissioning.

Table 3.2: Overview of facilities to be decommissioned

Rubie/ Renee Facility	Components of the Facilities to be Decommissioned	Proposed decommissioning schedule
Subsea wells	Rubie production wellhead (15/28b-7z) Renee production wellhead (15/27-6y) Renee water injection wellhead (15/27-7)	Well disconnection: 2013 P&A: 2016
	Renee appraisal wellhead (15/27-8)	P&A: 2016
Subsea infrastructure	Renee Production Manifold (RPM) Crossover Structure (COS)	Disconnect: 2014 Recovery: 2014 to 2015
Pipelines	0.16 km 8" oil test production pipeline (PL1616) 0.16 km 8" oil production pipeline (PL1617) 0.16 km 4" gas lift pipeline (PL1618) piggybacked on PL1620 0.16 km 8" water injection pipeline (PL1620) 21.6 km* PL1616 21.6 km* PL1617 21.6 km* PL1618 piggybacked on PL1620 21.6 km* PL1620 5.6 km* 8" oil production pipeline (PL1624) 5.6 km* 3" gas lift pipeline (PL1625)	Cut and wet stored: 2013 Recovery: 2015 Disconnect: 2014 to 2015 Leave *in situ*: 2015
Umbilicals	40 m ¾" (two) wellhead chemical umbilicals (PL1623.1 and PL1623.2)	Disconnection: 2011 Recovery: 2015
	21.6 km (two) methanol and (six) chemicals umbilicals (PL1619.1 to PL1619.8) 5.6 km* (two) methanol and (six) chemicals umbilicals (PL1626.1 to PL1626.8)	Disconnection:2011 Leave *in situ*: 2015
Jumpers	40 m 6" wellhead production jumper (PL1621) 40 m 2" flexible jumper (PL1622)	Disconnect :2013 Recovery: 2015
Spools	Spools connecting the wellheads to the production pipelines	Disconnected, cut and wet stored: 2013 Recovery: 2015
	Spools connecting the pipelines to the RPM.	Disconnection: 2014 Recovery: 2015
	COS to RBM spools (21)	Disconnected, cut and wet stored: 2011 Recovery: 2015
Protective structures	200 to 250 concrete mattresses	Recovery: 2015

3.2.1 Wells

The Rubie/ Renee Facilities have three suspended subsea tie-back wells; Renee production well (15/27-6y), Renee water injection well (15/27-7) and Rubie production well (15/28b-7z). All three wells are connected to the RPM. Figures 3.2a and 3.2b provide schematics of the wells which have the following features:

- The Rubie production well 15/28b-7z was drilled in 1999 and is located approximately 5.6 km northeast of the RPM. Production at the well ceased in 2007/2008, suspended in 2009, and disconnected in 2013. The spools connected to the well were

disconnected, cut and wet stored on the seabed. The flowlines (PL1624 and PL1625) that connect the wellhead to the RPM have been left in place. The wellhead protective structure remains in place.

- Renee production well 15/27-6y was drilled in 1998 and is located approximately 40 m southeast of the RPM. Production at the well ceased in 2009. The well was suspended later that year and disconnected in 2013. The spools connected to the well were disconnected, cut and wet stored on the seabed. The flowlines (PL1621 and PL1622) that connect the wellhead to the RPM have been left in place. The wellhead protective structure remains in place.
- The Renee water injection well 15/27-7 was drilled in 1998 and is located approximately 40 m north of the RPM. The well ceased operating in 2007/2008, was suspended in 2009 and disconnected in 2013. The spools connected to the well were disconnected, cut and wet stored on the seabed. The flowline that connected the wellhead to the RPM has been left in place. The wellhead protective structure remains in place.

During 2013, each well was disconnected from the pipeline system. Rated blinds were installed on the wells to provide continued well barrier integrity. Each well is comprised of

- A Xmas tree, approximately 5.3 m long, 5.3 m wide, and 4 m high.
- A guide base, approximately 2.9 m long, 2.9 m wide, and 3 m high.
- A wellhead, approximately 2 m long and wide and 0.8 m high.

A fourth well (appraisal well 15/27-8) was drilled and abandoned at the Renee field in 1999, approximately 40 m from the RPM and 15 m from production well 15/27-6y (Figure 3.2a).

3.2.2 Drill Cuttings

The upper hole sections of the Rubie and Renee wells were drilled with water-based muds (WBM) and cuttings from this section were discharged onto the seabed. Subsequently, the small cuttings piles that had accumulated on the seabed as a result of the top hole drilling were cleared away to allow the Xmas trees and wellheads to be properly located on the seabed.

No data are available for the drilling muds used at the Rubie and Renee wells. Therefore, a precautionary approach has been adopted and Endeavour assume that the wells were drilled with oil-based muds (OBM). The cuttings from sections drilled with OBM will have been returned to the drilling rig through the mud return line where they will have been contained within the rig's closed loop OBM system. The recovered mud and cuttings will have been taken to shore.

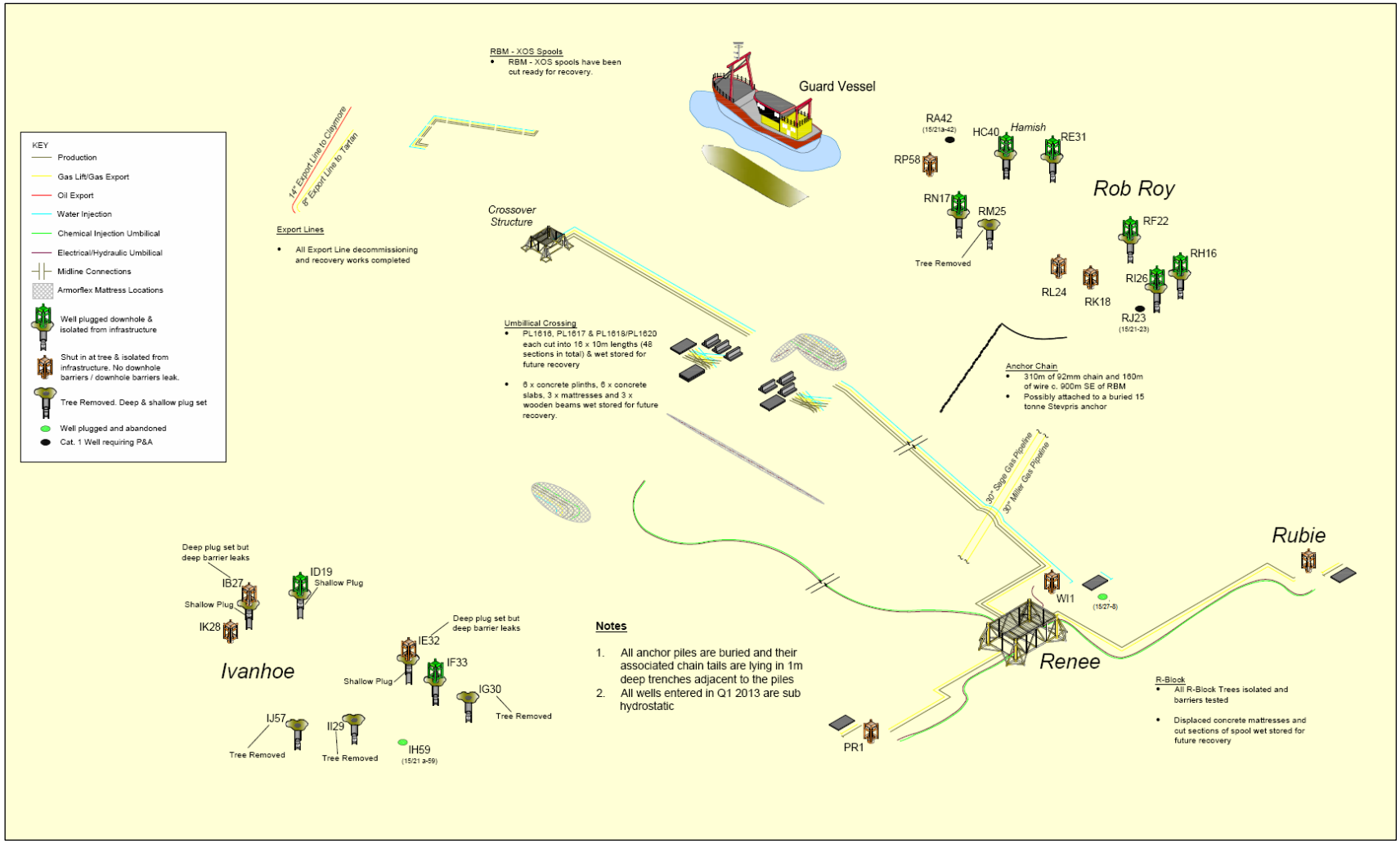

Figure 3.1: Schematic diagram of the current Rubie/ Renee Facilities layout after the commencement of preparatory decommissioning operations

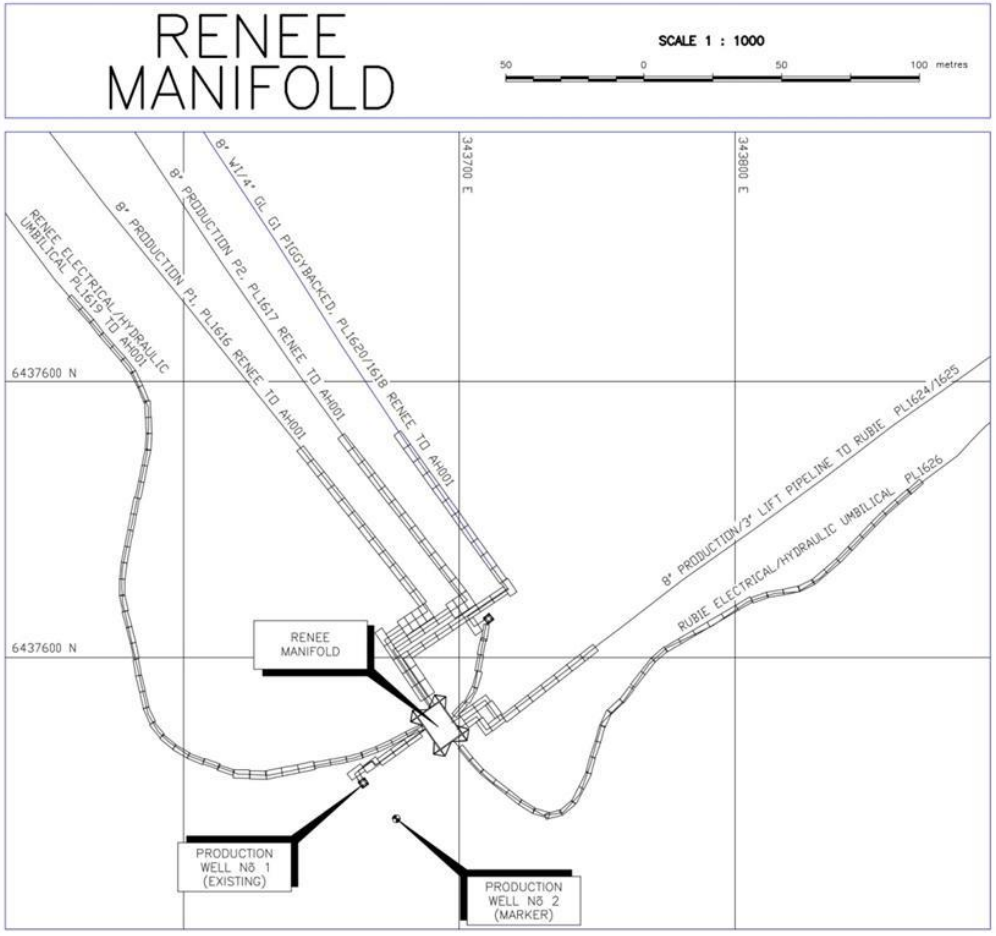

Figure 3.2a: Schematic of the Renee wells and RPM layout

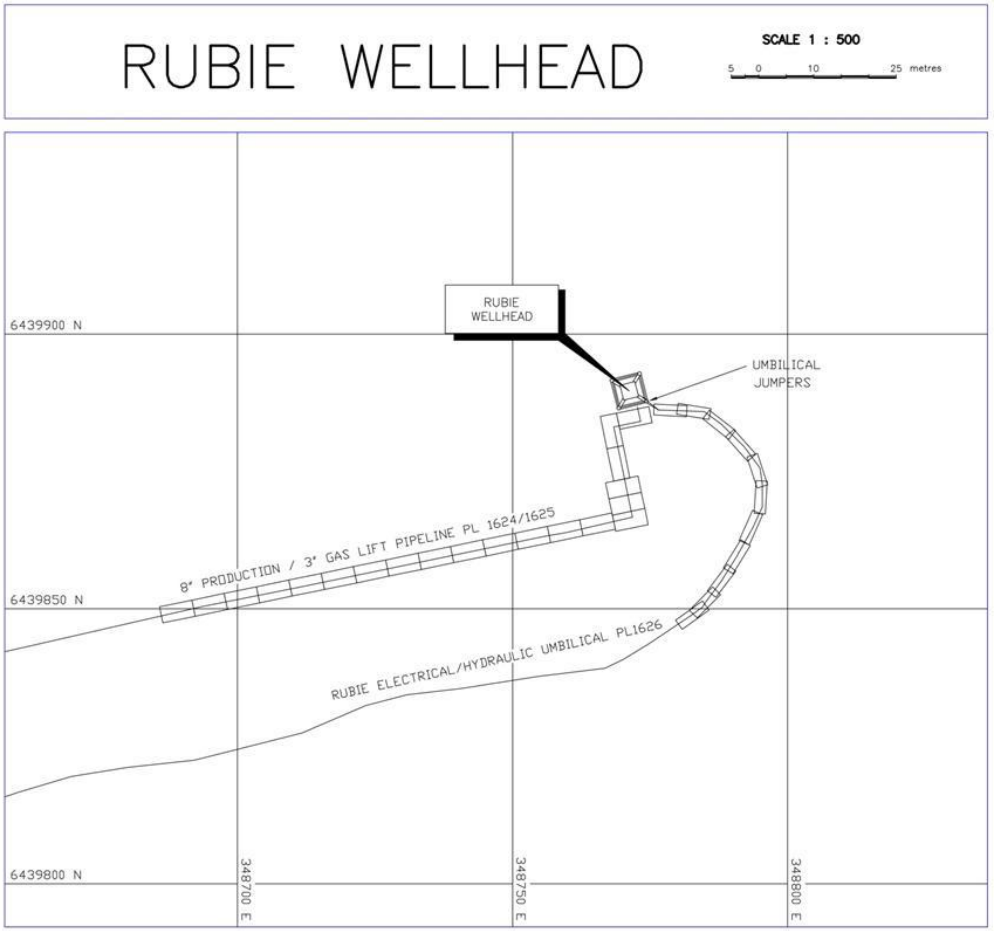

Figure 3.2b: Schematic of the Rubie well layout

Survey data indicates that surface sediments at the Rubie/ Renee Facilities area exhibited a 'background' level of recent and weathered low level petroleum and biogenic hydrocarbons such as that commonly found in surface sediments of the central North Sea (Fugro ERT, 2011). The apparent lack of any major effect around the well locations suggests that contamination of the seabed has been limited, or that the benthic communities have recovered from an initially more highly disturbed state (Section 4.2; Fugro ERT, 2011).

With only limited survey data available for the well locations, neither the area of seabed contamination nor a value for persistence have been calculated. Comparison has instead been made with the nearby Hess IVRRH locations, for which persistence has been estimated. However, much less drilling has occurred at the Rubie and Renee fields. Given that the IVRRH fields both fell well below the persistence threshold, Endeavour believe that it is highly likely that the Rubie and Renee drilling sites will also be well below the persistence threshold.

3.2.3 Subsea Structures

Endeavour's Rubie/ Renee Development included two subsea structures which remain on the seabed and will require removal as part of the proposed decommissioning operations:

- Renee Production Manifold (RPM)
- Cross Over Structure (COS)

Renee Production Manifold (RPM)

The RPM includes various equipment, including valves, subsea control modules, manifold and pigging equipment (Figure 3.3). It is located approximately 6 km from the Rubie production well and 21 km from the former location of the AH001. Rectangular in cross section, it is 15 m long, 6 m wide and 5 m in height, and weighs 105 tonnes, of which 35 tonnes is a result of the installed equipment.

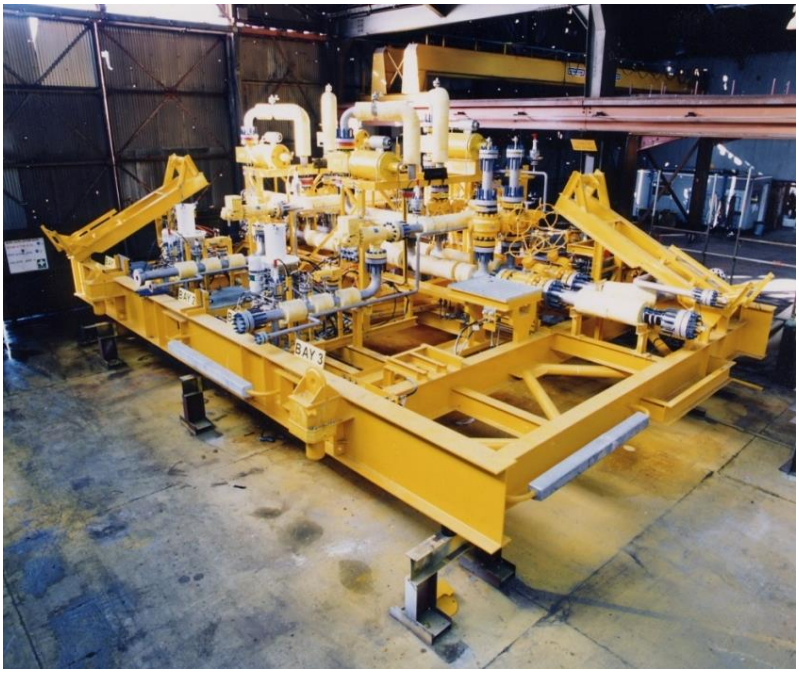

Figure 3.3: Renee Production Manifold (RPM)

The structure was secured to the seabed by four steel piles each of 0.6 m in diameter and 29 m in length. Skirted mudmats underneath the RPM provide seabed stability and scour protection. Although the RPM does not include a true protective structure, some over-trawlability was achieved by sloping deflectors on the corners of the structure.

The RPM ties back to the crossover structure (COS) through two 8" production pipelines (PL1616 and PL1617), a gas lift pipeline (PL1618) and electro/ hydraulic umbilicals (PL1619.1 to PL1619.8). These pipelines connect the COS to the Riser Base Manifold (RBM). PL1620, which transported injection water from AH001 via the RBM and then the COS connects directly to the Renee water injection well, rather than the RPM.

Crossover Structure (COS)

The crossover structure (COS) (Figure 3.4) is approximately 21 km from the RPM. The Renee and Rubie production fluids were transported to the COS via two 8" production pipelines (PL1616 and PL1617) from the RPM. A crossover valve within the COS was kept closed to allow the test fluids to be directed to the RBM test manifold and test flexible riser (PL517). The COS is a rectangular structure, 4 m long, 4.6 m wide and 3.4 m high, weighing 10 tonnes, and is equipped with a protective structure (Figure 3.4).

(a) COS without the protective structure **(b) COS protective structure**

Figure 3.4: Crossover structure (COS)

3.2.4 Pipelines

The Rubie/ Renee pipelines requiring decommissioning include (Figure 3.1):

- A 21.6 km 8” test production pipeline (PL1616) connects the RPM to the COS. The pipeline is trenched and buried. Approximately 160 m of PL1616 which crossed the Ivanhoe to Rob Roy electrical/ hydraulic umbilical has been cut and wet stored on the seabed.
- A 21.6 km 8” oil production pipeline (PL1617) also connects the RPM to the COS. The pipeline is trenched and buried. Approximately 160 m of PL1617 which crossed the Ivanhoe to Rob Roy electrical/ hydraulic umbilical has been cut and wet stored on the seabed.
- A 21.6 km 8” water injection pipeline (PL1620) connects the Renee water injection well to the COS. The pipeline is trenched and buried. Approximately 160 m of PL1620 which crossed the Ivanhoe to Rob Roy electrical/ hydraulic umbilical has been cut and wet stored on the seabed.
- A 21.6 km 4” gas lift pipeline (PL1618) connects the RPM to the COS. This pipeline was piggybacked with the water injection pipeline (PL1620). Both pipelines are trenched. Approximately 160 m of PL1618 which crossed the Ivanhoe to Rob Roy electrical/ hydraulic umbilical has been cut and wet stored on the seabed.
- A 5.6 km 8” oil production pipeline (PL1624) connects the Rubie production well to the RPM. This pipeline is trenched.
- A 5.6 km 3” gas lift pipeline (PL1625) connects the RPM to the Rubie production well. This pipeline was piggybacked with the 8” production pipeline (PL1624). Both pipelines are trenched.

3.2.5 Umbilicals

The Rubie/ Renee methanol and chemical umbilicals requiring decommissioning include:

- Two 21.6 km ¾" methanol umbilicals (PL1619.1 and 1619.2) connect the RPM to the DUBS subsea umbilical termination (Figure 3.5a). These umbilicals are trenched.
- Six 21.6 km ½" chemical umbilicals (PL1619.3 to 1619.8) connect the RPM to the DUBS subsea umbilical termination (Figure 3.5a). These umbilicals are trenched.
- Two 40 m ⅜" chemical umbilicals (PL1623.1 and PL1623.2), connect the Renee production well to the RPM. These umbilicals are surface laid and protected by mattresses.
- Two 5.6 km ¾" methanol umbilicals (PL1626.1 and 1626.2) connect the RPM to the Rubie production well, via the Rubie subsea umbilical termination (SUT) (Figure 3.5b). These umbilicals are trenched and backfilled.
- Six 5.6 km ½" chemical umbilicals (PL1626.3 to 1626.8) connect the RPM to the Rubie production well, via the Rubie SUT (Figure 3.5b). These umbilicals are trenched and backfilled.

3.2.6 Jumpers

The following surface laid jumpers require decommissioning:

- A 40 m 6" wellhead production jumper (PL1621) transported Renee production fluids from the Renee production wellhead to the RPM.
- A 40 m 2" flexible jumper (PL1622) transported gas from the RPM to the Renee production wellhead.

3.2.7 Spools

The following surface laid spools require decommissioning:

- Two 20 m spools, connecting PL1616 to the RPM and to the COS.
- Two 20 m spools, connecting PL1617 to the RPM and to the COS.
- Two 20 m spools, connecting PL1618 to RPM and to the COS.
- A 60 m spool, connecting PL1620 to the COS.
- A 20 m spool connecting PL1624 to the RPM.
- A 20 m spool connecting PL1625 to the RPM.

3.2.8 Crossings

Third party pipelines cross the Rubie/ Renee Facilities and have a bearing on the decommissioning programme for the Rubie/ Renee Facilities. These pipelines are summarised in Table 3.3.

3.2.9 Mattresses

Endeavour estimated that between 200 and 250 polypropylene link-lock concrete mattresses are currently deposited on the seabed at the Rubie/ Renee Facilities to provide protection, support and stability to the Rubie/ Renee Facilities. The mattresses are of standard density concrete with standard dimensions of 6 m long and 2 or 3 m wide and 0.15 m high.

3.3 Inventory of Materials

Table 3.4 presents an estimate of the mass of different types of material in the various Rubie/ Renee Facilities.

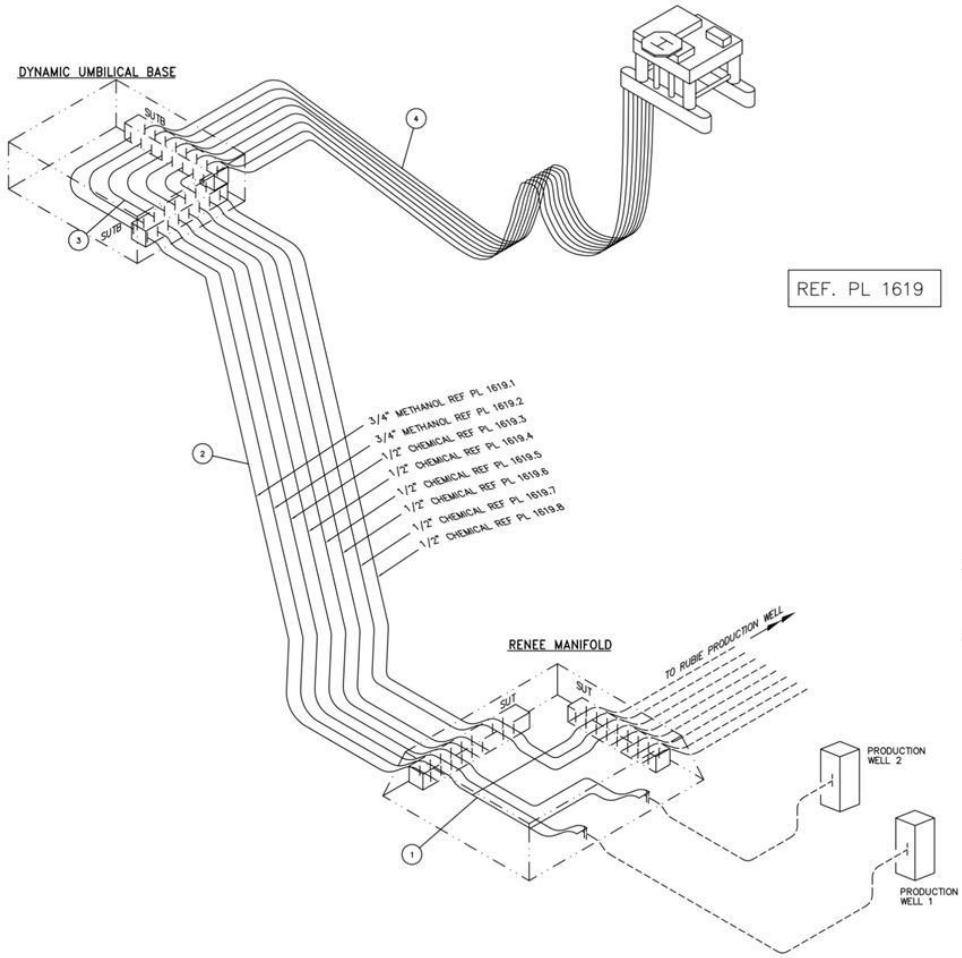

Figure 3.5a: Schematic illustration of the Renee chemical umbilical system

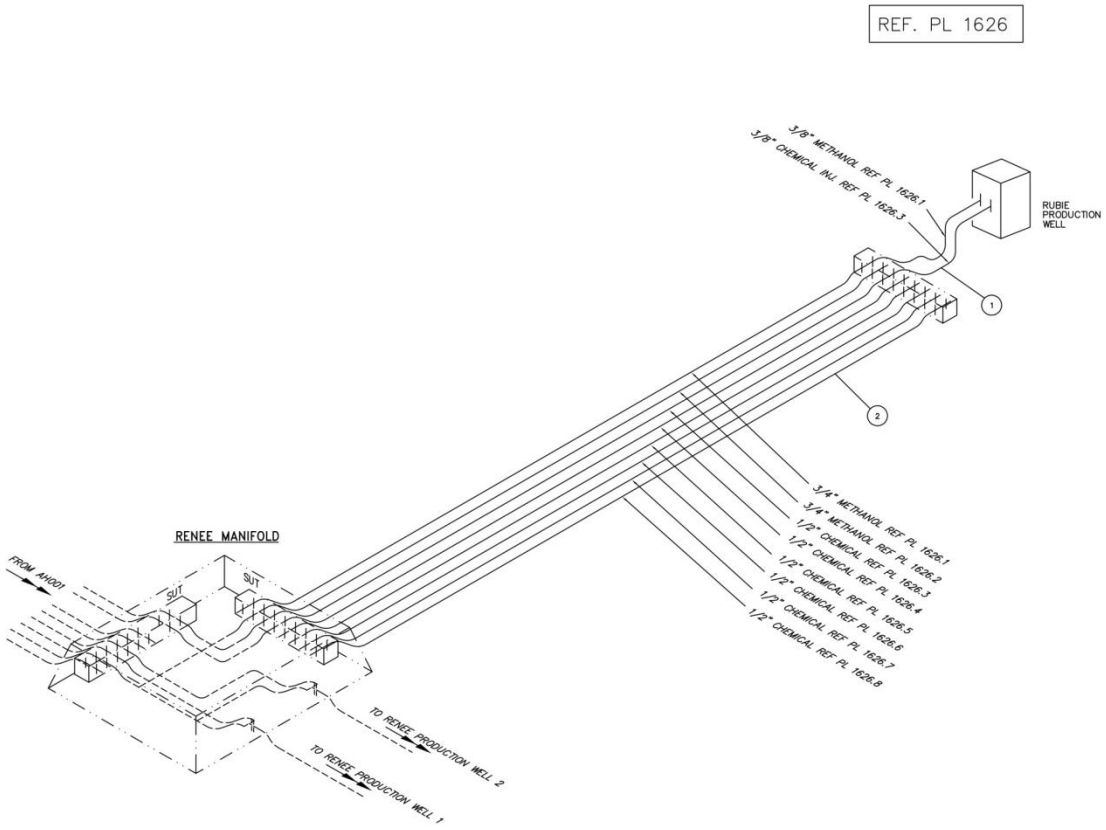

Figure 3.5b: Schematic illustration of the Rubie chemical umbilical system

Table 3.3: Rubie/ Renee Facilities Crossings

Operator	Pipeline Description	Pipeline Number	Rubie/ Renee Facility crossed	Position and protection
BP Exploration Limited	30" Miller to St Fergus	PL720	PL1616, PL1617, PL1618/ PL1620, PL1619	PL720 is under rock dump. PL720 crosses under pipelines
Apache North Sea Limited	30" SAGE Beryl to Fergus	PL762	PL1616, PL1617, PL1618/ PL1620, PL1619	PL762 is under rock dump. PL762 crosses under pipelines
Hess	CU3-CUBS Control Umbilical CUBS to Rob Roy Manifold*	Not applicable	PL1616, PL1617, PL1618/ PL1620	Umbilical is under protective mattresses. Umbilical crosses under pipelines
Talisman Energy (UK) Limited	12"/18" PIP Production Tweedsmuir Main Manifold to Piper Bravo USV	PL2125	PL1616, PL1617, PL1618/ PL1620, PL1619	PL2125 crosses over pipelines. Pipelines are protected by rock dump.
Talisman Energy (UK) Limited	10" Water Injection Tweedsmuir Main Manifold to Piper Bravo USV	PL2127	PL1616, PL1617, PL1618/ PL1620, PL1619	PL2127 crosses over pipelines. Pipelines are protected by rock dump.
Talisman Energy (UK) Limited	4" Gas Lift Tweedsmuir Main Manifold to Piper Bravo USV	PL2129	PL1616, PL1617, PL1618/ PL1620, PL1619	PL2129 crosses over pipelines. Pipelines are protected by rock dump.
Talisman Energy (UK) Limited	Control Umbilical Piper Bravo to Tweedsmuir Main Manifold	PL2131	PL1616, PL1617, PL1618/ PL1620, PL1619	PL2131 crosses over pipelines. Pipelines are protected by rock dump.
BT	Out-of-service BT Telecommunications cable.	Not applicable	PL1616, PL1618/PL1620, PL1619	Cable crosses under pipelines. Pipelines are buried at this point.
Hess	Chemical Injection Wet-Store to Rob Roy Manifold	PL520	PL1616, PL1617, PL1618/ PL1620	PL520 crosses over pipelines. Pipelines are protected by mattresses.
Nexen	Rochelle 30 km 14"/10" PiP Production Pipeline from East Rochelle Manifold to Scott Production Platform.		PL1616; PL1617; PL1618/ PL1620 PL1619	Pipelines are protected by rock dump.

**this umbilical does not have a PL number (Hess, 2013)*

Source: Endeavour (2013a)

Table 3.4: Inventory of the main materials comprising the Rubie/ Renee facilities and items to be decommissioned

Rubie/ Renee Facilty	Description of Rubie/ Renee Facilities	Mass (tonnes)				
		Concrete	Steel	Aluminium	Copper	Plastic
Wells (3 suspended and 1 P&A)	Tree Guidebase Wellhead	-	95.88 18.00 19.92	-	-	-
RPM	Structure	-	105.0	-	-	-
COS	Structure	-	10.00	-	-	-
Mattresses	200 -250 polypropylene link-lock concrete mattresses	1,250	-	-	-	-
RBM spools	Nine spools	-	18.73	-	-	0.1873
COS spools	Twelve spools	-	29.61	-	-	0.2960
RPM spools	Thirteen spools	-	22.29	-	-	0.2230
Rubie wellhead spools	Four spools	-	6.361	-	-	0.06400
PL1616	8” test pipeline	-	1,396	22.30	-	445.9
PL1617	8” oil pipeline	-	1,396	22.30	-	445.9
PL1618	4” gas lift pipeline	-	346.1	3.700	-	15.70
PL1620	8” water injection pipeline	-	1,396	6.800	-	29.90
PL1624	8” oil pipeline	-	362.0	-	-	115.6
PL1625	3” gas lift pipeline	-	55.80	-	-	3.200
PL1622	6” production jumper	-	0.1860	-	-	0.001860
PL1621	2” jumper	-	3.427	-	-	0.3427
PL1623.1 & .2	Two chemical umbilicals	-	-	-	-	0.01880
PL1626.1 & .3	Two chemical umbilicals	-	-	-	-	2.840
PL1619	Eight chemical umbilicals	-	350.5	-	10.97	186.9
PL1626	Eight chemical umbilicals	-	93.20	-	2.900	49.70
Total		**1,250**	**5,725**	**55.10**	**13.87**	**1,297**

3.4 Overview of the Options Available for Decommissioning

This section describes the viable options that Endeavour has considered for the decommissioning of the Rubie/ Renee Facilities and which therefore will be covered by this EIA. Decommissioning options for the pipeline and umbilicals were subject to a formal CA to determine which decommissioning options should be selected for the Rubie/ Renee Facilities. Table 3.5 provides a summary of these options.

Table 3.5: Overview of short-listed decommissioning options for each of the Rubie/ Renee Facilities

Rubie/ Renee Facility	Decommissioning Option	Method
Subsea Wellheads: • Renee production • Renee water injection • Rubie production	Full removal	
Subsea infrastructure: • RPM • COS	Full removal	
Pipelines and umbilicals: • PL1616 • PL1617 • PL1618 • PL1620 • PL1624 • PL1625 • PL1619.1 to PL1619.8 • PL1623.1 and PL1623.2 • PL1626.1 to PL1626.8	Leave *in situ*	No removal; burial of pipeline ends.
	Recovery by reverse reel	Cut and lift
	Recovery by reverse S-lay	Cut and lift
	Long section recovery	Cut and lift
	Removal by tow recovery	Cut and lift
	Short section recovery	Cut and lift
	J-lift recovery	Cut and lift
Jumpers/ spools, including PL1621 and PL1622	Full removal	
Mattresses	Full removal	
Rock placement	Leave *in situ*	

3.5 Overview of the CA Process

As required by the Petroleum Act 1998, and as described in the DECC Guidance Notes (DECC, 2011), if consideration is being given for part or all of the pipelines to be left *in situ* a CA is required to identify the best overall option for decommissioning the pipelines and umbilicals.

Endeavour carried out a CA of the available options for decommissioning the pipelines and umbilicals, to determine which option was most suitable in view of the status, condition and environmental setting of those facilities.

The findings of a number of individual technical studies on the various options were assessed and the results collated. The outcome of the CA process for the selection of the recommended option for decommissioning the pipelines and umbilicals is summarised in Section 3.8. The methods and outcomes for decommissioning the remaining Rubie/ Renee Facilities (subsea wells and subsea infrastructure) are also summarised in Section 3.8.

3.5.1 Description of options for the pipelines and umbilicals

This section outlines the methods that may be used to decommission the Rubie/ Renee pipelines and umbilicals. The DECC Guidance Notes recommend that smaller diameter pipelines, including flexible flowlines and umbilicals which are neither trenched nor buried, should normally be entirely removed.

3.5.2 Pipeline removal techniques for the umbilicals and RPM to wellheads pipelines

Endeavour plan to fully remove the umbilicals, jumpers, spools connecting the wellheads to the RPM, by cutting and lifting the structures. Sections of the pipelines and umbilicals will be cut at the seabed using a large ROV equipped with specialist hydraulic guillotine cutting equipment. Cut sections of the pipelines and umbilicals will be lifted onto a support vessel and returned to shore for recycling or disposal.

3.5.3 Decommissioning options for the RPM to COS and Rubie pipelines

The potential decommissioning options being considered for the trenched and buried pipelines and umbilicals (Table 3.5) are:

1. Leave *in situ*;
2. Recovery by reverse reel;
3. Recovery by reverse S-lay;
4. Long section recovery;
5. Towed recovery;
6. Short section recovery (cut and lift); and
7. J-lift recovery.

The following provides a description of these seven options considered for the four trenched and buried pipelines that connect the RPM to the COS, along with the justification for the selection or exclusion of the particular options from further consideration in the CA.

Option 1: Leave *in situ* (Selected)

The pipelines currently contain inhibited seawater and will be left in their original locations buried in seabed sediments. The decommissioned lines will remain buried to a minimum depth of 0.6 m below the natural seabed level, thereby creating an unobstructed seabed. The exposed ends of the disconnected pipelines in the seabed will be buried, and any sections of pipeline which have become uncovered naturally during seabed sediment movement will be buried to an adequate depth. Periodic monitoring of the lines will be carried out according to DECC requirements.

The option of leaving the pipelines in place was selected for further consideration in the CA because it is practicable and has been widely used for the decommissioning of buried pipelines on the UKCS.

Option 2: Recovery by reverse reel (Selected)

Pipeline recovery with a reel barge/ vessel is the reverse of pipeline laying, consequently, appreciable lengths of pipe can be recovered quickly. A dynamically positioned reel barge or vessel will be used to recover the lines. The vessel will travel along the pipeline route, recovering pipeline and storing it on the reel. Once the reel(s) are full, the vessel will travel to port, where the pipelines would be recycled or disposed to landfill. Reuse of the pipelines is unlikely because of warranty issues relating to their condition and age.

A sweep of the seabed will be undertaken following pipeline removal to ensure it is free from obstructions and a clearance certificate will be issued. The intended decommissioning outcome is a clear seabed, availability of recycled material to society, and removal of long-term monitoring and liability.

This removal method will only be suitable for sections of the pipelines which are sufficiently sound to enable the pipelines to be reverse reeled. It would not be suitable for sections which are seriously corroded.

Removal by reverse lay was selected for further consideration in the CA because it would effectively be the reverse of the method of installation of the small diameter pipelines (8” and less). It is likely that reverse lay could be used for the majority of the pipelines; however another method would be needed to recover the seriously corroded sections of line.

Option 3: Recovery by reverse S-lay (Rejected)

Reverse lay effectively reverses the normal pipeline construction method where standard lengths of pipe welded end to end on board the lay barge are then paid out from a hinged ramp or stinger as the barge moves forward.

The pipeline will be picked up by a dynamically positioned or anchored lay barge as in Option 2. The barge will travel along the pipeline route recovering the pipeline, which will then be cut into manageable sections on the barge. These will then be transported to shore to be recycled or disposed to landfill.

This option will only be suitable for sections of the pipelines which are sufficiently sound to enable the lines to be recovered by reverse S-lay. It would not be suitable for sections which are seriously corroded.

This option was rejected for further consideration in the CA because it tends to be more suited to larger diameter pipelines and less practicable for smaller diameter pipelines. Recovery rates could be slower and weather down time could be more significant than with Option 2.

Option 4: Long section recovery (Rejected)

With this option, the pipeline is suspended on the side of the recovery vessel. As the recovery vessel travels slowly along the pipeline route, the pipeline would be lifted in a controlled S-bend configuration to avoid buckling. The pipeline is cut into lengths on the vessel for transport to shore on a supply boat.

Long section recovery was rejected because this technique is not used in the central North Sea and is more suitable for shallower and sheltered waters. Appropriate vessels

and experienced crews are not readily available. Relatively slow removal rates and weather down time could also be significant disincentives.

Option 5: Removal by tow recovery (Rejected)

This method can be used to recover lengths of rigid pipeline, especially large diameter steel pipelines and concrete covered pipelines. However, it was rejected from further consideration in the CA because it has not been used previously in the central North Sea. Suitable. vessels are readily available but experienced crews are not, and hence there would be a steep learning curve.

Navigational and handling issues to pull the pipeline ashore, cut it into lengths and transport it onwards would have to be addressed. Safety issues relating to two or more vessels working in close proximity would also need to be addressed. Tow recovery would be expensive (i.e. cost increases in proportion to length, water depth and weather) and removal rate would be relatively slow.

Option 6: Short section recovery (Selected for use with Option 2)

This option requires the pipeline to be cut into short lengths on the seabed, before they are lifted onto the vessel deck. This option is suitable for any size or type of pipeline. Technically the method is robust, well understood and can readily be achieved. It uses established and proven techniques with minimal engineering requirement, and is undertaken frequently. Suitable vessels are readily available.

Short section recovery has been selected for further consideration in the CA because it is the only method that is suitable for the recovery of seriously corroded sections of buried pipelines. However, it has not been chosen for a wider application for decommissioning the pipelines. Uncovering, cutting and removal of buried pipelines would be relatively slow, labour intensive and costly. High cost diving or remotely operated vehicle operations, subsea cutting equipment and prolonged use of divers and the high risk of schedule delays provide strong disincentives.

Option 7: J-lift recovery (Rejected)

This option requires the pipeline to be uncovered during removal. This method avoids the excessive "S" bend stresses in pipelines that result from the pipeline's extra weight in very deep water. J-lift which could be used to recover lengths of rigid and flexible pipeline requires a dedicated vessel and is suitable for longer lengths of larger diameter pipeline. This method is designed for deep-water installation and is technically inappropriate for the shallower water depth at Rubie/ Renee. In addition to the technical risk and potential for schedule delays, the option would be slow and expensive.

3.5.4 Outcome of the initial CA screening

On the basis of the initial screening, the CA provides a comparison of the following two options:

- *Option 1*: leave *in situ*; and
- *Option 2*: removal by reverse reel for the majority of the lines, in combination with Option 6. Short Section Recovery for the seriously corroded sections which are

unsuitable for reverse reeling. Short Section Recovery may also be used where lines have tight bends or other constrictions.

3.5.5 Outcome of the CA

Based on the CA, Endeavour have selected to leave *in situ* the four 21.6 km trenched and buried pipelines and umbilicals that connect the RPM to the COS, and the 5.6 km trenched and buried pipelines and umbilicals that connect the RPM to the Rubie production well. The results of the CA revealed a strong differentiation between the two options on the basis of the scores obtained during the assessments of the following criteria.

- *Option 1* scored higher in the assessments for technical feasibility, safety, and cost; and
- *Option 2* scored higher in the assessment of energy usage and emissions.

Both environmental impact and societal impact provided a weak basis for differentiation. Further details are provided in the CA report (Endeavour, 2013b).

3.6 Preparatory Work

This section provides a brief description of the preparatory work that would be carried out, regardless of which option was selected for decommissioning at the Rubie/ Renee Fields.

3.6.1 Wells

Production at the three subsea wells ceased between 2007 and 2009 and was subsequently suspended (Section 3.2.1). During 2013, the wells were disconnected from their pipelines and rated blinds installed on the tree. Before decommissioning the Rubie/ Renee Facilities, the wells will be plugged and abandoned.

3.6.2 Mattresses

The 200 to 250 concrete mattresses will be removed and wet stored for recovery in 2015.

3.6.3 Pipelines

Following cessation of production (COP) in 2009 flushing operations were undertaken to remove all hydrocarbons and process chemicals from the production, water injection and gas lift pipelines. The pipelines are currently filled with inhibited seawater (seawater treated with an oxygen scavenger, biocide and corrosion inhibitor).

During 2013, 160 m of the four RPM to COS pipelines were cut and wet stored on the seabed (Section 3.1).

3.6.4 Umbilicals

At COP flushing operations were undertaken to remove the fluids from the umbilicals. The umbilicals are currently filled with potable water. During 2011, the RPM to COS umbilicals were disconnected.

The umbilical jumpers connecting the wellheads to the RPM and the Xmas tree control umbilicals were disconnected during 2013. The jumper ends have been wet stored on the seabed adjacent to each wellhead.

3.6.5 Spools

During 2011, the 21 COS to RBM spools were disconnected, cut and wet stored on the seabed (Section 3.1). The spools connected to the wells were disconnected, cut and wet stored on the seabed during 2013 (Section 3.1).

3.6.6 DUBS

The DUBS was recovered from the seabed in June 2013 as part of the IVRRH Decommissioning Programme.

3.7 Decommissioning seabed infrastructure

3.7.1 Wells

The well abandonment programme will comply with Oil and Gas UK guidelines Issue 3, January 2009, and will be undertaken using a mobile drilling unit (MODU) anchored over the three wells.

3.7.2 Subsea structures

The following subsea structures will be removed from the seabed:

- COS.
- RPM. The RPM is piled to the seabed at each of the four corners. The four piles will be cut by a subsea hydraulic band saw or similar device to allow removal from the seabed. This operation is expected to take approximately four days.

These structures will be lifted onto a Construction Support Vessel (CSV) and taken to shore for refurbishment prior to re-use. These operations are expected to take approximately 0.5 days.

3.7.3 Decommissioning the pipelines

Endeavour intends to leave all six Rubie/ Renee production pipelines (PL1616, PL1617, PL1618 and PL1620) and the two associated umbilicals (PL1624 and PL1625) *in situ.* These six pipelines are currently trenched and buried in the seabed. The 160 m of these pipelines that crossed the Ivanhoe to Rob Roy umbilical were cut and wet stored on the seabed (Section 3.1), with the exposed ends truncated and buried.

The remainder of these four pipelines, approximately 21 km, would then be left in place in their trenches, covered by the existing sediment. The pipelines are buried to a depth of at least 0.6 m below the level of the seabed (measured from the top of the pipeline).

A recent survey of the pipelines has shown that the majority of the pipeline remains buried or covered (Table 3.6).

Table 3.6: Overview of the current (2013) seabed status of the Rubie/ Renee pipelines

Pipeline status	Pipelines			
	PL1616	PL1617	PL1618/ PL1620*	PL1624/ PL1625
Distance (km)				
Length buried	13.436	15.399	19.581	4.824
Length covered	7.520	5.583	1.432	0.794
Length exposed	0.654	0.651	0.648	0
Total length	***21.61***	***21.633***	***21.661***	***5.618***
Percentage (%)				
Buried	62.18	71.18	90.40	85.87
Covered	34.8	25.81	6.62	14.13
Exposed	3.02	3.01	2.99	0
Total	***100***	***100***	***100***	***100***
Spanned pipeline				
Length (km)	0.309	0.216	0.283	0
Percentage (%)	1.43	1	1.31	0

** 4" gas lift pipeline (PL1618) piggybacked on the 8" water injection pipeline (PL1620)*

At both ends of the pipelines, divers would use water-jetting to uncover the ends of the static pipeline on the seabed back to the deepest part of each trench. A subsea hydraulic band saw or similar device would then be used to cut these short sections, which would be lifted to the Dive Support Vessel (DSV) for transportation to shore. The cut ends of the pipeline would then be buried using rock-placement.

The Rubie to RPM 3" gas lift pipeline (PL1625) is piggybacked on the 8" oil production pipeline (PL1624). The pipelines are in a trench, covered by a thin layer of natural seabed sediments with rock and mattresses providing additional stabilisation.

3.7.4 Decommissioning the umbilicals

The RPM to COS umbilical (PL1619) lies in a trench which is covered by a thin layer of natural seabed sediments with rock-placement and mattresses, providing additional stabilisation. Endeavour intends to leave the PL1619 umbilical *in situ.*

The RPM to Renee production wellhead umbilical (PL1623) lies on the surface of the seabed and will be removed by reverse reeling or cut and lift. The operations to remove the PL1619 and PL1623 umbilicals are expected to take approximately two days. The umbilicals would be taken ashore for recycling or disposal.

The RPM to Rubie wellhead umbilical (PL1626) lies in a trench and is covered by a thin layer of natural seabed sediments with rock-placement and mattresses providing additional stabilisation. Endeavour intends to leave the PL1626 umbilical *in situ.*

3.7.5 Rock-placement

Rock will be placed on the seabed such that the pipeline and umbilical ends are not exposed and do not pose a snagging risk to other sea users. In addition, approximately

3% of each pipeline is currently exposed (Table 3.6). Endeavour anticipates that approximately 16,900 tonnes of rock will be required to cover the exposed areas of pipeline and the pipeline and umbilical ends.

3.7.6 Jumpers and spools

Divers and an ROV, deployed from a DSV, will be used to disconnect the jumpers and spools as detailed in Sections 3.2.6 and Section 3.2.7. The jumpers and spools will then be lifted onto a CSV and taken to shore for refurbishment prior to re-use. These operations expected to take approximately eight days.

3.7.7 Mattresses

All of the concrete mattresses will have been moved aside and gathered together on the seabed to allow the jumpers/ spools to be decommissioned. Endeavour estimated that 200 to 250 mattresses are currently deposited on the seabed at the Rubie/ Renee Facilities. After removal of the jumpers/ spools, the mattresses will be removed from the seabed, by lifting them onto the CSV, and taken ashore for recycling or disposal as appropriate. The removal of the mattresses from the seabed is expected to take approximately five days.

3.7.8 Debris Clearance

With the exception of the six production pipelines, all of the infrastructure presently on the seabed will be completely removed to shore. The locations of all items are well-known, and it is planned that every item will be found and retrieved during the offshore programme of work. Any major piece of equipment or material that is accidentally lost overboard during this programme will be located and retrieved.

Seabed clearance survey

On completion of the planned offshore programme of work the seabed will be surveyed using side-scan sonar to ensure that it is clear of items or obstructions that might pose a safety risk to fishermen or other users of the sea. The areas that will be surveyed will be:

- a 500 m radius circle centred on the former site of the RPM;
- a 500 m radius circle centred on the former site of the COS;
- a 200 m wide corridor 21 km long, centred on the PL1616, PL1617, PL1618 and PL1620 pipeline routes, running from the RPM to the COS site.

If any significant oil related debris is found it will be retrieved and taken ashore for recycling or disposal, as appropriate.

Verification of seabed clearance

After the removal of any residual debris, the areas will be swept to verify that they are clear of obstructions. The sweeps will be carried out by an independent contractor, using specially-designed trawling equipment. The results of the sweeps and a copy of the seabed clearance certificate issued by the verifier will be submitted to DECC.

Final condition of the offshore site

Existing rock-placement will remain in place along the pipeline and umbilical routes. Over time, it is likely that this would be partially covered by a layer of natural seabed sediment. At no point along the route or at the ends of the pipeline will any pipeline be left exposed. The seabed will be free of debris. Along the former route of the spools, the seabed will be free of all items and debris.

At the former location of the RPM, COS, and the three wellheads, the surface of the seabed will be clean and free of all items and debris. The severed ends of the well casings will be located at a depth of about 3 m below the natural level of the seabed.

3.7.9 Activity Schedule

The Rubie/ Renee Facilities will be decommissioned in 2014/ 2015. The exact timing of events will be decided once contracts have been awarded and may be subject to change depending on the availability of vessels and the possible benefits of co-operation with other offshore activities. Endeavour will inform DECC of all such proposed changes.

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4.0 ENVIRONMENTAL DESCRIPTION

The purpose of this section is to describe the environmental setting of the Rubie/ Renee Facilities and assess the particular sensitivities in and around this location. An understanding of the environmental sensitivity informs the assessment of the risks associated with the proposed decommissioning of the Rubie/ Renee Facilities.

The Rubie/ Renee Facilities are located within the UKCS Blocks 15/21, 15/26, 15/27 and 15/28, in an established area of oil and gas development and infrastructure in the central North Sea (Figure 4.1).

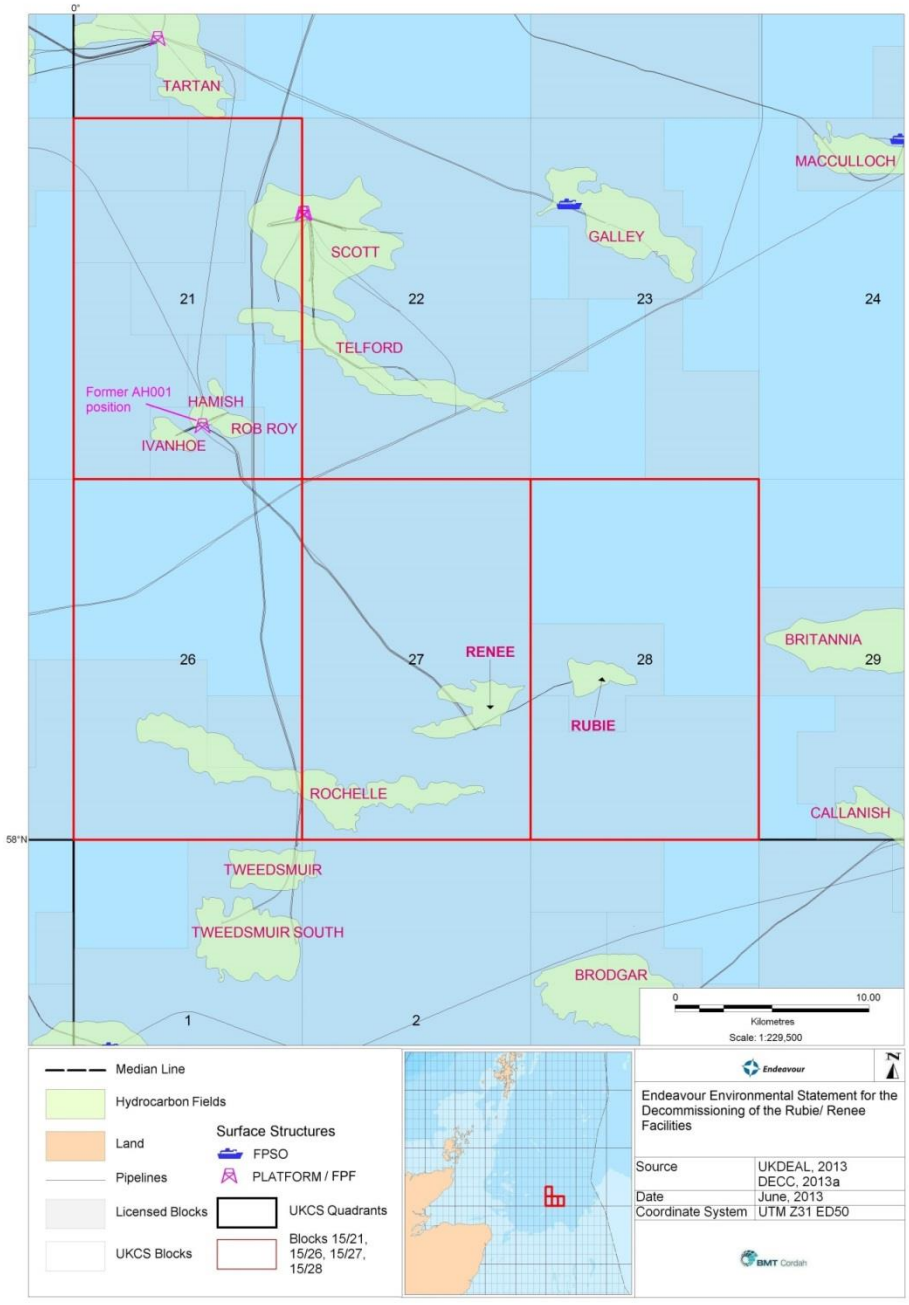


Figure 4.1: Infrastructure associated with the Rubie/ Renee Facilities

4.1 Environmental Surveys

A series of surveys has been undertaken at the Rubie/ Renee development area. The following surveys have been used to inform the environmental description chapter, specifically sediment physical and chemical characterisation and macrofaunal analysis:

- **Pre-Decommissioning Environmental Baseline Survey (Fugro ERT, 2011)**

  A pre-decommissioning environmental baseline survey was carried out for the Rubie/ Renee area during 2010 (Fugro ERT, 2011). Seabed sampling was undertaken in UKCS Blocks 15/27 and 15/28 to provide an assessment of the current seabed conditions at the Rubie and Renee fields. The pre-baseline survey informs the characterisation, hydrocarbon content, heavy metal and macrofauna content of the sediment found at the Rubie/ Renee location.

- **Rig Site Investigation UKCS Block 15/27 Proposed Location Renee-2, Volume 1: Geophysical Survey Report (Fugro Survey Limited, 2008)**

  A combined geophysical and environmental survey was carried out in June/ July 2008 within UKCS Block 15/27. The geophysical survey consisted of a 4 x 4 km analogue survey grid and a 2 x 2 km high-resolution digital seismic survey grid centred on the proposed Renee-2 location. The RPM is located within this survey area and 1.9 km from the proposed Renee-2 well location. Data were acquired for the analogue survey using single and multibeam echo sounders, side scan sonar and hull-mounted pinger. Data were acquired for digital seismic survey using a gun array and a streamer. The survey is used in this chapter to inform seabed, sub-seabed and drilling hazard information for the area.

- **Rig Site Investigation UKCS Block15/27 Proposed Location Renee-2, Volume 2: Annex I Habitat Investigation (Fugro Survey Limited, 2008)**

  This volume details the findings of the habitat investigation. The survey was specifically designed to assess the presence or absence of Annex I habitats in the proposed Renee-2 area. This survey comprised a frame mounted high-resolution digital still camera to obtain seabed photography and video footage.

4.2 Physical and Chemical Environment

This section describes the physical and chemical characteristics of the environment around the Rubie/ Renee Facilities.

4.2.1 Bathymetry

The Rubie/ Renee Facilties are located within the UKCS central North Sea, where water depth varies from approximately 113 m to 150 m. The area is located within the broad, shallow trough known as the Witch Ground Basin.

4.2.2 Currents

The Rubie/ Renee Facilities are influenced by the northern North Sea water mass and the central North Sea water currents (Figure 4.2).

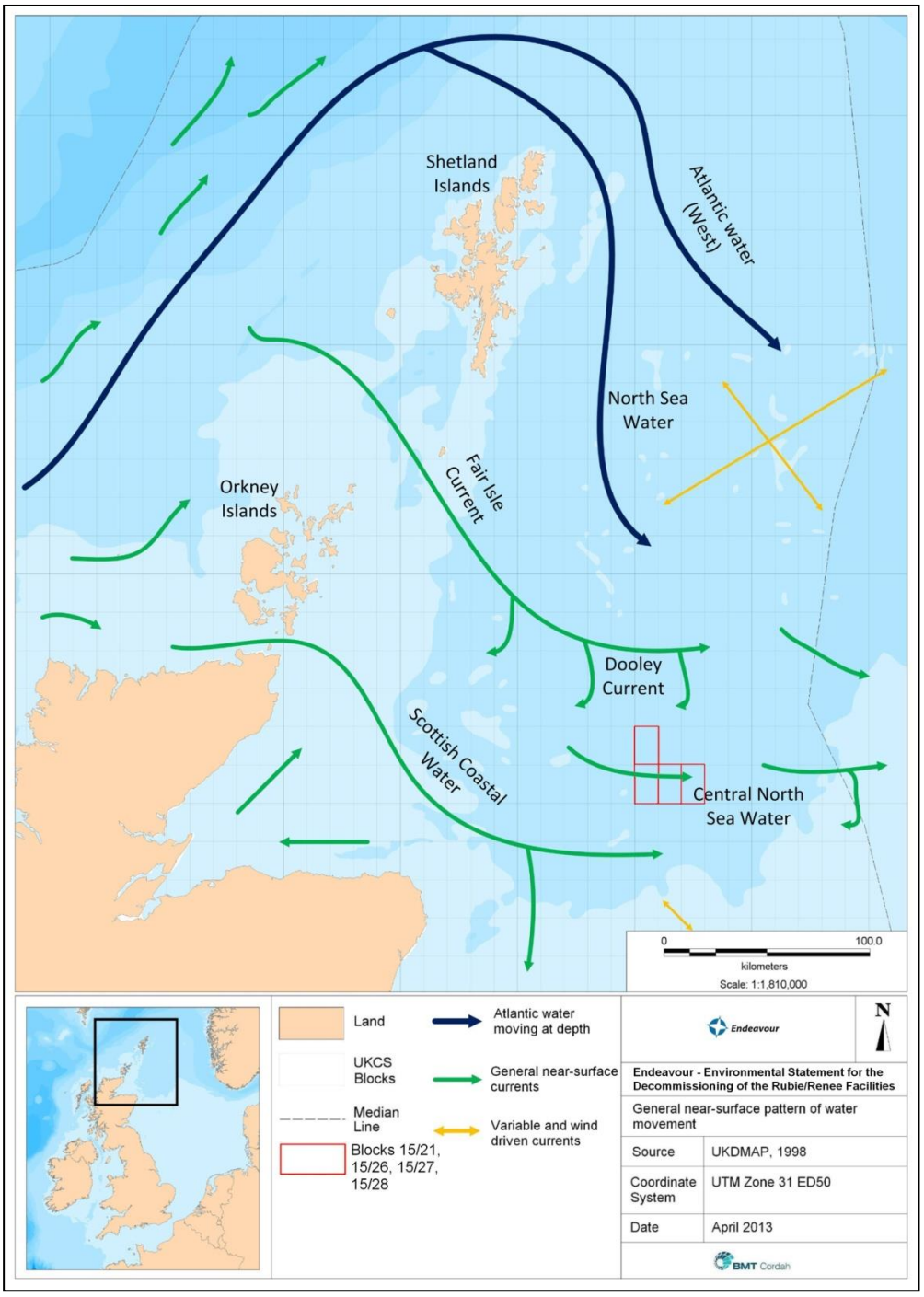


Figure 4.2: Currents associated with the Rubie/ Renee Facilities

Several water masses exist in the North Sea that are based on temperature, salinity (Table 4.1) and residual current patterns or stratification and which play a major role in the supply and dispersion of nutrients, plankton and fish larvae. The major water masses in the North Sea can be classified as Atlantic Water, Scottish Coastal Water, Northern North Sea Water, Norwegian Coastal Water, Central North Sea Water, Southern North Sea Water, Jutland Coastal Water and Channel Water (NSTF, 1993).

Table 4.1: Typical values for salinity and temperature of water masses in the North Sea

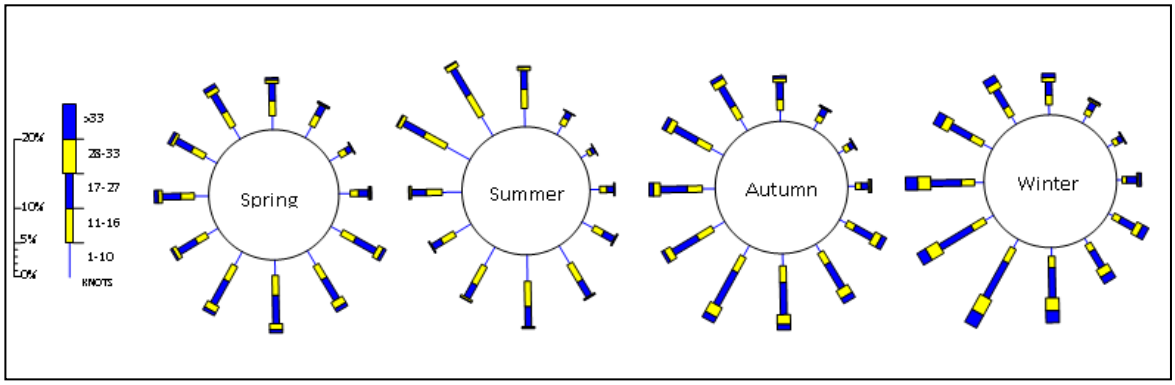
Water mass	Salinity	Temperature (°C)
Atlantic Water	> 35.0	7.0 to 15.0
North Sea Water	34.9 to 35.3	6.0 to 16.0
Scottish Coastal Water	33.0 to 34.5	5.0 to 15.0
Central North Sea Water	34.75 to 35.0	5.0 to 10.0

OSPAR (2000)

Over most of the North Sea, maximum tidal stream speeds vary from 0.25 m/s to 0.5 m/s and reach in excess of 1.0 m/s around the Orkney and Shetland Islands (UKDMAP, 1998). Tidal currents in the location of the Rubie/ Renee area are typical of the central North Sea, with relatively weak surface current velocities and mean spring tides ranging from 0.26 m/s to 0.39 m/s (UKDMAP, 1998). Throughout the year the residual current speed ranges from 0.0 m/s to 0.01 m/s (UKDMAP, 1998). Prevailing seabed currents in the Rubie/Renee Facilities area run in a northwest to southeast direction.

4.2.3 Meteorology

Winds in the vicinity of the Rubie/ Renee Facilities vary seasonally and are characterised by large variations in wind direction and speed. There is frequent cloud and relatively high precipitation. Wind data collected for the period January 1976 to December 2005 within the area is illustrated in seasonal windroses for the Rubie/ Renee Facilities area (Figure 4.3). These indicate that winds occur from multiple directions; however the predominant source is from a Westerly direction throughout the autumn and winter months. This source direction is similar in spring and summer months, however the wind speed is less intense (Figure 4.3; Met Office 2006).



Source: Met Office (2006)

Figure 4.3 Seasonal wind roses from the Rubie/ Renee Facilities area

4.2.4 Sea temperature and salinity

In the North Sea, water temperature is relatively uniform throughout the water column during the winter months. Over the summer months, the increase in solar radiation can result in a thermocline, which separates an upper warmer less dense surface layer from the denser cooler water below (Gill, 1982). The strength of the thermocline is determined by the intensity of the input of solar heat, wind and tide generated turbulence. The depth of the thermocline increases from May to September and the thermocline is

approximately 50 m deep from August to September in the central North Sea (NSTF, 1993).

Table 4.2 presents the sea surface and sea bottom salinity and temperatures expected at the Rubie/ Renee Facilities area (UKDMAP, 1998).

Table 4.2: Typical values for seawater temperature and salinity in the Rubie/ Renee Facilities area

Parameter	Summer	Winter
Mean sea surface temperature (ºC)	14.5	6.5
Mean bottom temperature (ºC)	8	6.5
Mean sea surface salinity	35.10	35.20
Mean bottom salinity	35.20	35.20

Source: UKDMAP (1998)

4.2.5 Seabed sediments

Sediments in the North Sea consist mainly of sand, gravel and muds in various proportions (MAFF, 1981). There is also a large region of sandy mud which is underlain by finer muddy sediments, with the mud exposed at water depths greater than 100 m. These muddy beds are known as the Fladen and the Witch Grounds and extend to the northerly limit of the central North Sea incorporating the Rubie/ Renee location.

Collectively, the Fladen and Witch Grounds are one of the main topographical features of the North Sea (DTI, 2001). Sediments within the Witch Ground Basin vary, comprising of fine and “thick” muds and sands near the centre becoming coarser and “thinner” toward the outer extremes (Judd, 2001). The Rubie/ Renee Facilities lie relatively central to the Fladen and Witch Grounds.

The nature of seabed sediments in the central North Sea results from a combination of hydrographic conditions, bathymetry and sediment supply. Within the central North Sea, sediments classified as either sand or muddy sand cover approximately 65% and 20% of the sea floor, respectively. The remainder is covered by gravelly sand and small patches of gravel and sandy mud (BGS, 1994). The Rubie/ Renee Facilities are located in an area of the central North Sea where much of the sediment is mud and sandy mud (Kunitzer *et al*., 1992), constituting an approximate silt fraction of 5% and an organic fraction of 3% (Basford *et al*., 1990; Basford and Eleftheriou, 1989).

The Rubie/ Renee Decommissioning area is located in an area where current energy has a “low” effect on the seabed sediments distribution (<0.13 N/m^2; UKSeaMap, 2010). Generally, the Rubie/ Renee area is located in a “low” energy zone of the North Sea. Therefore, it is expected that the sediments in the area will be fine to coarse grained in nature.

Sediment types

During the 2010 pre-decommissioning baseline survey (Fugro ERT, 2011) sediment samples were taken at 15 stations positioned in a cruciform pattern centred around the Renee and Rubie wellheads. Figures 4.4a and 4.4b illustrate the station locations around the Renee wellheads and the Rubie wellheads, respectively.

The survey found that the sediment type across the Rubie/ Renee area showed little variation and it was classified as moderate to poorly sorted, medium silts (Fugro ERT, 2011). Surface sediments from the Renee-2 rig site survey area were found to comprise of very soft, slightly sandy clay (Fugro Survey Limited, 2008), ranging in thickness from 19 m to 32 m. These surface sediments were found to overlay firm to stiff sandy clay with occasional gravel (Coal Pit Formation; Fugro Survey Limited, 2008).

The silt/ clay content of the Rubie/ Renee area surface sediments showed little variation, with mean levels of 80.4% and 83.3% at Renee and Rubie respectively (Fugro ERT, 2011). The silt component dominated in all samples with mean levels of 67.8% and 72.6% at Renee and Rubie, respectively (Fugro ERT, 2011).

Total carbonate (as calcium carbonate) and organic matter content in the Renee sediments ranged from 19.4% to 30.4% and 2.5% to 7.6%, respectively. Total organic carbon levels ranged from <0.10% to 1.10%; and total nitrogen levels, 1,200 to 1,620 µg/g (Fugro ERT, 2011).

In the Rubie sediments, total carbonate and organic matter content ranged from 17.7% to 26.4% and 4.3% to 10.1%, respectively. Total organic carbon and total nitrogen levels ranged from 0.69% to 1.40% and 1,220 to 2,460 µg/g, respectively (Fugro ERT, 2011).

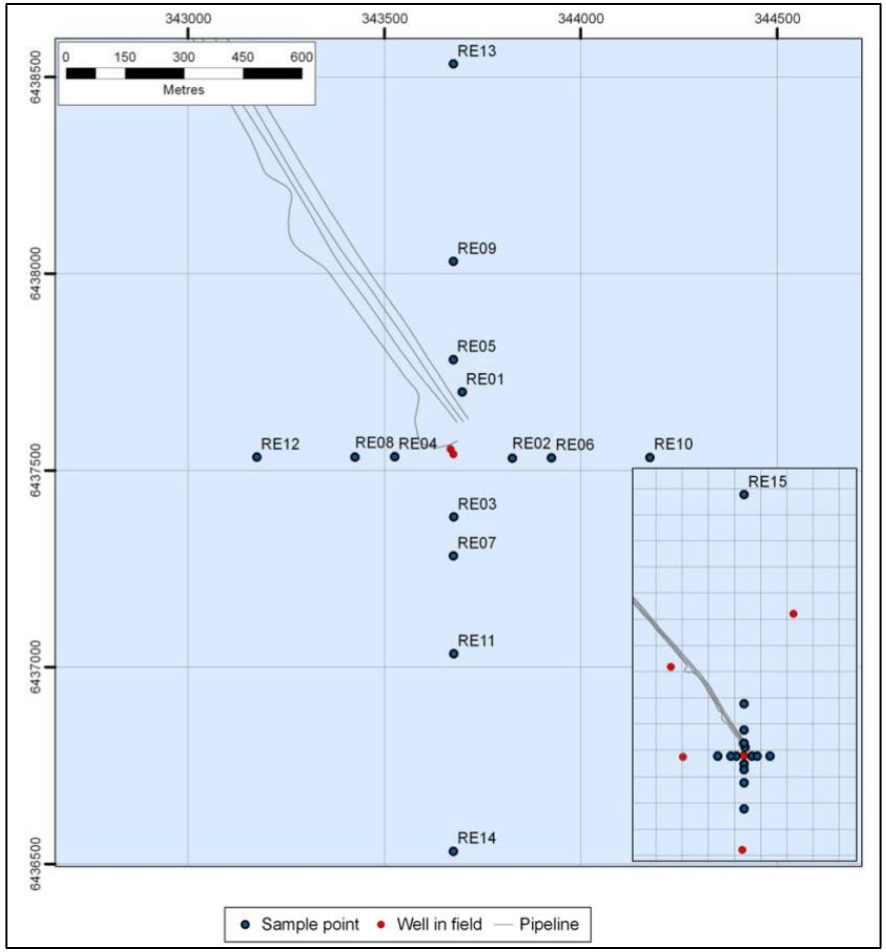


Figure 4.4a: Sampling stations positioned around the Renee wellheads

Source: Fugro ERT (2011)

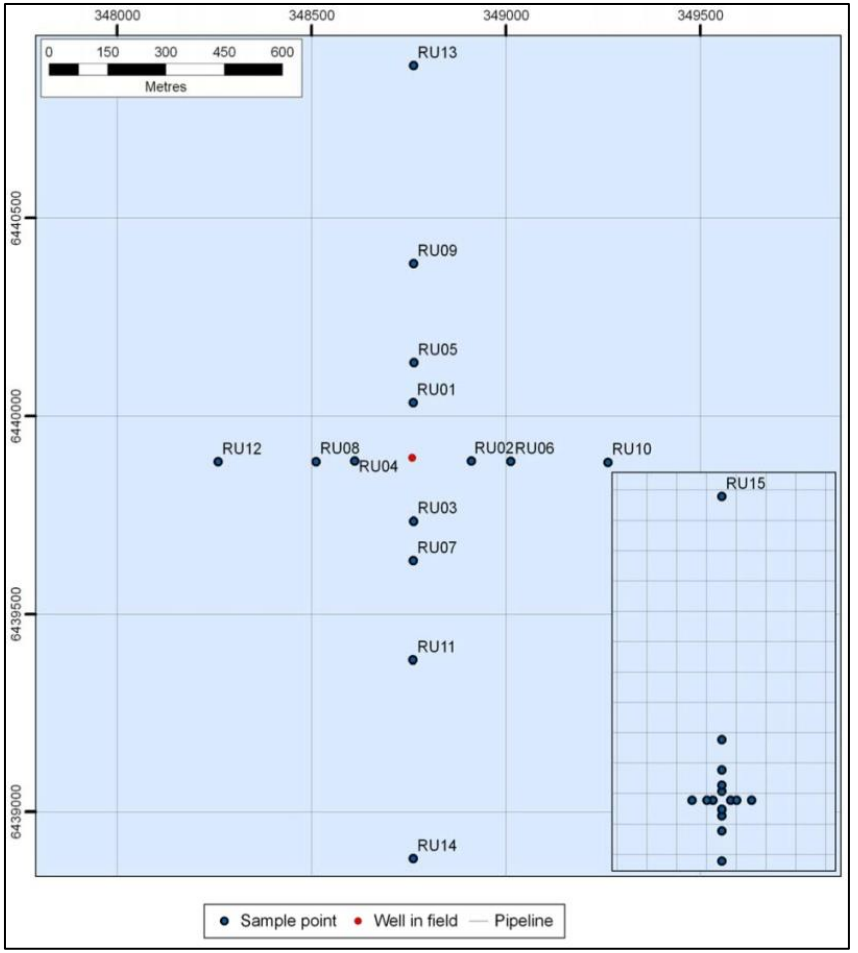


Figure 4.4b: Sampling stations positioned around the Rubie wellhead

Seabed features

Numerous pockmarks were found to occur throughout the Renee-2 survey area. The pockmarks were generally 0.5 to 3.5 m deep and varied in shape, from sub-circular to elliptical (Fugro Survey Limited, 2008). In addition, numerous trawl marks were observed throughout the Renee-2 survey area, with a small area of disturbed seabed observed around each of the four existing wells located in the survey area (Fugro Survey Limited, 2008).

Seabed chemistry

Chemical analysis of the seabed sediments (concentrations of hydrocarbons and metals) provides an indication of the condition of the seabed in the Rubie/ Renee Facilities area. Sediment chemistry is an important factor in ecological investigations, with areas of fine sediments acting as sinks which have the potential to contaminate the water column when disturbed.

The principal sources of hydrocarbons in the marine environment are anthropogenic; however, contamination of the marine environment with crude oils is not a recent phenomenon, nor solely attributable to anthropogenic activities (Douglas *et al*., 1981).

Metals are generally persistent and most are toxic to varying degrees. Many essential metals such as copper, zinc and chromium are readily bio-accumulated meaning that they are capable of causing lethal and sub-lethal toxic effects in benthic organisms even when these metals are found in apparently low amounts (Clark, 1996). Metals typical of sediment contaminated with drilling muds or cuttings are barium, chromium, lead and zinc (Neff, 2004). By far the most abundant metal in most drilling muds is barium, found in the form of barite ($BaSO_4$). Generally, contamination by metals extends no further than 500 m from production platforms, but elevated concentrations of barium are found within 500 m to 1,000 m (CEFAS, 2001a). Monitoring sediment barium concentrations can provide information on the extent to which drill cuttings have been transported from their point of origin.

Table 4.3 presents typical values of contaminants found in surface sediments in the central North Sea (CEFAS, 2001a), compared with expected background concentrations in “pristine” areas far from oil and gas installations (UKOOA, 2001; OSPAR, 2005). The table also presents the hydrocarbon and metal concentrations found in sediment samples retrieved during the 2010 Rubie/ Renee decommissioning baseline survey (Fugro ERT, 2011).

Total hydrocarbon concentrations (THC) measured in the Renee and Rubie surface sediments ranged from 5.3 to 56.8 µg/g and 5.9 to 34.7 µg/g, respectively (Fugro ERT, 2011). Variation across the sampling stations is moderate (Fugro ERT, 2011). A comprehensive report summarising data from environmental surveys between 1975 and 1995 (UKOOA, 2001 as cited in Fugro ERT, 2011) reports the mean THC for stations greater than 5 km from platforms as 9.5 µg/g for the central North Sea (CNS). The North Sea Quality Status Report (NSTF, 1993) suggests that typical THC in sediments remote from anthropogenic activities range from 0.2 to 5 µg/g, although in some areas values may be as high as 15 µg/g. THC measured at Renee and Rubie are found to be within offshore THC ranges (Table 4.3).

Polycyclic aromatic hydrocarbon (PAH) concentrations in the surface sediment ranged from 0.185 to 17.2 µg/g and 0.235 to 1.02 µg/gfor Renee and Rubie, respectively (Fugro ERT, 2011). The distribution and ratios of individual groups of PAHs can be used to determine whether the PAH compounds in the sediments are derived from manmade or natural origins. The proportion of naphthalenes, phenanthrenes and dibenzothiophenes in the Rubie/ Renee sediments derived from manmade origins to total aromatic material ranged from 21% to 42%, with a typical value of 23%. This indicates a predominantly natural input of aromatic material within the Rubie/ Renee sediments (Fugro ERT, 2011).

High levels of barium were recorded for a number of stations at both Renee and Rubie resulting from the deposition of barite (used as a weighting agent in drilling muds) on the seabed during drilling operations (Fugro ERT, 2011). Increased concentrations of other metals (i.e. arsenic, cadmium, copper and lead) were typically recorded where sediment barium content was elevated. It is known that barites often contain significant quantities of other trace metals and it is likely, therefore, that most of these metals would also be associated with drilling mud deposition (Fugro ERT, 2011). The pre-decommissioning baseline survey observed that concentrations of all metals in the sediments were of no obvious environmental concern and could be ascribed as natural background concentrations (Table 4.3; Fugro ERT, 2011).

Cuttings pile

Gas chromatographic profiles obtained for the surface sediments at the Rubie/ Renee survey area exhibited a ‘background’ of recent and weathered low level petroleum and biogenic hydrocarbons, commonly found in surface sediments of the CNS. As described previously several sample stations showed evidence of drilling-related hydrocarbon fluids, typical of areas where drill cuttings have been discharged (Fugro ERT, 2011).

In general, where cuttings have been discharged to the seabed a biological effect may be expected up to a distance of 500 m along the main tidal axis. In comparison to the nearby area, the status of the macrobenthic community around the Renee and Rubie well locations, suggests that contamination of the seabed has been limited, or that the benthic community at the inner stations has recovered from an initially more highly disturbed state (Fugro ERT, 2011). However, without historical macrobenthic data this was not possible to ascertain fully (Fugro ERT, 2011).

Table 4.3: Summary of contaminant concentrations typically found in central North Sea surface sediments and Rubie/ Renee surface sediments

Location	THC	PAH	Ni	Cu	Zn	Cd	Hg	Ba	Pb	Fe
	µg/g									
Estuaries	-	0.2 - 28	-	-	-	-	-	-	-	-
Coast	-	-	-	-	-	-	-	-	-	-
Offshore	17 - 120	0.2 - 2.7	9.5	3.96	20.87	0.43	0.16	-	-	-
Oil & Gas installations	10 - 450	0.02 - 74.7	17.79	17.45	129.74	0.85	0.36	-	-	-
Maximum expected BC[1]	-	-	30	-	90	0.2	0.07	-	-	-
UKCS monitoring data[2]	9.5	0.2	-	-	-	0.03	0.03	-	6.8	
NSTF, 1993	5	-	-	-	-	-	-	-	-	-
Co-ordinated Environmental Monitoring Programme (CEMP) (Background Concentration (BC)),	-	0.2	-	-	-	0.31	0.05	-	25	-
CEMP (Effects Range Low (EFL)), 2010	-	3.3	-	-	-	1.20	0.15	-	47	-
Renee (range)	5.3 – 56.8	0.185 -17.2	12.7 - 14.9	5.19 - 12.0	33.5 - 70.8	0.036 - 0.161	0.008 - 0.09	117 – 3,800	6.63 - 13.3	12,000 - 15,600
Rubie (range)	5.9 – 34.7	0.235 – 1.02	14.4 - 17.7	5.52 - 11.2	37.4 - 46.5	0.052 - 0.068	0.009 - 0.019	103 - 1,160	6.69 - 12.9	13,000 - 17,100
Renee (mean value)	24.4	1.66	13.4	6.36	40.1	0.069	0.024	626	8.79	13,453
Rubie (mean value)	17.7	0.572	15.9	6.97	41.3	0.057	0.012	313	10.1	14,493
Note: *OSPAR, 2005 (BC) - maximum expected background concentration, normalised to 5% aluminium if the environment were pristine; (–) means no data currently available and UKOOA, 2001 - values are mean (95th percentile in brackets).										

- *Source: [1]OSPAR (2005); [2]UKOOA (2001);*

4.3 Biological Environment

4.3.1 Plankton

The planktonic community is composed of a range of microscopic plants (phytoplankton) and animals (zooplankton) that drift with the oceanic currents. These organisms form the basis of marine ecosystem food chains and many species of larger animals such as fish, birds and cetaceans are dependent upon them. The distribution of plankton therefore directly influences the movement and distribution of other marine species.

The distribution and abundance of plankton are heavily influenced by water depth, tidal mixing and thermal stratification within the water column (NSTF, 1993). The majority of the plankton occurs in the photic zone (the upper 20 m of the North Sea which receives enough light for photosynthesis to occur) (Johns and Reid, 2001). Most of the phytoplanktonic organisms, such as diatoms and dinoflagellates, are unicellular, however, the zooplankton is composed of a wide variety of multicellular herbivorous and carnivorous organisms.

Typical zooplanktonic organisms are the copepods, arrow worms, krill, and jellyfish. Zooplankton also includes the larval stages of non-planktonic organisms such as fish, crabs and barnacles (Johns and Reid, 2001). The composition of the plankton community reflects environmental conditions such as salinity, temperature, water movements in the area and the presence of local benthic communities that have planktonic larval stages.

Phytoplankton and the associated grazing zooplankton usually show a bimodal pattern of abundance throughout the year. The main peak occurs towards the end of spring in response to the increasing photoperiod, with a secondary peak occurring in late summer/ early autumn (Johns and Reid, 2001).

Analysis of data provided by the Continuous Plankton Recorder (CPR) surveys suggest that the most abundant zooplankton species in the North Sea are the calanoid copepods, in particular *Calanus* spp. and smaller copepod species such as *Para-Pseudocalanus* spp., *Acartia* and the younger stages of *Calanus* (Johns and Reid, 2001). Macro zooplankton in the North Sea includes euphausiids (krill), which are usually confined to the upper 100 m of the water column.

Calanus finmarchicus has historically dominated the zooplankton of the North Sea. However, its abundance has decreased significantly over the last 50 years. This has mainly been attributed to changes in seawater temperature and salinity (Beare *et al.,* 2002). *C. finmarchicus* has been replaced by boreal and temperate Atlantic and neritic species. In terms of copepods, such communities in the central North Sea are impoverished both qualitatively and quantitatively (Kröncke and Bergfield, 2003).

Macro-zooplankton numbers (which include the euphausiids, salps and siphonophores) in the North Sea are known to peak in the months of June, July and September (Johns and Reid, 2001). *Meganyctiphanes norvegica*, a large krill with a wide distribution and tolerance to climatic conditions (Lass *et al.,* 2001), is of particular importance in the North Sea as a major predator of smaller zooplankton and as a primary food source for fish and cetaceans.

4.3.2 Benthic fauna

Benthic fauna comprises species which live either within the seabed sediment (infauna) or on its surface (epifauna). Benthic fauna are also typically divided into categories, principally according to size. The largest are the megafauna comprising animals, usually living on the seabed, which are large enough to be seen in bottom photographs and caught by trawl (i.e. brittle stars, sea urchins, sea cucumbers, sea spiders, sponges and corals). Macrofauna are defined as those animals larger than 500 µm. Meiofauna are smaller (with a lower size limit of between 45 µm and 62 µm) and comprise the smaller interstitial animals (mainly nematode worms and harpacticoid copepods) (Kennedy and Jacoby, 1999).

Colonisation of sediments by different species is largely dependent on the type of sediment present and its characteristics. Both physical and biological factors are important in governing species abundance and distribution, including seabed depth, water movements, salinity, temperature and available oxygen.

Each species has its own response and degree of adaptability to changes in the physical and chemical environment. Consequently, the species composition and relative abundance in a particular location provides a reflection of the immediate environment, both current and historical (Clark, 1996). For example, infaunal species are particularly vulnerable to external influences, which alter the physical, chemical or biological community of the sediment. These organisms are largely sedentary and are thus unable to avoid unfavourable conditions.

Benthic fauna are also susceptible to physical disturbance of the seabed, for example from fishing trawls, anchoring, pipeline trenching and rock-placement operations or smothering from discharged cuttings (DTI, 2001).

In the remainder of Section 3.4.2, information is provided on:

- the types of benthic communities typically occurring in the CNS;
- the characteristics of the macrofaunal communities determined from the surveys undertaken specifically in the Rubie and Renee area; and
- the distribution of biotopes in the surveyed area.

Benthic communities in the central North Sea

The infauna of the CNS is a mixture of the species found in the southern and northern North Sea (Kröncke and Bergfield, 2003) but is primarily characterised by the polychaetes *Minuspio cirrifera*, *Aricidea catherinae* and *Exogone verugera* and the bivalve mollusc *Thyasira* spp. (Künitzer *et al*., 1992). Basford and Eleftheriou (1989) found that the muddy sediments of the CNS were typified by *Eriopisa elongata* (amphipod crustacean), and *Levinsenia gracilis* and *Lumbrineris gracilis* (polychaetes). Some of the most common macrofaunal species in the CNS include the glistenworm *Chaetoderma nitidulum* and the tubicolous amphipod *Ampelisca tenuicornis* (Kröncke and Bergfield, 2003).

During 1986, the whole of the North Sea was surveyed using standard techniques and equipment (Basford *et al*., 1990 Künitzer *et al*., 1992). According to the benthic classification scheme of Künitzer *et al.* (1992), the Rubie/ Renee Facilities fall within

Category IIIb (which is fine sediment below 100 m depth) where the characteristic infauna would be the polychaetes *Minuspio cirrifera*, *Aricidea catherinae* and *Exogone verugera* and the bivalve mollusc *Thyasira* spp. According to Basford *et al*. (1990) a Category IIIb area would be characterised by bivalve *Thyasira* spp. and the polychaetes *Lumbrineris gracilis, Heteromastus* spp., *Phylo norvegica* and *Ceratocephale loveni*. In the central North Sea, the hermit crab *Anapagurus laevis* and the shrimp *Crangon allmanni* are increasingly dominant (Jennings *et al.,* 1999).

The muddy silty regions of the central North Sea area are characterised by the sea pen *Pennatula phosphorea* (Basford and Eleftheriou, 1989; Basford *et al*., 1990). The 'Sea pen and Burrowing Megafauna Communities' biotope complex is on the initial OSPAR List of Threatened and/ or Declining Species and Habitats (OSPAR, 2008) and the North Sea is one of the regions where concern for this habitat has been identified. This habitat is described as being associated with a sheltered fine mud substratum, generally between the depths of 20 to 50 m and with sea pens at a density of 20 or more per m^2 (Connor *et al*., 2004).

Benthic communities in the surveyed area

Both Rubie and Renee survey stations recorded similar macrofaunal communities with the polychaetes *Paraphinome jeffreysii* and *Heteromastus filformis* and the bivalve molluscs *Adontorhina similis* and *Parvicardium minimum* being largely dominant across both sites (Fugro ERT, 2011). These polychaete species are common across the North Sea. Other species common to the survey areas were the polychaetes *Levinsenia gracilis*, *Spiophanes kroyeri*, *Abyssoninoe hibernica* and the molluscs *Timoclea ovate*, *Cylinhnina umbilicata* and *Thyasira flexuosa* all of which are characteristic of sediments in this area of the North Sea (Fugro ERT, 2011).

Multivariate analysis of the Rubie/ Renee baseline survey showed a moderate (due to the high abundances of the dominant species) to high degree of similarity across both Rubie and Renee survey areas and highlighted no significant variation in the communities (Fugro ERT, 2011). The inner stations of both fields were found to contain higher numbers of species that are more tolerant of elevated hydrocarbon levels. Correlations between the main biological and chemical determinants suggested that activities at Renee have modified the benthic community within these areas (Fugro ERT, 2011). The reference station at Rubie was noted to be significantly different due to the absence of several species that are found across the rest of the Rubie survey area, however no spatial trends in the physico-chemical data were found to explain these differences.

Univariate statistics showed that there was no significant difference between the Rubie or Renee survey locations (Fugro ERT, 2011). At the Renee sample stations there was a slight variation in the abundance of the polychaetes (annelids) and molluscs at both the taxa and the individuals levels (Figure 4.5a). The north/ south axis showed that communities contained a larger number of polychaete taxa and individuals; whereas the east/ west axis communities contained fewer polychaetes and a greater abundance of molluscs.

Overall the Renee phyletic composition revealed that 47.9% of the taxa were annelids (polychaetes), 23.1% arthropods, 16.5% molluscs and 4.1% echinoderms whilst 8.3% of

the taxa consisted of other phyla (i.e. sipuculans, flatworms, cnidarians). This trend was also observed at the Rubie sample stations (Figure 4.5b). The phyletic composition for Rubie consisted of 49.2% annelids (polychaetes), 21.3% arthropods, 18.9% molluscs, 3.3 echinoderms and 7.4% other phyla.

The epifaunal diversity reported for the nearby Renee-2 survey area was observed to be poor, with few species recorded (Fugro Survey Limited, 2008). Fauna observed in the Renee-2 survey area were dominated by the seapens *Virgularia mirabilis* and *Pennatula phosphorea*, which are typical of sandy clay sediments within the North Sea (Fugro Survey Limited, 2008). Numerous Oweniidae worm tubes were visible on the seabed throughout the Renee-2 survey area. Other fauna identified included hagfish (*Myxine glutinosa*) and Norwegian lobster (*Nephrops norvegicus*) (Fugro Survey Limited, 2008).

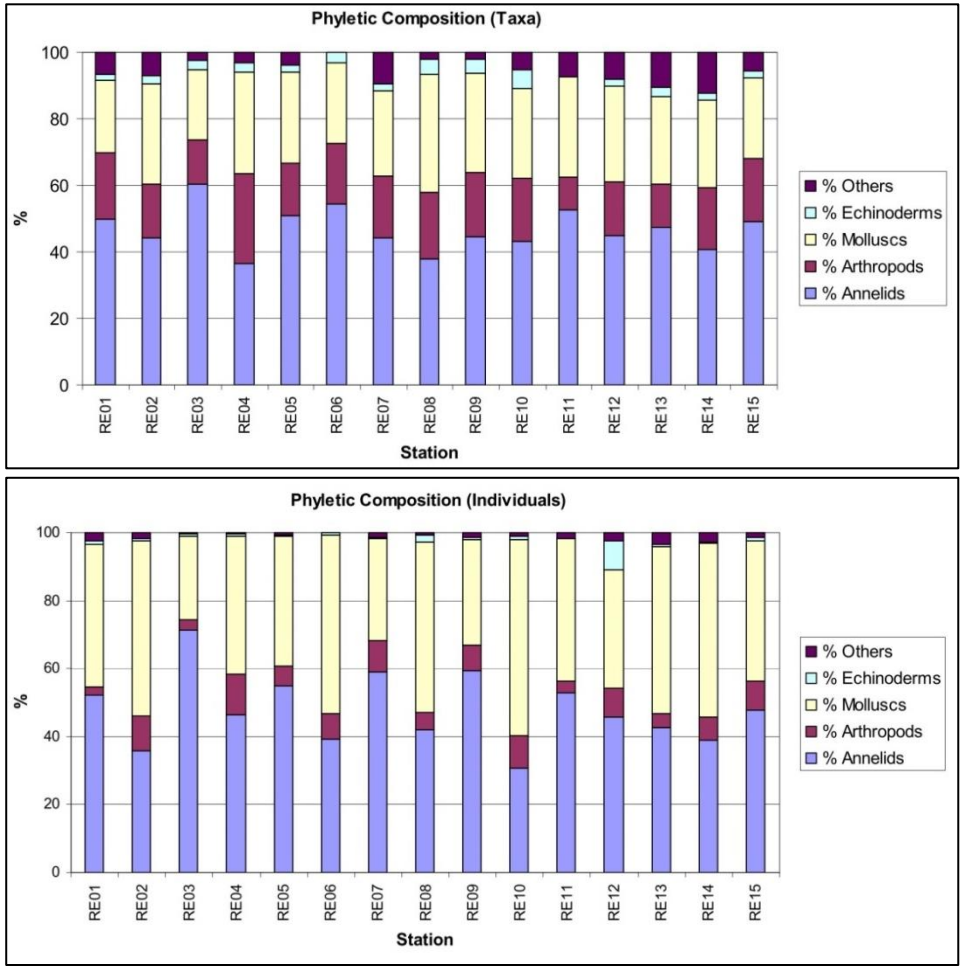
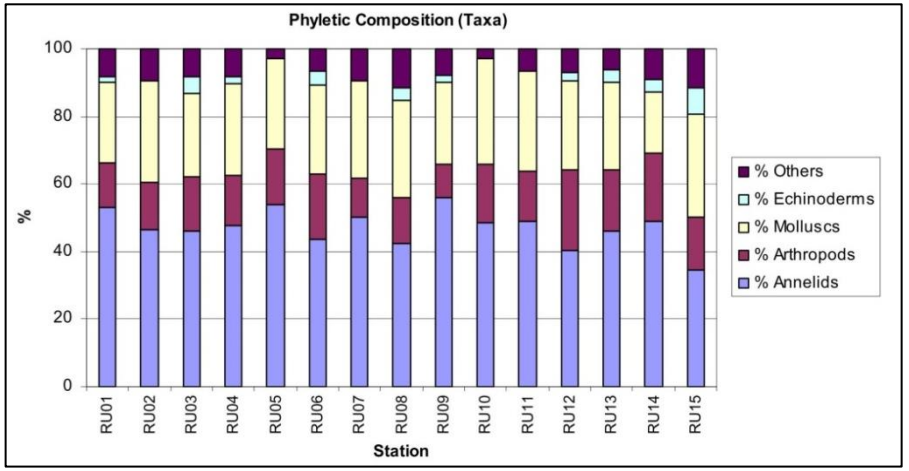


Figure 4.5a: Phyletic composition of taxa and individuals at Renee



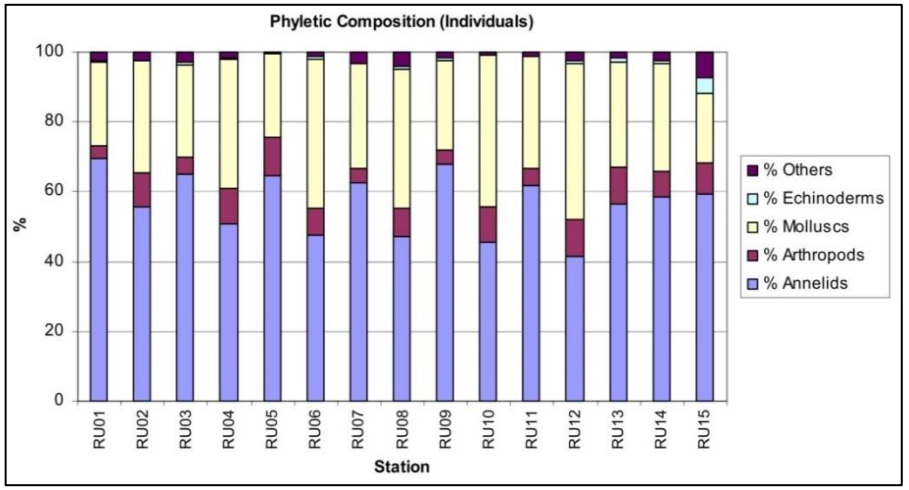


Figure 4.5b: Phyletic composition of taxa and individuals at Rubie

Source: Fugro ERT (2011)

Habitat distribution

A biotope can be defined as a habitat with which a specific biological community is associated. Habitat is used here in its accepted scientific sense (i.e. as an area defined solely by its abiotic characteristics). However, in common usage, for example in the EC Habitats Directive, biota tends to be included in its definition. Used in this way, the term habitat can be considered synonymous with the term biotope (Connor *et al.,* 2004).

A marine biotope classification system for British waters has been developed by Connor *et al*. (2004) from data acquired during the Joint Nature Conservation Committee's (JNCC) Marine Nature Conservation Review. The classification system has been developed to be compatible with the European Nature Information Service (EUNIS) which has compiled habitat information from across Europe into a single database. The two classification systems developed by EUNIS and Connor *et al*. (2004) are both based around the same hierarchical analysis. Initially abiotic habitats are defined at four levels, and biological communities are then linked to these (at the two lower levels) to produce a biotope classification. For the purposes of this ES, the EUNIS coding system was used for classification of biotopes.

The Rubie/ Renee blocks 15/21, 15/26, 15/27 and 15/28 lie in an area of deep circalittoral mud (EUNIS Code A5.27). The substrate which contains sand and muddy sand, is found in relatively stable marine environments and provides habitats for burrowing megafaunal species such as *Nephrops.* The habitat in deep water can also support seapen populations (JNCC, 2008).

4.3.3 Finfish and shellfish

Adult and juvenile stocks of finfish and shellfish are an important food source for seabirds, marine mammals and other fish species. Species can be categorised into pelagic and demersal finfish and shellfish.

- Pelagic species occur in shoals swimming in mid-water, typically making extensive seasonal movements or migrations between sea areas. Examples of pelagic species include herring (*Clupea harengus*), Norway pout (*Trisopterus esmarkii*), lemon sole (*Microstomus kitt*), mackerel (*Scomber scombrus*), blue whiting (*Micromesistius poutassou*) and sprat (*Sprattus sprattus).*
- Demersal species live on or near the seabed and include cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), plaice (*Pleuronectes platessa*), sandeel (*Ammodytes* spp.), sole (*Solea solea*), ling (*Molva molva*); anglerfish (*Lophius piscatorius*); spurdog (*Squalus acanthias*), European hake (*Merluccius merluccius*) and whiting (*Merlangius merlangus*)
- Shellfish species are demersal (bottom-dwelling) molluscs, such as mussels and scallops, and crustaceans, such as shrimps, crabs and *Nephrops* (Norway lobster).

The most vulnerable period for fish species is during the egg and juvenile stages of their life cycles. Fish that lay their eggs on the sediment (e.g. herring and sandeels) or which live in intimate contact with sediments (e.g. sandeels and most shellfish) are susceptible to smothering by discharged solids (Coull *et al.,* 1998). Other ecologically sensitive fish species include cod, most flatfish (including plaice and sole) and whiting because in the

North Sea these stocks are considered to be outside ‘safe biological limits’ (WWF, 2001; JNCC, 2012).

'Safe biological limits' are defined by a minimum safe stock size and a maximum exploitation rate. The stock size is measured in terms of 'spawning stock biomass’ (SSB), which represents the total weight of spawning fish each year. The exploitation rate is measured by 'fishing mortality' which represents the rate at which fish are removed from the stock by fishing. If the stock is either below the minimum safe SSB or above the maximum ‘safe exploitation rate’, the stock is said to be outside safe biological limits (Marine Scotland, 2011). There have been a number of factors that have contributed to some fish stocks being outside ‘safe biological limits’ and these include a combination of overfishing, poor recruitment and poor fisheries management, with respect to underestimation of fish stocks and related issues (WWF, 2001). Fish spawning and nursery grounds that coincide with the Rubie/ Renee Facilities are detailed in Table 4.4 and illustrated in Figure 4.6.

Table 4.4: Spawning and nursery grounds coinciding with the Rubie/ Renee Facilities

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Nursery
anglerfish[2]													
blue whiting[1,2]													
cod[2]		•	•										
European hake[2]													
herring[2]													
ling[2]													
mackerel[2]													
Nephrops[1]				•	•	•							
Norway pout[1]		•	•										
sandeel[2]													
spotted ray[2]													
sprat[1]													
spurdog[2]													
whiting[2]													

Key:

	Spawning period
•	Peak spawning period
	Nursery area

Source: [1]Coull et al. (1998) and [2]Ellis et al. (2010)

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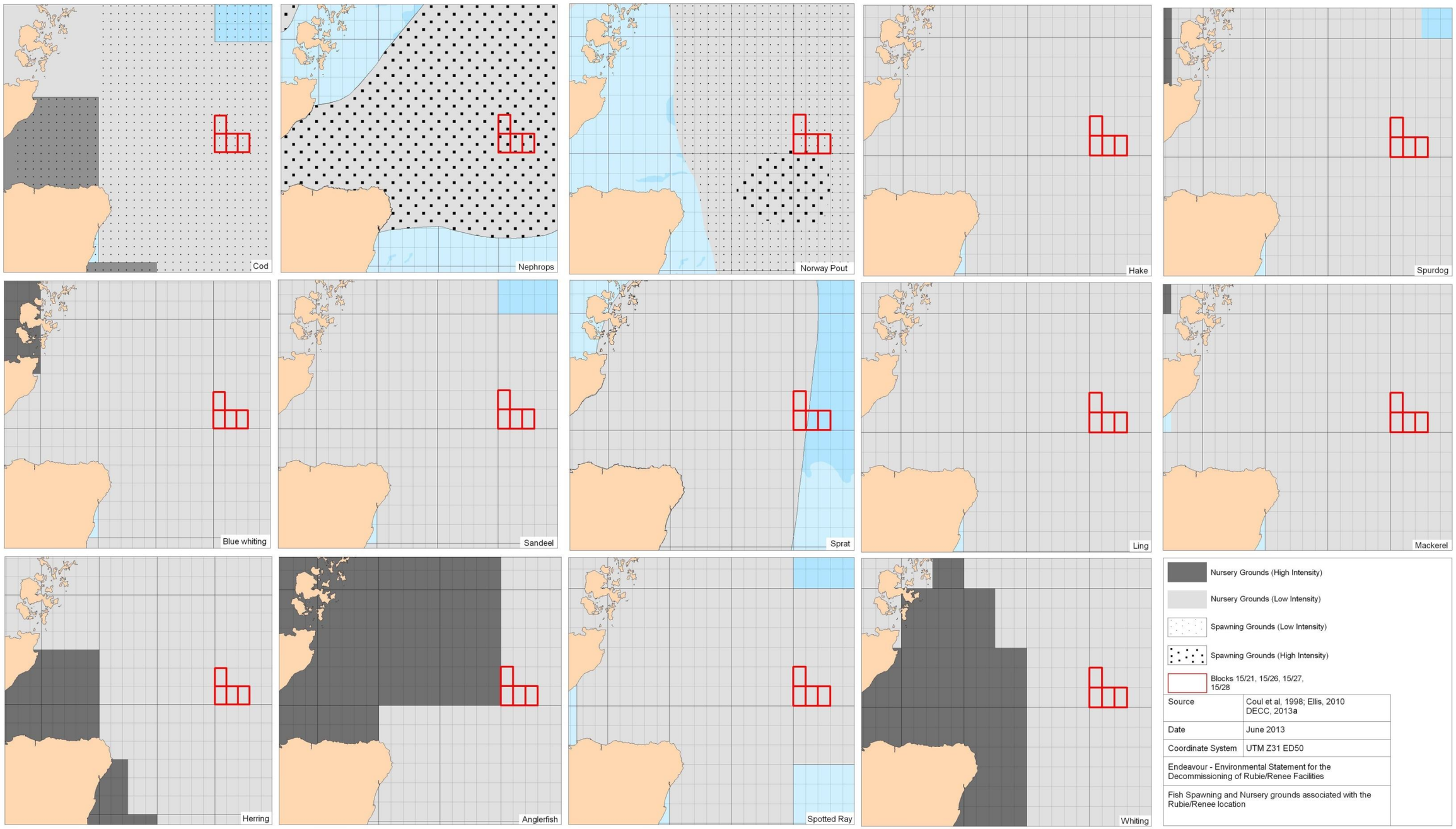

Figure 4.6: Nursery and Spawning Grounds for North Sea species coinciding with the Rubie/ Renee Facilities

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These are based on data provided by the industry-commissioned Fisheries Sensitivity Maps in British Waters and Department for Environment, Food and Rural Affairs (DEFRA) commissioned reports mapping the spawning and nursery grounds of selected fish species (Coull *et al.*, 1998; Ellis *et al*., 2010). Figure 4.6 illustrates a generalised pattern of spawning; many species have much more tightly defined peak spawning areas. The information provided in Figure 4.6 represents the widest known distribution given present knowledge and should not be seen as a fixed, unchanging description of presence or absence of a species (Coull *et al.,* 1998; Ellis *et al*., 2010).

The Rubie/ Renee Facilities lie within spawning grounds for cod (January to April), Norway pout (January to April), *Nephrops* (All year). Cod and Norway pout have pelagic eggs that are released into the water column. *Nephrops* are benthic spawners laying their eggs on the seabed, and therefore may be at more risk from activities that disturb the seabed.

The distribution of *Nephrops* is limited by the extent of suitable muddy sediment in which the animals construct their burrows. Populations exist in the North Sea and in waters west of Scotland (in open water and sea lochs) at depths ranging from 5 m to 500 m. *Nephrops* spend most of their life in burrows only exiting to feed or to mate. They are opportunistic in their feeding habits primarily feeding on crustaceans, molluscs and polychaetes. *Nephrops* mate in early summer, spawn in September and carry their eggs until they hatch, usually the following spring (Marine Scotland, 2013a).

Nursery grounds exist in the Rubie/ Renee Facilities area for anglerfish, blue whiting, cod, European hake, herring, ling, mackerel, *Nephrops*, Norway pout, sandeel, spotted ray, sprat, spurdog and whiting (Table 4.4, Figure 4.6). The nursery grounds are used throughout the year, potentially making it impossible for an operation to avoid being coincident with the presence of juvenile fish. Currently however, there is no direct evidence to suggest that these activities cause significant disturbance to nursery areas (CEFAS, 2001b).

Spurdog is a demersal fish, giving birth to live young that are reliant on yolk reserves during embryonic development (ICES FishMap, 2013). Although spurdog are less vulnerable to oil and gas associated activities, they are included in the OSPAR list of threatened species (OSPAR, 2008) due to the population sensitivity to overfishing and habitat damage.

4.3.4 Marine mammals

Marine mammals include whales, dolphins and porpoises (cetaceans) and seals (pinnipeds). Marine mammals may be vulnerable to the effects of oil and gas activities and can be impacted by noise, contaminants, oil spills and any effects on prey availability (SMRU, 2001). The abundance and availability of prey, including plankton and fish, can be of prime importance in determining the numbers and distribution of marine mammals and can also influence their reproductive success or failure. Changes in the availability of principal prey species may be expected to result in population level changes of marine mammals but it is currently not possible to predict the extent of any such changes (SMRU, 2001).

Cetaceans

Cetaceans can be divided into two main categories: baleen whales (*Mysticeti*), which feed by sieving water through a series of baleen plates; and toothed whales (*Odontoceti*), which have teeth for prey capture.

Many whale and dolphin species have been recorded throughout the year and they can be found over a wide geographical range with no species being limited to UK waters(Reid *et al*., 2003). Cetacean distribution may be influenced by variable natural factors such as water masses, fronts, eddies, upwellings, currents, water temperature, salinity and length of day. A major factor likely to influence cetacean distribution is the availability of prey, mainly fish, plankton and cephalopods (Stone, 1997).

More than 20 cetacean species have been recorded in UK waters (Table 4.5). Of these, nine species are known to occur regularly whilst nine have been infrequently recorded.

Table 4.5: Cetacean species recorded in UK waters

Common species name	Latin name
Regularly occurring species in UK waters	
minke whale	*Balaenoptera acutorostrata*
harbour porpoise	*Phocoena phocoena*
bottlenose dolphin	*Tursiops truncatus*
short-beaked common dolphin	*Delphius delphis*
white-beaked dolphin	*Lagenorhynchus albirostris*
Atlantic white-sided dolphin	*Lagenorhynchus acutus*
killer whale	*Orcinus orca*
Risso's dolphin	*Grampus griseus*
long-finned pilot whale	*Globicephala melas*
Infrequently occurring species in UK waters	
striped dolphin	*Stenella coeruleoalba*
sperm whale	*Physeter macrocephalus*
pygmy sperm whale	*Kogia breviceps*
sei whale	*Balaenoptera borealis*
fin whale	*Balaenoptera physalus*
humpback whale	*Megaptera novaeangliae*
Cuvier's beaked whale	*Ziphius cavirostris*
Sowerby's beaked whale	*Mesoplodon bidens*
northern bottlenose whale	*Hyperoodon ampullatus*

Source: Reid *et a*l., 2003; DECC, 2009a

The main marine mammal species occurring in the vicinity of the Rubie/ Renee Facilities are minke whale, killer whale, white-beaked dolphin, Atlantic white-sided dolphin, harbour porpoise, Risso's dolphin and common dolphin with most sightings occurring in the summer months (Reid *et al*., 2003; UKDMAP, 1998; Table 4.6).

Minke whales occur throughout the central and northern North Sea, particularly during the summer months (DECC, 2009a; SMRU, 2001). The abundance of minke whales in

the north and central North Sea is estimated at approximately 3,704 animals (SCANS II, 2006; DECC, 2009a).

In UK waters killer whales are commonly observed off northern and western Scotland and occur in all months of the year. Between Shetland and Norway, the species is regularly recorded from November to March (Reid *et al.,* 2003). No overall population estimates exist for killer whales in the Northeast Atlantic or UK waters (DECC, 2009a).

White-beaked dolphins are present year-round in the North Sea, with most sightings recorded between June and October (Reid *et al*., 2003). The abundance of white-beaked dolphins in the north and central North Sea is estimated at approximately 9,443 animals (SCANS II, 2006; DECC, 2009a).

The Atlantic white-sided dolphin is primarily an offshore species, but has been recorded during a number of surveys in the North Sea, especially during summer months (Northridge *et al*., 1997; Reid *et al.,* 2003). Their presence in the North Sea is seasonal, with the majority of sightings recorded between July and September (DECC, 2009a).

Table 4.6: Seasonal cetacean sightings in the vicinity of the Rubie/ Renee Facilities

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Common dolphin								L				
Harbour porpoise	L	M		L	VH	L	H	M	L	L		H
Killer whale											L	
Minke whale					L		L	L				
Risso's dolphin							L					
White-beaked dolphin		M	M		M	L	H	L	M	L	M	L
White-sided dolphin							L	L	H			

Key

	No animals / No data
L	Low densities (0.01 to 0.09 animals/km)
M	Moderate densities (0.10 to 0.19 animals/km)
H	High densities (0.20 to 0.49 animals/km)
VH	Very high densities (≥ 0.50 animals/km)
	Sightings within Quadrant 15
	Sightings within surrounding Quadrants

Source: UKDMAP, 1998

The harbour porpoise is the most common cetacean in UK waters (DECC, 2009a). It is occurs in most of the North Sea throughout the year, with higher numbers occurring between May and October. The harbour porpoise is generally described as a coastal species, but there have been numerous sightings in deep, offshore waters (Hammond *et al*., 2002; MacLeod *et al*., 2003; Northridge *et al.,* 1995; Rogan and Berrow, 1996).

The common dolphin is mainly found off western coasts of Britain and Ireland in continental shelf waters and beyond. Common dolphins are widely distributed offshore with numbers varying substantially year to year (JNCC, 2007).

Risso's dolphin is mainly distributed off western and northern coasts of Britain and along the continental shelf. There seems to be some seasonality in patterns of occurrence, with more sightings recorded near the continental shelf in winter (October to May) and further inshore during August and September.

Pinnipeds

Two species of seal are resident in UK waters, the grey seal (*Halichoerus grypus*) and the harbour or common seal (*Phoca vitulina*), and both occur regularly over large parts of the North Sea (SMRU, 2001). Both species breed in the UK, with harbour seals pupping in June and July and grey seals pupping between October and December.

The harbour seal is one of the most widespread pinniped species and is found in all coastal waters around the North Sea. Animals around the UK belong to a European sub-species (*P. vitulina vitulina*), approximately 33% of the world population of this sub-species occurs in the UK (DECC, 2009a).

The vast majority (85%) of harbour seals are found in Scotland (DECC, 2009a). Pupping occurs on land from June to July, while the moult is centred around August and extends into September. Therefore, from June to September harbour seals are ashore more often than at other times of the year. Seals are widespread throughout coastal waters surrounding breeding colonies and haul-out sites. Their distribution at sea is constrained by the need to return periodically to land (DECC, 2009a).

Grey seals are found across the North Atlantic Ocean and in the Baltic Sea. Approximately half of the world population occurs in the northeast Atlantic (including the Baltic Sea); with approximately 40% of these animals occurring in the UK. It is estimated that approximately 70,000 seals are associated with breeding colonies in the North Sea (SMRU, 2001) and over 90% of the UK population breeds in Scotland (DECC, 2009a).

Most of the grey seal population will be on land for several weeks from October to December during the pupping and breeding season, and again in February and March during the annual moult. Densities at sea are likely to be lower during this period than at other times of the year. They also haul-out and rest throughout the year between foraging trips to sea (DECC, 2009a).

Tracking of seals suggests they make feeding trips lasting 2 to 3 days, travelling less than 40 km from their haul-out sites and ultimately returning to the same haul-out site from which they departed (JNCC, 2002). Grey seals may spend more time further offshore than harbour seals. Grey and harbour seals are listed in Annex II of the Habitats Directive (Section 4.3.6).

The Rubie/ Renee Facilities are located more than 115 km from the nearest UK coastline. Though their coastal habitats could be impacted by an accidental release of oil, it is unlikely that significant numbers of grey and harbour seals may be found in the vicinity of the facilities to be decommissioned.

4.3.5 Seabirds

Important numbers of several species of seabird breed on the North Sea coastal margin, and depend on the offshore North Sea for their food supply and for much of the year their habitat. Species commonly found in North Sea waters and species that breed in the and

around the UK are listed in Table 4.7. Each year over 7 million seabirds breed in the UK (DECC, 2009b).

Table 4.7: Species of seabird that can be found and breed in North Sea waters

Common species name	Latin name
Commonly found	
Fulmar	*Fulmarus glacialis*
Gannet	*Morus bassanus*
Guillemot	*Uria aalge*
Razorbill	*Alca torda*
Kittiwake	*Rissa tridactyla*
Herring gull	*Larus argentatus*
Great black-backed gull	*Larus marinus*
Lesser black-backed gull	*Larus fuscus*
Regularly breeding seabird species in the UK and North Sea coasts	
Pomarine skua	*Stercorarius pomarinus*
Arctic skua	*Stercorarius parasiticus*
Sandwich tern, Roseate tern, Common tern, Arctic tern and Little tern	*Sterna hirundo*
Black guillemot	*Cepphus grylle*

DTI (2001); DECC (2009b)

In general, offshore areas of the North Sea contain peak numbers of seabirds following the breeding season and through winter, with birds tending to forage closer to coastal breeding colonies in spring and early summer (DTI, 2001).

Birds are vulnerable to oiling from surface oil pollution, which can cause direct toxicity through ingestion, and hypothermia as a result of the birds' inability to waterproof their feathers. During the moulting season, certain species (e.g. guillemot, razorbill and puffin) become flightless and spend a large amount of time on the water surface, making them particularly vulnerable to surface oil pollution (DTI, 2001). However, seabirds are not normally affected by planned offshore oil and gas operations (DTI, 2001). Although locally important numbers of birds have been killed directly by oil spills, such spills have primarily been associated with the transportation of oil (DTI, 2004).

Seabird vulnerability to surface pollution varies throughout the year with peaks in late summer after breeding when the birds disperse into the North Sea, and during the winter months with the arrival of over-wintering birds. To assess the relative risk for different species, the JNCC Seabirds at Sea Team (SAST) has developed an index of the vulnerability of bird species to the threat of oil pollution. This offshore vulnerability index (OVI) is derived by taking account of the following four factors (Williams *et al.,* 1994):

- the amount of time spent on the water;
- total biogeographic population;
- reliance on the marine environment; and
- potential rate of recovery.

The seabird vulnerability to oil pollution in the Rubie/Renee Facilities area derived from the JNCC block-specific vulnerability data (JNCC, 1999), is presented in Table 4.8.

Table 4.8: Seabird vulnerability to oil pollution around the Rubie/ Renee Facilities

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	All
14/20	2	3	4	3	3	4	1	2	3	2	1	3	3
14/25	2	2	4	3	3	4	2	1	1	2	1	3	2
14/30	3	2	4	4	3	4	2	1	1	2	1	3	2
15/16	2	3	4	3	3	4	1	2	N/D	2	1	4	2
15/17	2	3	4	3	3	4	1	2	N/D	2	1	4	**3**
15/21	2	3	4	3	3	4	2	2	2	2	1	N/D	3
15/22	2	3	4	3	3	4	2	2	2	2	1	N/D	3
15/23	2	3	4	3	3	4	2	2	2	1	1	N/D	3
15/24	3	3	4	3	4	4	2	2	3	1	1	N/D	3
15/26	3	3	4	4	3	4	2	2	2	2	1	N/D	3
15/27	3	3	4	4	3	4	2	2	2	2	1	N/D	3
15/28	3	3	4	4	3	4	2	2	2	1	1	N/D	3
15/29	3	3	4	4	4	4	2	2	3	1	1	N/D	3
20/05	3	2	3	4	3	3	2	1	1	1	1	3	3
21/01	3	3	3	4	3	4	2	1	1	1	1	N/D	2
21/02	3	3	3	4	3	4	2	1	1	1	1	N/D	2
21/03	3	3	3	4	3	4	2	1	1	1	1	N/D	2
21/04	**3**	**3**	**4**	4	4	4	2	2	2	1	1	N/D	3

Key

1	Very high Seabird Vulnerability
2	High Seabird Vulnerability
3	Moderate Seabird Vulnerability
4	Low Seabird Vulnerability
	Rubie/ Renee Facilities Blocks
N/D	No Data

Source: JNCC (1999)

The most sensitive times of year for seabirds in the Rubie/ Renee Facilities area (Blocks 15/21, 15/26, 15/27, 15/28 and surrounding blocks) are from July to November when seabird vulnerability to oil pollution ranges from moderate to very high. Vulnerability ranges from low to high for the remainder of the year. The overall seabird vulnerability to surface pollution in the Rubie/ Renee Facilities area is moderate to high (Table 4.8).

4.3.6 Offshore conservation areas

The European Community (EC) Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the Habitats Directive) and the EC Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive), are the main instruments of the European Union (EU) for safeguarding biodiversity. These Directives provide for the protection of animal and plant species of European importance and the habitats which support them, particularly through the establishment of a network of protected sites. The Habitats Directive includes a requirement to establish a European network of important, high quality conservation sites that will make a significant contribution to conserving the habitat and species identified in Annexes I and II of the Directive respectively. Habitat types and species listed in Annexes I and II are those considered to be in most need of conservation at a European level (JNCC, 2002; JNCC, 2011).

Special Areas of Conservation

The UK government, with guidance from the JNCC and DEFRA, has statutory jurisdiction under the EC Habitats Directive to propose offshore areas or species (based on the habitat types and species identified in Annexes I and II) to be designated as Special Areas of Conservation (SAC). These designations have not yet been finalised, but will be made to ensure that the biodiversity of the area is maintained through conservation of important, rare or threatened species and habitats of certain species.

SACs are sites that have been adopted by the EC and formally designated by the government of each country in whose territory the site lies. Sites of Community Importance (SCIs) are sites that have been adopted by the EC but not yet formally designated by the government of each country. Candidate SACs (cSACs) are sites that have been submitted to the EC, but not yet formally adopted. cSACs are considered in the same way as if they had already been classified or designated, and any activity likely to have a significant effect on a site has to be appropriately assessed. Possible SACs (pSACs) are sites that have been formally advised to the UK Government, but not yet submitted to the EC. Draft SACs (dSACs) are areas that have been formally advised to the UK government as suitable for selection as SACs, but have not been formally approved by the government as sites for public consultation. A site remains a cSAC until it has been formally designated as a SAC by the UK Government, following approval as a SCI by the European Commission (JNCC, 2011).

In relation to UK offshore waters, four habitats from Annex I and four species from Annex II of the Habitats Directive are under consideration for the identification of SACs in UK offshore waters (Table 4.9; JNCC, 2002; JNCC, 2011).

Table 4.9: Annex I habitats and Annex II species occurring in UK offshore waters

Annex I habitats considered for SAC selection in UK offshore waters	Species listed in Annex II known to occur in UK offshore waters

• Sandbanks that are slightly covered by seawater all the time
• Reefs (bedrock, biogenic and stony)
  • Bedrock reefs – made from continuous outcrops of bedrock which may be of various topographical shape (e.g. pinnacles, offshore banks);
  • Stony reefs – these consist of aggregations of boulders and cobbles which may have some finer sediments in interstitial spaces (e.g. cobble and boulder reefs, iceberg ploughmarks); and
  • Biogenic reefs – formed by cold-water corals (e.g. *Lophelia pertusa*) and the polychaete worm *Sabellaria spinulosa*.
• Submarine structures made by leaking gases
• Submerged or partially submerged sea caves
	• Grey seal (*Halichoerus grypus*)
	• Harbour or common seal (*Phoca vitulina*)
	• Bottlenose dolphin (*Tursiops truncatus*)
	• Harbour porpoise (*Phocoena phocoena*)

Source: JNCC (2002); JNCC (2011)

Currently in UK offshore waters there are no SACs, eight cSACs and twelve SCIs. In addition, there is an on-going process of SAC identification in UK offshore waters. The JNCC has identified areas where additional SACs may be sited, following further survey work or analysis of data gathered through surveys already conducted. These areas are termed Areas of Search (AoS). There are currently three AoSs in UK offshore waters (JNCC, 2011). The proximity of conservation areas in the central North Sea in relation to the Rubie/ Renee Facilities is presented in Table 4.10 and Figure 4.7.

Table 4.10: Conservation areas in the vicinity of the Rubie/ Renee Facilities

Name	Description	Location	Location	Area (km^2)	Status	Approx. distance to Rubie/ Renne UKCS Blocks
Braemar Pockmarks UK003057	Submarine structures made by leaking gas	central North Sea	58°59.4’ N, 1°28.8’ E	5.18	SCI	101 km
Scanner Pockmark UK0030354	Shallow depression approx. 600 m by 300 m and 20 m deep	central North Sea	58°16.8’N, 0°58.2’W	3.35	SCI	24 km
SE Fladen	Burrowed Mud	central North Sea	58° 9’ 57” N 00° 43’ 6”E	415	MPA	7.3 km
Western Fladen	Burrowed Mud	central North Sea	58° 22’ 2” N 00° 10’ 1” W	723	MPA	10.8 km

Source: JNCC (2013a)

The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (amended 2007) apply the Habitats Directive and Birds Directive in relation to oil and gas plans or projects wholly or partly on the UKCS and adjacent waters outside territorial waters. These regulations extend to the seaward limits of territorial waters (12 nautical miles offshore) (DECC, 2009a).

The Offshore Marine Conservation (Natural Habitats, & c.) (Amendment) Regulations 2009 transpose the Habitats Directive and Birds Directive in the marine offshore area, from 12 nautical miles to 200 nautical miles from the UK coast. Under these regulations it is an offence to deliberately disturb any species, that has a designated SAC or SCI, or while it is within its SAC/ SCI; capture, injure or kill any wild bird or any wild animal of a European Protected Species (EPS); and/ or significantly disturb any EPS, whether it is within a protected site or not, in such a way as to significantly affect (i) the ability of any significant group of animals to survive, breed, rear or nurture their young; or (ii) the local distribution or abundance of that species. EPS include all species of cetaceans (whales, dolphins and porpoises), all species of marine turtles, the sturgeon (*Acipenser sturio*) and the otter (*Lutra lutra*) (DEFRA, 2010; JNCC, 2011).

Annex I Habitats

Of the Annex I habitats listed in Table 4.9 the habitat most likely to be present in the Rubie/ Renee Facilities area are submarine structures made by leaking gases (Fugro Surveys Limited, 2008). The water depth is not sufficient for the formation of sandbanks and the sediment is too fine to allow the attachment and growth of subtidal reef organisms. Although numerous pockmarks have been identified in the Renee area, no Annex I habitats or communities of conservation importance were considered to be present within the survey area (Fugro Surveys Limited, 2008).

Annex II Species

Of the Annex II species listed in Table 4.9, the only species which has been observed within the Rubie/ Renee Facilities area is the harbour porpoise. Its abundance is very high in May, high in July and December, and low to medium in January, February, April, June, August, September and October (UKDMAP, 1998; Section 4.3.5).

Marine Protected Areas

The Marine (Scotland) Act introduces new powers relating to functions and activities in the Scottish marine area, including provisions concerning marine plans, licensing of marine activities, the protection of the area and its wildlife including seals, and the regulation of sea fisheries.

Scotland has devolved responsibility under the Marine and Coastal Access Act (2009) for the designation of sites out to 200 nautical miles as Marine Protected Areas (MPAs) (JNCC, 2013a). There will be three types of MPA within Scottish territorial waters: Nature Conservation MPAs; Historic MPAs; and Research/ Demonstration MPAs (JNCC, 2013b).

As yet there are no designated MPAs in UK offshore waters. The proximity of possible MPAs (pMPAs) in relation to the Rubie/ Renee Facilities is presented in Table 4.10 and Figure 4.7.

The Western Fladen and the SE Fladen possible pMPAs are the closest ones to the Rubie/ Renee Facilities area. Both of these proposed pMPAs have been recommended in order to offer protection for the seapens and the burrowing megafauna living in the burrowed mud habitat at these sites.

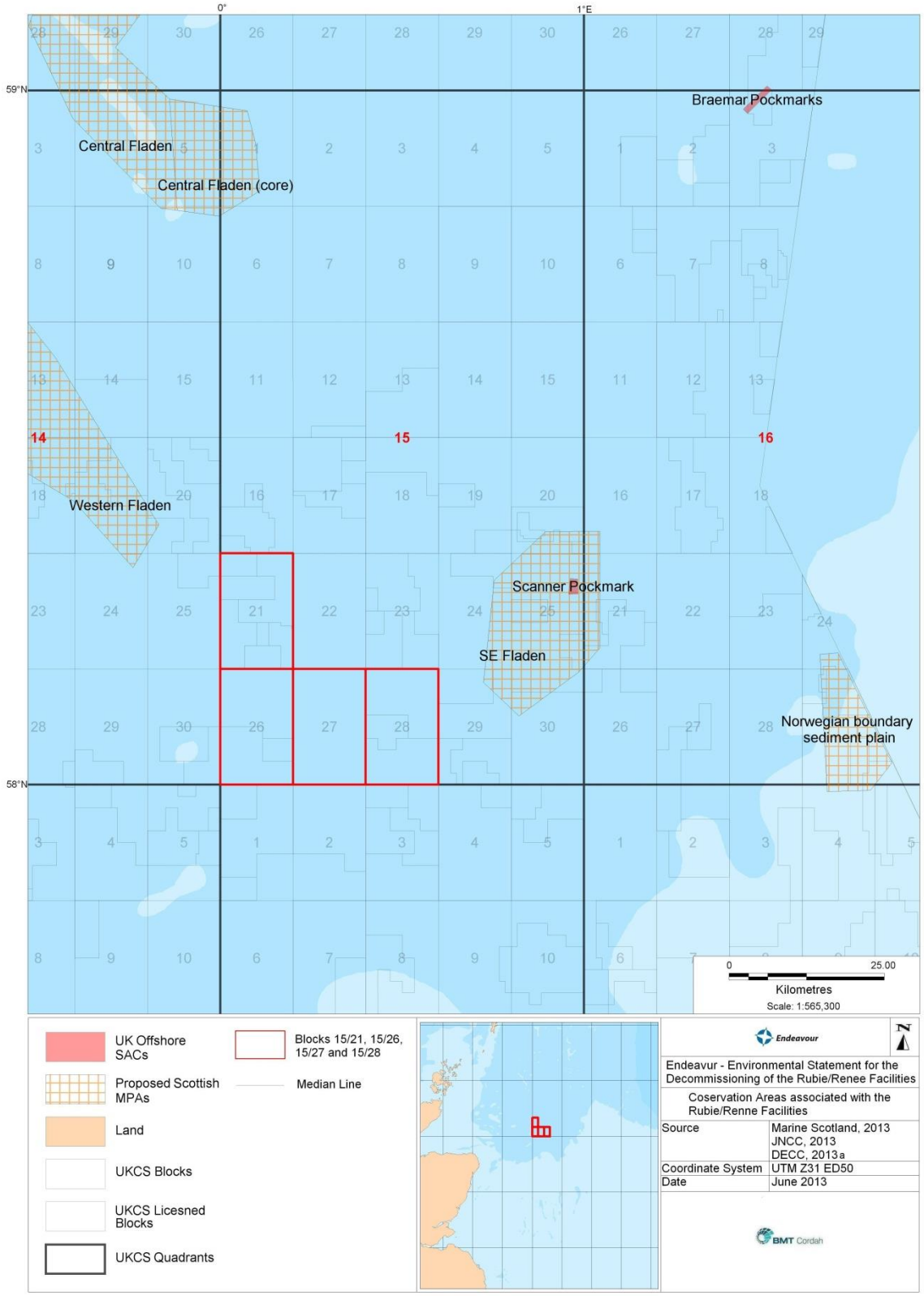


Figure 4.7: Conservation areas located in the vicinity of the Rubie/ Renee Facilities

Other protected species and habitats

The OSPAR List of Threatened and/ or Declining Habitats has been developed to fulfil the OSPAR Biological Diversity and Ecosystems Strategy commitment to identifying habitats which need to be protected (OSPAR, 2008). The proposed development is located in OSPAR Region II; habitats which are known to occur in this region and which may be applicable to the area of the proposed development include “sea pens and burrowing megafauna” habitat type (EUNIS code A5.361).

The ‘sea pens and burrowing megafauna’ biotope complex is a community type found in sub-tidal particulate substrata, ranging from muddy sands with admixtures of shell and gravel to fine, clay-dominated muds. The designation of the biotope complex refers to a taxonomic grouping, ‘sea pens’ (three species of colonial anthozoan cnidarians) and a functional category, ‘burrowing megafauna’ (a taxonomically-diverse assemblage of crustaceans, and worms and fish), whose common feature is their construction of large and conspicuous burrows in the sea bed. Although grouped together for current purposes, and often occurring in the same habitat, it is important to note that sea pens and burrowing megafauna are functionally quite dissimilar and not invariably associated with each other (Hughes, 1998).

The rig-site investigation (Fugro Survey Limited, 2008) that took place at the Renee location (Block 15/27) in 2008 revealed that the epifaunal diversity across the survey area was poor, with few species observed from video footage and digital stills. The faunal communities observed reflected what would be expected of the seabed habitat at the survey site with the seapens (*Pennatula phosphorea* and *Virgularia mirabilis*) being recorded. Numerous worm tubes were visible throughout the survey area along with hagfish (*Myxine glutinosa*) and *Nephrops*.

4.4 Socioeconomic Environment

This section focuses on the broader socioeconomic considerations of the existing baseline in relation to the Rubie/ Renee Facilities. Consideration is given to the potential impact on the fishing (UK and non-UK fishing in the area) and shipping industries as well as any potential impact on other users of the sea, such as military activity and activity within the renewable energy sector. The existence of submarine cables, historic wrecks and other oil and gas installations are also considered.

4.4.1 UK commercial fishing industry

An assessment of the fishing industry in the Rubie/ Renee Facilities area has been derived from International Council for the Exploration of the Seas (ICES) fisheries statistics, provided by Marine Scotland’s Science Division. Offshore oil and gas operations, including decommissioning activities, have the potential to interfere with fishing activities, for example as a result of the exclusion of fishing vessels from around an area of operation (CEFAS, 2001b). It is therefore important to have an understanding of the fishing activities and intensity in the Rubie/ Renee Facilities area in order to evaluate the potential impacts associated with the proposed decommissioning activities on the fishing industry.

For management purposes, ICES collates fisheries information for individual rectangles measuring 30 nautical miles by 30 nautical miles. Data were obtained for ICES

rectangles 45F0, which contains the Rubie/ Renee Facilities. Statistical data from the ICES rectangles provides information on the UK fishing effort and live weight of demersal, pelagic and shellfish caught by all UK vessels between 2009 and 2011 (Marine Scotland, 2012a).

Data on the economic value of the fishing industry in this area have been produced based on UK catches and landings (Marine Scotland, 2012b). The overall value of different fisheries by area (financial yield per ICES rectangle) is an indication of the differential worth of areas and is used as a method of expressing commercial sensitivity (Coull *et al*., 1998).

The type of fishing gear and techniques employed by fishermen depends on a variety of factors, such as:

- species fished, e.g. demersal, pelagic or shellfish;
- depth of water and seabed topography; and
- seabed characteristics.

Species found in the water column (pelagic species) are fished using techniques that do not interact with the seabed; whereas demersal and shellfish species are generally fished on or near the seabed and there is therefore the potential for these gears to interact with structures left on the seabed. Both finfish, such as cod, whiting, haddock and flatfish, and shellfish species, such as *Nephrops* which are found on or near the bottom, are caught by demersal fishing methods. Demersal trawling methods interact with the seabed, and may interact with existing infrastructure on the seabed and historical seabed anomalies created by oil and gas activities, including disturbance from subsea structures left *in situ* such as pipelines, rock-placement or concrete mattresses left or buried in the sediment.

Fishing Effort

Fishing effort can be used to quantify the value of landings and establish whether or not any changes in landings are due to alterations in effort or in value of the catch (SFF Services, 2012). Fishing effort (in number of days) for different gear types in ICES rectangle 45F0 over the most recent three year period (2009 to 2011) is presented in Table 4.11.

During this three year period, the total effort peaked during 2010 at 3,468 days. The number of days of fishing effort decreased to 1,651 during 2011. Over the three year period, the predominant method of fishing in ICES rectangle 45F0 was by demersal otter trawl. August to December were the most intensively fished months (Table 4.11), with the exception of 2010 where the spring months (March to May) showed an increase in fishing intensity.

The relative effort (kWdays) in ICES rectangle 45F0 has been recorded as “very high” for *Nephrops* gears and “low” for whitefish gears, with no effort recorded for the remaining gears types (Table 4.12; Marine Scotland, 2012b).

Table 4.11: UK fishing effort (days fished) according to gear types in ICES rectangle 45F0

Gear Type	Effort (days)		
	2009	2010	2011
Otter trawls (not specified)	-	2	-
Otter trawls - bottom	1,502	2,380	1,182
Otter trawls - midwater	-	-	-
Otter twin trawls	682	1,079	456
Pair trawls - bottom	-	7	1
Nephrops trawls	-	-	4
Beam Trawls	-	1	1
Scottish seines	-	-	8
Total	**2,184**	**3,468**	**1,651**

Source: Marine Scotland (2012b)

Table 4.12: "Relative Fishing Effort" of Commercial Fisheries in ICES Rectangles 45F0

Gear Type	Effort (Kwdays)
Whitefish gear	Low (20,000 to <100,000)
Pelagic gear	None
Nephrops gear	Very High (>300,000)
Gill nets and Long lines	None
Pots and Creels	None
Dredges	None

Source: Marine Scotland (2012b)

Catch composition

Between 2009 and 2011, the annual total live weight of fish landed from ICES rectangle 45F0 ranged from 1,931 tonnes in 2011 to 4,018 tonnes in 2010. Demersal and shellfish dominated the landings, contributing 3,029 and 5,850 tonnes, respectively for the years 2009 to 2011 (Table 4.13). Pelagic landings equated to 221 tonnes for the same time period (Table 4.13).

Table 4.13: Total landings (tonnes) of demersal, pelagic and shellfish species caught in ICES Rectangles 45F0 and by UK and Foreign Vessels between 2009 and 2011

Species Type	Live weight (tonnes)		
	2009	2010	2011
Demersal	1,090	1,164	776
Pelagic	185	35	1
Shellfish	1,877	2,819	1,154
Total	3,152	4,018	1,931

Source: Marine Scotland (2012b)

Figure 4.8 presents the catch composition of UK landings from UK and foreign vessels in ICES rectangle 45F0 during the period 2009 to 2011. Over this time period the catch composition was dominated by the shellfish species *Nephrops* and the demersal species haddock. Other species landed from ICES rectangle 45F0 included cod, herring, monkfish, saithe, witch, ling and lemon sole (Figure 4.8).

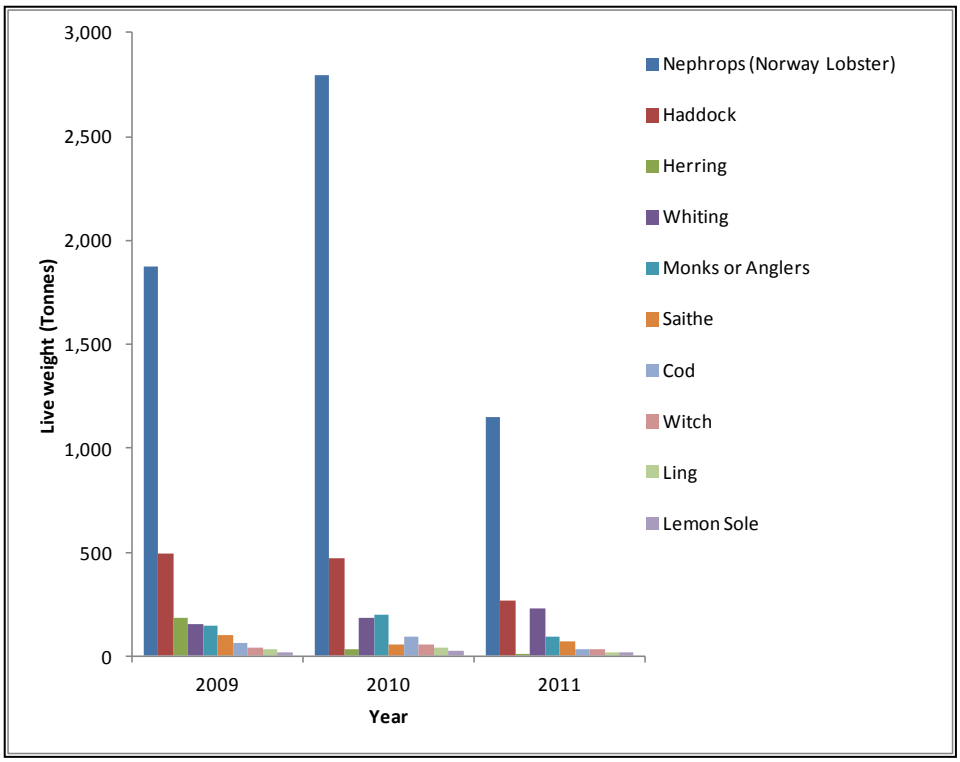


Figure 4.8: Catch composition of UK landings from UK and Foreign vessels in ICES Rectangle 45F0 between 2009 to 2011

Value

Marine Scotland (2012a) provide the "relative value" of whitefish, pelagic, *Nephrops*, gill nets and long lines, pots and creels and dredges landed by UK vessels during 2011. The "relative value" gives an indication of sensitivity. With regard to fisheries, damaging events, such as an oil spill, would be of more concern in an area of higher relative value than a similar spill in less productive waters.

Table 4.14 present the relative value for the fish landed from the Rubie/ Renee Facilities area (ICES rectangles 45F0) in 2011. The relative value was "medium" for whitefish gears, "very high" for *Nephrops* gears and no catch was recorded for the remaining gears (Table 4.14; Marine Scotland, 2012a)

Table 4.14: Relative value of commercial fisheries in ICES Rectangle 45F0 during 2011

Gear Type	Relative Value (£)
Whitefish gear	Medium (100,000 to <500,000)
Pelagic gear	None
Nephrops gear	Very High (>1,000,000)
Gill nets and Long lines	None
Pots and Creels	None
Dredges	None

Source: Marine Scotland (2012a)

4.4.2 Oil and gas industry

Oil and gas development in this region of the North Sea is relatively intensive. There are several oil fields (Table 4.15) and existing oil and gas infrastructure close to the Rubie/ Renee Facilities, (Figure 4.9).

Table 4.15: Oil and gas fields within close proximity of the Rubie/ Renee Facilities

Field	Distance	Direction
Rochelle	4 km (Renee manifold)	SW
Tweedmuir	10 km (Renee manifold)	SW
Ivanhoe	0.6 km (Dynamic umbilical base)	W
Rob Roy	0.2 km (Dynamic umbilical base)	N
Hamish	1.7 km (Dynamic umbilical base)	NNE

Pipelines in the vicinity of the Rubie/ Renee Facilities include:

- Talisman operated Tweedsmuir control umbilical, 4” gas lift and 12” production pipelines situated 2.7 km, 2.6 km and 2.5 km from the Rubie/ Renee DUB.
- The Apache North Sea Limited operated Beryl to St Fergus pipeline is approximately 5.1 km from the DUB and the BP operated Miller to St Fergus pipeline 5.3 km (UKDEAL, 2013).

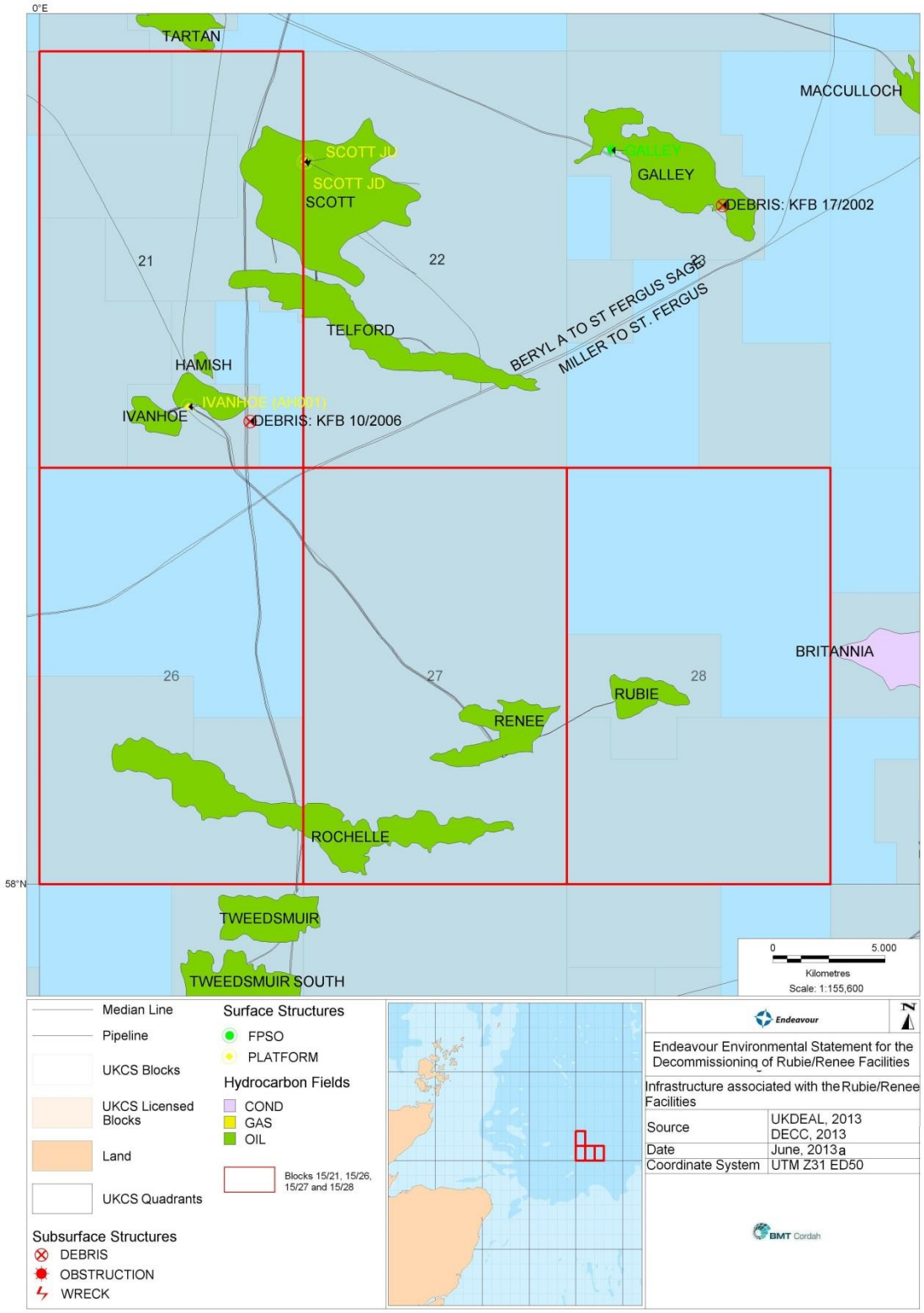
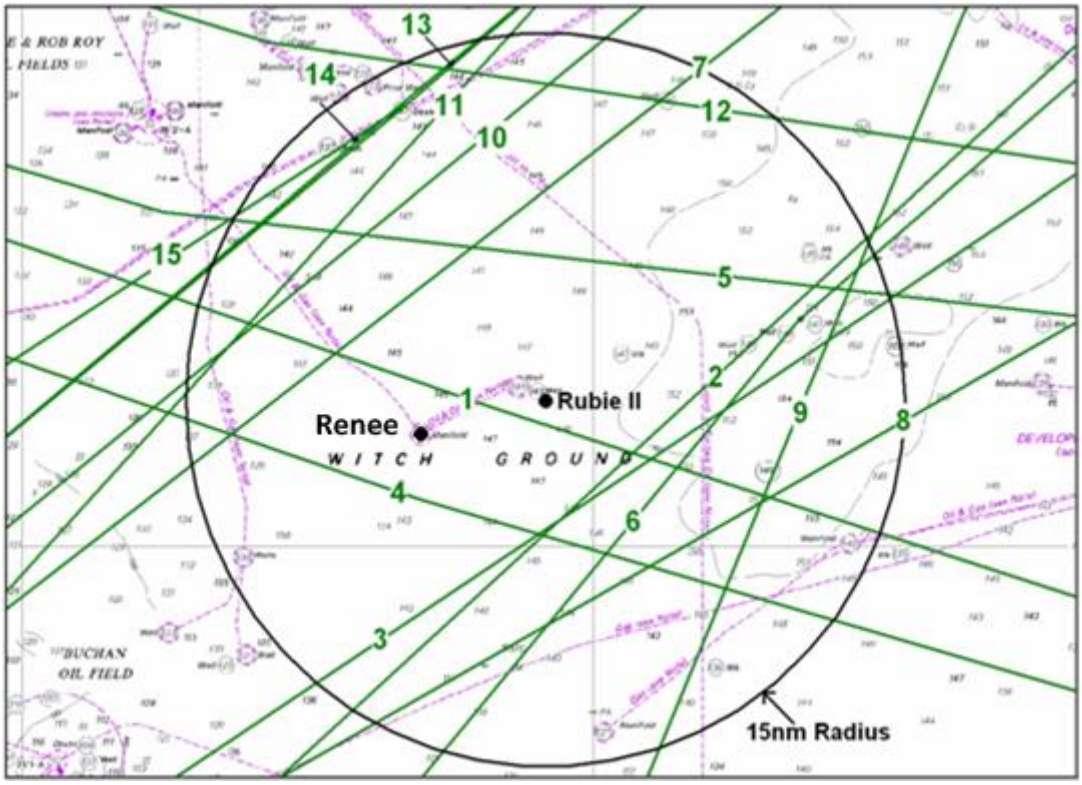


Figure 4.9: Oil and Gas Infrastructure associated with the Rubie/ Renee Facilities

4.4.3 Shipping

The North Sea has some of the busiest shipping lanes in the world. For example, in 1996 there were 37,055 shipping movements transporting 48 million tonnes of cargo between the North Sea and the Baltic.

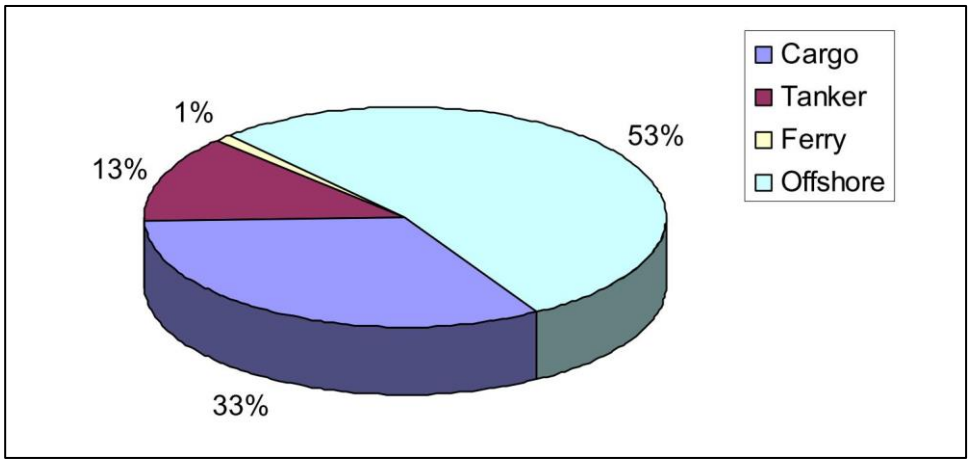
Figure 4.10 presents the shipping routes study that was originally undertaken for Endeavour's Rubie II well, but remains relevant for the Rubie/ Renee Facilities. This study centred on the Rubie II well location that is located 1 km north east from the RPM (Figure 4.10). Anatec UK Ltd's (Anatec) UK shipping route database, ShipRoutes provided traffic intensity data for shipping routes that were identified within 10 nmiles of the Rubie II well location.



Source: Endeavour (2008)

Figure 4.10: Vessel routes identified in the vicinity of Rubie/ Renee Facilities

Fifteen different routes were identified to pass within 10 nautical miles of the Rubie II well location (Figure 4.10). Total annual traffic for the 15 shipping routes was estimated at 932 vessels, which correspond to an average of approximately two to three vessels per day. Figure 4.11 presents the overall breakdown of traffic by vessel. The majority of the passing vessels identified as offshore vessels (53%) and cargo ships (33%). The majority of all vessels in the vicinity are recorded to be between 1,500 and 15,000 dead weight tonnes (DWT).



Source: Endeavour (2008)

Figure 4.11: Vessel type distribution in the vicinity of Rubie/ Renee Facilities

The eight closest shipping routes to the Rubie II well and the Rubie/ Renee Facilities (Figure 4.10; Table 4.16), account for 50% of the total traffic. The route closest to Rubie II and Rubie/ Renee is route No.1 and is trafficked by cargo vessels and tankers with an estimated 85 crossings per annum as they travel from Clyde to Kattegat. The busiest routes are North America to Kattegat b and Brae/ East Brae to Peterhead (identified as route numbers 4 and 15) with an estimated 135 and 160 ships per year accounting for 14% and 17% of the total traffic, respectively.

Table 4.16: Shipping routes that pass in the vicinity of Rubie/ Renee Facilities

Route No	Description	Ships per Year	% of Total
1	Clyde-Kettergat b	85	9
2	Tay-Marstein	10	1
3	Aberdeen-Tiffany/ Balmoral	52	6
4	America North-Kattergat b	135	14
5	Kattergat-Belfast b	70	8
6	Marstein-Forth	25	3
7	Tiffany/ Balmoral-Aberdeen	52	6
8	Aberdeen-Bomlafjorden	30	3
9	Blyth-N Norway/Russia	15	2
10	Aberdeen-MacCulloch	86	9
11	Sognefjorden-Forth	10	1
12	Kattergat-Greenland Pentland	20	2
13	Aberdeen-Marstein	82	9
14	Aberdeen-Miller	100	11
15	Brae/ East Brae-Peterhead	160	17
Total		**932**	**100**

Source: Endeavour (2008)

4.4.4 Defence

There is no known military activity in the vicinity of the Rubie/ Renee Facilities, nor any recorded munitions dumping grounds (DTI, 2001).

4.4.5 Telecommunications and cables

The Atlantic crossing cable (AC1) and the TAT-14 cable both lie to the north of the Rubie/ Renee Facilities. To the east lies the Russian Optical Trans-Arctic System (ROTACS) cable and further east lies the NorSea Com cable (Kis-Orca, 2013; TeleGeography, 2013; CableMap, 2013).

4.4.6 Wrecks

Within the CNS SEA2 area, there are 524 confirmed and possible wrecks (DTI, 2001). In addition, there are 84 recorded non-wreck items in the CNS SEA2 area, including lost cargoes, anchors, cables and large boulders (DTI, 2001). There are no wrecks designated under the Protection of Wrecks Act 1973 within the SEA2 area (DTI,2001).

Subsea debris has been recorded approximately 3 km to the southeast of the DUBS. Approximately 25 km to the northeast of the DUBS is the abandoned Galley (G6) wellhead, 40 km southeast of the DUBS is a seabed obstruction and 18 km to the north lies debris from a manifold and its protective structure weighing 4.9 tonnes and 8.9 tonnes, respectively (DECC, 2013a).

4.6 Summary of Environmental Sensitivities

Table 4.17 summarises the environmental sensitivities in the vicinity of the Rubie/ Renee Facilities.

Table 4.17: Environmental sensitivities in the vicinity of the Rubie/ Renee Facilities

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Habitats Directive: Annex I Habitats											
There are no known Annex I habitats in the Rubie/ Renee Facilties area. Marine conservation areas (SACs and MPAs) exist in UKCS to the east, north and west of the facilities. Some of these have qualifying features that meet those stated in Annex I.											
Habitats Directive: Annex II Species											
Of the Annex II species, only the harbour porpoise has been sighted in the Rubie/ Renee Facilities area, with very high sightings in May, high abundance in July and December, with low to moderate abundance January, February, April, June, August, September and October (UKDMAP 1998).											
Benthic Fauna											
Benthic communities in the Rubie/ Renee Facilities area are similar to those found throughout a large surrounding area of the central North Sea. No rare species are known to occur in this area (Fugro ERT, 2011; Fugro Survey Limited, 2008).											
Plankton											
Peak productivity occurs in spring and summer throughout the CNS.											
Finfish and Shellfish											
The Rubie/ Renee Facilities are located in spawning grounds for cod (Jan to Apr), Norway pout (Jan to Apr) and *Nephrops* (Jan to Dec); and in nursery grounds for anglerfish, blue whiting, cod, European hake, herring, ling, mackerel, *Nephrop*s, Norway pout, sandeels, spotted ray, sprat, spurdog and whiting (Coull *et al.,* 1998; Ellis *et al.,* 2010).											
Marine Mammals											
Marine mammals sighted in and around the Rubie/ Renee Facilities area include minke whales, killer whales, white-beaked dolphins, Atlantic white-sided dolphins, harbour porpoises, common dolphins and Risso's dolphins. Peak sightings generally occur from May to September (Reid *et al*., 2003; UKDMAP, 1998).											
Seabirds											
Seabird vulnerability to oil pollution in the Rubie/ Renee Facilities area is "very high" in October and November, "high" in January, July, August and September and moderate or Low for the remainder of the year except for December when there is no data. The overall vulnerability in the Rubie/ Renee Facilities area is "moderate" (JNCC, 1999).											
Fisheries											
The Rubie/ Renee Facilities area "medium" relative value for whitefish gear and a "very high" *Nephrops* relative value. Fishing effort is "low" for whitefish gear and "very high" for *Nephrops*. Historically, shellfish dominate the landings in the vicinity of the Rubie/Renee Facilities area targeting mostly *Nephrops* (Marine Scotland, 2012b, 2011).											
Shipping											
The majority of shipping activity results from the offshore industry and cargo voyages.											

Key

- Very high sensitivity
- High sensitivity
- Moderate sensitivity
- Low sensitivity
- Not surveyed/ No data available

5.0 STAKEHOLDER VIEWS

Consultation with stakeholders is an important part of the EIA process because it enables the issues and concerns of stakeholders to be recorded, addressed and communicated within the ES and, where applicable, acted upon during the subsequent planning and implementation stages of the project.

5.1 Initial consultation

Endeavour has held initial meetings and dialogue with the Department of Energy, Climate and Change (DECC), Marine Scotland, Joint Nature Conservation Committee (JNCC) and the Scottish Fishermen's Federation (SFF) on the proposed decommissioning strategy.

Table 5.1 provides a summary of the key issues raised during the consultation process and Endeavour's responses to these issues.

5.2 Future consultation

The formal consultation process will begin with the submission of the consultation draft for the Decommissioning Programmes. The consultation process will include the Decommissioning Programmes placed on the Endeavour website. In addition a copy of the Decommissioning Programmes will be available at Endeavour's Aberdeen office for inspection by members of the public. As well as making the programmes publicly available, copies will be sent to the following statutory consultees for comment:

- SFF
- National Federation of Fishermen's Organisations (NFFO)
- Northern Ireland Fish Producer's Organisation (NIFPO)
- Global Marine Systems Ltd (GMS)
- Marine Scotland
- JNCC
- Maritime and Coastguard Agency (MCA)

The consultation period will last approximately 30 days, following which Endeavour will be notified of any objection to the proposals.

Table 5.1: Summary of key issues raised by regulatory agencies during early discussions

Stakeholder	Comments/ concerns	Endeavour's responses
DECC Meeting – 22 July 2013 Meeting – 1 September 2013	DECC advised Endeavour that: • Both the Decommissioning Programme and ES should state that the AH001 FPF has been removed. • All preparatory work undertaken at the Rubie/ Renee Facilities should be included within both the DP and ES. • The Dynamic Umbilical Base Structure (DUBS) should be mentioned within the DP and ES, even though the subsea structure has been removed from the seabed. • They should follow the new DP format or prepare one similar to the Hess' IVRRH DP submitted to DECC early 2013. • The next meeting should be held when the draft DP has been submitted. • To continue the dialogue with DECC as the decommissioning plan progressed.	Endeavour have ensured that the DP and ES includes: • The removal of the AH001 FPF • All preparatory work undertaken at the fields. • The removal of the DUBS. • Endeavour have prepared the DP using DECC's new format. • Endeavour submitted an early draft of DP to DECC in late August 2013 for informal advice. An informal advisory meeting was subsequently held between DECC and Endeavour on 1 September 2013.
	Informal advisory meeting on the progress of the Rubie/ Renee Facilities Decommissioning Programmes.	Endeavour have continued to keep DECC informed on the progress of the DP, CA and ES as requested by DECC
Marine Scotland Meeting / Letter– TBC	• [HOLD]	• [HOLD]
JNCC Meeting / Letter – TBC	• [HOLD]	• [HOLD]
MCA Meeting / Letter – TBC	• [HOLD]	• [HOLD]
SFF Meeting / Letter – TBC	• [HOLD]	• [HOLD]

6.0 EVALUATION OF POTENTIAL ENVIRONMENTAL IMPACTS

As required under the Petroleum Act, 1998 and OSPAR Decision 98/3, this section identifies and ranks the environmental and societal impacts and risks that could arise directly or indirectly from planned and unplanned activities associated with the decommissioning of the Rubie/ Renee Facilities.

The decommissioning of the Rubie/ Renee Facilities has the potential to cause environmental impact in several different ways, including physical disturbance of the seabed, emissions of gases to the atmosphere, discharges of liquids and contaminants to sea and the generation of wastes for disposal onshore. These effects could arise as a result of the operations or consequences in the following broad three aspects of the decommissioning programme:

1. Removal of the subsea laid infrastructures (including manifolds, wellheads, mattresses and jumpers).
2. Leaving the pipelines and umbilicals *in situ*.
3. Removing the umbilicals and surface laid flowlines.

An assessment was undertaken of the significance of the risks to any environmental compartment as a result of the operations (the activities that would be undertaken to complete the option) or the end-points (the final state of the facilities, materials or environment as a result of successfully completing the operation). The assessment also looked at both planned operations and accidental events. Hence, within three aspects of the decommissioning programme, the activities have been broken down further into four sub-categories:

1. Planned operations.
2. Planned end-points.
3. Unplanned operations.
4. Unplanned end-points.

6.1 Risk Assessment Methodology

The purpose of the risk assessment process is to identify those potential impacts and risks that may be significant in terms of the threat that they pose to particular environmental receptors, the need for measures to manage the risk in line with industry best practice and the requirement to address concerns or issues raised by stakeholders during the consultation for this ES.

In this section of the ES, the scope of the risk assessment is confined entirely to the decommissioning of the Rubie/ Renee Facilities. Tables 6.6 to 6.8 shows the outcome of this assessment and Sections 7 to 12 provide a more detailed evaluation of those impacts and risks that were assessed to be significant. Appendix B provides a justification for those risks that were deemed to present a low risk.

6.1.1 Overview of the assessment process

The risk assessment for the planned activities was derived by reducing the definition to:

The likelihood that an event will have an impact upon a particular environmental receptor **x** **The magnitude of the effect** **=** **Significance of the impact/ risk**

For planned events, it is certain that the event will occur; therefore, the first term can be set as equal to one and effectively be ignored. The primary driver for the risk assessment is then the likelihood that a particular environmental receptor will be affected by the planned activity. This is governed by the receptor's sensitivity to the causes of impact, its location in relation to the source of the impact, the timing of the impact and the ability of the receptor to recover.

The definitions for "the likelihood of occurrence of the impact upon a particular receptor" and the "magnitude/ consequence of the environmental impact" for each activity are presented in Tables 6.1 and 6.2, respectively.

Table 6.1: Guidelines for assessing likelihood of occurrence of an impact upon a particular receptor resulting from the planned activities

Decreasing likelihood	Likelihood		Frequency of planned activity impacting receptors during project lifetime
	A	Definite	Impact observed every time
	B	Likely	Impact often observed
	C	Possible	Impact occasionally observed
	D	Unlikely	Impact rarely observed
	E	Remote	Impact almost never observed

Table 6.2: Guidelines for assessing the magnitude/ consequence of the impacts on the environment

Magnitude/ consequence		Characteristics
5	Catastrophic	Adverse permanent impacts on key ecosystem functions in larger natural habitats or societal resources, uses or activities. Scale typically widespread (national or greater level).
4	Severe	Adverse long term impact on ecologically valuable natural habitats (e.g. restitution time >10 years), or social and economic resources/ assets, uses or activities. Scale typically regional to national level.
3	Major	Adverse medium term impacts on a significant number of habitats (e.g. restitution time 1 to 10 years) or social and economic resources/ assets, uses or activities. Scale typically local to regional level.
2	Moderate	Adverse short term impact on natural habitats, social and economic activities or resources, or social and economic resources/ assets, uses or activities. Scale typically localised.
1	Minor	Very limited adverse impact on natural habitats or social and economic resources/ assets, uses or activities. No impact on population, only on individual level. Typically transient and highly localised.

These factors were combined using a risk assessment matrix (Table 6.3) to determine what level of risk the proposed activity could pose to groups of receptors (or related attributes such as use of resources, use of disposal facilities, integrity of conservation sites, etc) in the physical, chemical, biological and societal receiving environments. The overall significance for a particular activity was determined by taking the highest level of risk associated with the project activity against any one of these receptors/ attributes.

Table 6.3: Environmental risk assessment matrix

		Planned	Accidental	Magnitude/ consequence of impact (Table 6.2)					
				0 Beneficial	1 Minor	2 Moderate	3 Major	4 Severe	5 Catastrophic
Likelihood of occurrence (Tables 6.1 and 6.4)	A	Definite	Likely	Beneficial A0	Low A1	Medium A2	Medium A3	High A4	High A5
	B	Likely	Unlikely	Beneficial B0	Low B1	Medium B2	Medium B3	High B4	High B5
	C	Possible	Very unlikely	Beneficial C0	Low C1	Low C2	Medium C3	High C4	High C5
	D	Unlikely	Extremely unlikely	Beneficial D0	Negligible D1	Low D2	Low D3	Medium D4	Medium D5
	E	Remote	Almost unheard of	Beneficial E0	Negligible E1	Negligible E2	Low E3	Low E4	Medium E5

Although decommissioning the Rubie/ Renee Facilities will create employment and other direct and indirect benefits, these positive impacts of the project were not considered further in the assessment that follows.

6.1.2 Assessment of unplanned/ accidental events

The risk assessment for unplanned/ accidental events was derived by reducing the definition to:

The likelihood that an event will occur **x** **The magnitude of the effect** **=** **Significance of the Impact/ risk**

The assessment is focussed, therefore, on the magnitude of any impact and the probability that the causal event will occur. As with Section 6.2.1, the magnitude of impact was assessed for each receptor and recorded in the tables.

The definitions for “the likelihood of occurrence of the unplanned or accidental event” and “the magnitude/ consequence of the environmental effects” for each activity are provided in Tables 6.2 and 6.4**,** respectively.

Table 6.4: Guidelines for assessing likelihood of occurrence of an impact resulting from unplanned/ accidental activities

Decreasing likelihood	Likelihood		Frequency of an unplanned or accidental event occurring and impacting receptors during project lifetime
	A	Likely	Might happen once a year; 1 per year
	B	Unlikely	Could happen several times; 1 per 10 years
	C	Very unlikely	Might happen; 1 per 100 years
	D	Extremely unlikely	Has occurred several times in industry; 1 per 1,000 years
	E	Almost unheard of	Few if any events in industry; 1 per 10,000 years

These factors were combined using a risk assessment matrix (Table 6.3) to determine what level of risk the proposed activity could pose to the physical, chemical, biological and societal receiving environments. The overall significance for a particular activity was determined by taking the highest magnitude of impact associated with the project activity (Table 6.2) against any one receptor/ attribute of the receiving environment and compared with the likelihood of the causal event from Table 6.4. The totals for “low” and “medium” environmental risks associated with each activity are presented in Table 6.5.

6.2 Risk Assessment Findings

The results of the risk assessment are shown in Tables 6.6 to 6.8. The left-hand column of the tables identifies the aspects of the project that will definitely cause or have the potential to cause impacts to sensitive receptors. These environmental aspects (BSI, 2004) include routine, abnormal and emergency events during the lifetime of the decommissioning project. The remaining columns of the tables identify the potential physical, chemical, biological and societal receptors. The four right-hand columns of the tables present the stakeholder concerns, the overall assessment of significance (i.e., the highest assessed risk) and the sections of the report that give a detailed justification of the assessment made.

For the impacts or risks that were considered to be “low”, Appendix B provides the justification for the assessment made and for excluding these impacts and risks from further investigation in the EIA.

Table 6.5: Summary of the risk assessment conducted for the decommissioning of the Rubie/ Renee Facilities

Project Stage	Risk																			
	Beneficial				Negligible				Low				Medium				High			
	Planned Operations	Planned End-points	Unplanned Operations	Unplanned End-points	Planned Operations	Planned End-points	Unplanned Operations	Unplanned End-points	Planned operations	Planned End-points	Unplanned Operations	Unplanned End-points	Planned Operations	Planned End-points	Unplanned Operations	Unplanned End-points	Planned Operations	Planned End-points	Unplanned Operations	Unplanned End-points
Removal of surface laid seabed infrastructures	0	3	0	0	0		0	0	10	2	2	0	3	0	1	0	0	0	0	0
Leaving the buried pipelines and umbilicals *in situ*	0	0	0	0	0	0	0	0	7	1	0	3	1	1	0	0	0	0	0	0
Removing the surface laid flowlines	0	2	0	0	0	0	0	0	5	1	1	1	2	0	1	0	0	0	0	0
TOTAL	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**22**	**4**	**3**	**4**	**6**	**1**	**2**	**0**	**0**	**0**	**0**	**0**

Taking the effects of planned mitigation into account, no “high” environmental risks were identified during the assessment. The risk assessment did, however, identify the following activities associated with the Rubie/ Renee Facilities as having the potential to be of “medium” risk and which are assessed further in Sections 7 to 12:

- Energy use and atmospheric emissions (Section 7).
- Underwater noise (Section 8).
- Seabed footprint (Section 9).
- Societal impact (Section 10).
- Discharges to sea (Section 11).
- Accidental hydrocarbon release (Section 12).

Table 6.6: Sources of potential environmental impacts associated with decommissioning the Rubie/ Renee Facilities: Surface laid seabed infrastructures

1. Surface laid seabed infrastructures: • **RPM** • **COS** • **Four wellheads** • **Mattresses** • **Jumpers** ** Cumulative effect*	**Physical and Chemical**					**Biological**								**Societal**								
	Sediment structure / chemistry	Water quality	Air quality (local)	Land	Fresh-water	Sediment biology (benthos)	Water column (plankton)	Finfish and shellfish	Sea mammals	Seabirds	Integrity of conservation sites	Terrestrial Flora	Terrestrial Fauna	Commercial fishing	Shipping	Other commercial users of the sea	Recreational users of the sea	Communities	Other commercial users of the land	Stakeholder concerns	Overall Significance	Justification Section Reference
Planned Operations																						
Physical presence of vessels														✓	✓	✓	✓				A1*	Section 10
Routine discharges and emissions from vessels		✓	✓				✓	✓	✓												A1*	Section 7 Section 11
Underwater noise from Dynamic Positioning (DP) vessels								✓	✓												A1*	Section 8
Disconnect jumpers between seabed infrastructure	✓	✓				✓		✓													A1	Appendix B
Unlatch wellheads from casing and lift to surface	✓	✓				✓		✓													A1	Appendix B
Cut casing below level of seabed	✓	✓				✓	✓	✓	✓												A2	Section 9
RPM and COS removed	✓	✓				✓	✓	✓	✓												A2	Section 9
Removal of mattresses	✓	✓				✓	✓	✓	✓												A2	Section 9
Retrieval of mattresses to surface	✓	✓				✓	✓	✓													A1	Appendix B
Retrieval of jumpers to surface vessel	✓	✓				✓	✓	✓													A1	Appendix B
Transport retrieved material to shore			✓											✓	✓	✓	✓				A1*	Section 7

Transport retrieved material on land			✓															✓	✓		A1*	Section 7
Treatment or recycling of material			✓															✓	✓		A1*	Section 7
Planned End-Points																						
Re-use of jumpers																			✓		A0	Appendix B
Materials not re-used or recycled go to landfill				✓	✓													✓	✓		A1*	Section 7
Mattresses to landfill				✓	✓													✓	✓		A1*	Section 7
Recycling of RPM, COS and wellheads																			✓		A0	Appendix B
Small amounts of material recycled																			✓		A0	Appendix B
Unplanned Operations																						
Removing dropped objects	✓	✓												✓		✓					C1	Appendix B
Oil spill due to vessel collision		✓		✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		C3	Section 12
Discharges and emissions from additional vessels		✓	✓				✓	✓	✓												A1*	Section 7 Section 11

Table 6.7: Sources of potential environmental impacts associated with decommissioning the Rubie/ Renee Facilities: Leaving the buried pipelines and umbilicals *in situ*

2. Leaving the buried pipelines and umbilicals *in situ* ** Cumulative effect*	**Physical and Chemical**					**Biological**								**Societal**								
	Sediment structure / chemistry	Water quality	Air quality (local)	Land	Fresh-water	Sediment biology (benthos)	Water column (plankton)	Finfish and shellfish	Sea mammals	Seabirds	Integrity of conservation sites	Terrestrial Flora	Terrestrial Fauna	Commercial fishing	Shipping	Other commercial users of the sea	Recreational users of the sea	Communities	Other commercial users of the land	Stakeholder concerns	Overall Significance	Justification Section Reference
Planned Operations																						
Physical presence of vessels														✓	✓	✓	✓				A1*	Section 10
Routine discharges and emissions from vessel spread		✓	✓				✓	✓	✓												A1*	Section 7 Section 11
Underwater noise from DP vessels								✓	✓												A1*	Section 8
Subsea cutting of pipeline ends	✓	✓				✓		✓	✓												A1	Appendix B
Release of inhibited water when capping pipelines	✓	✓				✓	✓	✓													A1*	Section 11
Burial of ends by natural sediments/ rock dump	✓	✓				✓	✓	✓													A2	Section 9
Offshore transportation of ends to harbour			✓											✓	✓	✓	✓				A1*	Section 7
Onshore transportation of ends for recycling			✓															✓	✓		A1*	Section 7
Planned End-points																						
Corrosion of pipelines and release of metals and pipeline contents	✓	✓				✓	✓	✓													B1*	Section 11
Long term physical presence	✓					✓								✓		✓					A2	Section 10

Unplanned End-points																					
Pipeline does not remain covered/ fully buried	✓	✓				✓	✓	✓						✓		✓					C2*	Section 10
Unrecovered large debris or dropped objects remain on the seabed	✓	✓				✓	✓	✓						✓		✓					C1*	Section 10
Offshore post-project mitigation activities (rock placement/ cut and lift)	✓	✓				✓	✓	✓						✓	✓	✓					B1	Appendix B

Table 6.8: Sources of potential environmental impacts associated with decommissioning the Rubie/ Renee Facilities: Removing the surface laid flowlines

3. Removing the surface laid flowlines * *Cumulative effect*	Physical and Chemical					Biological						Societal									Stakeholder concerns	Overall Significance	Justification Section Reference
	Sediment structure / chemistry	Water quality	Air quality (local)	Land	Fresh-water	Sediment biology (benthos)	Water column (plankton)	Finfish and shellfish	Sea mammals	Seabirds	Integrity of conservation sites	Terrestrial Flora	Terrestrial Fauna	Commercial fishing	Shipping	Other commercial users of the sea	Recreational users of the sea	Communities	Other commercial users of the land			
Planned Operations																							
Physical presence of vessels															✓	✓	✓	✓			A1*	Section 10
Routine discharges and emissions from vessel spread		✓	✓				✓	✓	✓												A1*	Section 7 Section 11
Underwater noise from DP vessels								✓	✓												A1*	Section 8
Removal of mattresses	✓	✓				✓	✓	✓	✓												A2	Section 9
Extraction of umbilicals and flowlines from seabed	✓	✓				✓	✓	✓	✓												A2	Section 9
Offshore transport to harbour			✓											✓	✓	✓	✓				A1*	Section 7
Onshore transportation for recycling			✓															✓	✓		A1*	Section 7
Planned End-Points																						
Recycling of flowlines																			✓		A0*	Appendix B
Seabed recovers to natural state	✓					✓		✓													A0	Appendix B
Disposal of mattresses to landfill				✓	✓													✓	✓		A1*	Section 7

Unplanned Operations																					
Oil spill due to vessel collision		✓		✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	C3	Section 12
Spillage of chemicals		✓				✓	✓	✓						✓	✓	✓	✓			B1	Appendix B
Unplanned End-Points																					
Unrecovered large debris or dropped objects remain on the seabed	✓	✓												✓		✓				C1*	Section 10

7.0 ENERGY USE AND ATMOSPHERIC EMISSIONS

This section provides quantitative estimates of the energy use and the atmospheric emissions from the decommissioning operations and end points for the Rubie/ Renee Facilities. The section also assesses the potential for environmental impact and outlines mitigation measures to minimise emissions and optimise energy use.

7.1 Regulatory Requirements

Atmospheric emissions generated from the decommissioning of the Rubie/ Renee Facilities will be managed in accordance with current legislation and standards as detailed within Appendix A.

7.2 Approach

The energy and emissions assessment was based on the Institute of Petroleum (IoP) "Guidelines for the Calculation of Estimates of Energy Use and Gaseous Emissions in the Decommissioning of Offshore Structures" (IoP, 2000). The main steps of the assessment included:

- Establishment of a materials inventory for each structure to be decommissioned.
- Identification of all operations associated with decommissioning options.
- Identification of all end points associated with decommissioning each structure, where end points are defined as the final states of the materials at the cessation of the decommissioning operations, including the presence of material in landfill sites or on the seabed. For each operation and end point, identification of the associated activities that will be a source of energy use and atmospheric emissions.
- Selection of conversion factors and calculation of energy use and atmospheric emissions.

The assessment predominantly used the energy use and emission factors provided within IoP (2000) guidelines. In accordance with these guidelines, alternative factors may be used where specific equipment is considered to have a significantly different fuel use from that presented in the IoP database. Appendix C details the factors used for each aspect of the energy and emissions calculations: manufacture of new materials, recycling of materials, general fuel consumption and vessel fuel use.

7.3 Sources of Potential Impact

The following section reports the findings of the energy and emissions assessment which considered, where appropriate, the following sources for each stage of the decommissioning of the Rubie/ Renee Facilities:

- Vessels for transportation and offshore operations.
- Helicopters for transportation of personnel.
- Onshore dismantling and/ or processing of materials.
- Onshore transportation to processing, recycling and landfill sites.
- Manufacture of new items (e.g. rock-placement and temporary steel work) required for decommissioning operations.

- Recycling.
- New manufacture to replace recyclable materials left at sea or disposed of in landfill.

7.3.1 Materials and Operations Inventories

Inventories of materials and operations are provided within Section 3.

7.3.2 Vessel Use

Table 7.1 summarises the vessels expected to be associated with the decommissioning of the Rubie/ Renee Facilities.

Table 7.1: Summary of vessel use during the decommissioning of the Rubie/ Renee Facilities

Rubie/ Renee Facility	Recommended Decommissioning Option	Decommissioning Method	Vessel Use
Subsea Wellheads: • Rubie production (15/28b-7z) • Renee production (15/27-6y) • Renee appraisal (15/27-8) • Renee water injection (15/27-7)	Full removal		CSV DSV Guard vessel
Subsea infrastructure: • RPM • COS	Full removal		CSV Guard vessel
Pipelines: • PL1616 • PL1617 • PL1618 • PL1620 • PL1624 • PL1625	Leave *in situ*	No removal and burial of pipeline ends.	DSV Rock dump vessel Guard vessel Survey vessel Fishing trawler
Umbilicals: • PL1626.1 to PL1626.8 • PL1619.1 to PL1619.8	Leave *in situ*	No removal and burial of umbilical ends.	DSV Rock dump vessel Guard vessel Survey vessel Fishing trawler Jetting vessel/ trencher
Jumpers/spools	Full removal		CSV DSV Guard vessel
Mattresses	Full removal, with reuse of mattresses to protect *in situ* subsea infrastructure where necessary.		CSV DSV Guard vessel

7.3.3 Subsea Wellheads

Table 7.2 details estimated energy use for full removal of the four subsea wellheads. The operations are predicted to use 2,478 GJ of energy, all of this is attributed to vessel and helicopter use.

Table 7.2: Energy use and atmospheric emissions for decommissioning the four subsea wellheads

Decommissioning aspect	Energy (GJ)	Emissions (Tonnes)			
		CO_2	NOx	SO_2	CH_4
Vessel and helicopter use	2,478	184	3.4	0.2	0.02
Onshore transportation	0.00	0.00	0.00	0.00	No data
Recycling	0.00	0.00	0.00	0.00	No data
New manufacture to replace recyclable materials left in situ or taken to landfill	0.00	0.00	0.00	0.00	No data
Total	***2,478***	***184***	***3.4***	***0.2***	***0.02***

7.3.4 Subsea infrastructure

Table 7.3 details estimated energy use for full removal of the subsea structures (RPM and COS). The operations are predicted to use approximately 6,886 GJ of energy, all of this is attributed to vessel and helicopter use.

Table 7.3: Energy use and atmospheric emissions for decommissioning the subsea infrastructure

Decommissioning aspect	Energy (GJ)	Emissions (Tonnes)			
		CO_2	NO_x	SO_2	CH_4
Vessel and helicopter use	6,886	511	9.3	0.6	0.04
Onshore transportation	0.00	0.00	0.00	0.00	No data
Recycling	0.00	0.00	0.00	0.00	No data
New manufacture to replace recyclable materials left *in situ* or taken to landfill	0.00	0.00	0.00	0.00	No data
Total	***6,886***	***511***	***9.3***	***0.6***	***0.04***

7.3.5 Pipelines *in situ*

Table 7.4 shows the estimated energy use and atmospheric emissions during the recommended option of leaving the trenched and buried pipelines and umbilicals *in situ*, and the burial of exposed sections and line ends by rock-placement. The removal of debris from along the pipeline and umbilical routes is not included within the calculated energy use and atmospheric emissions. The operations are predicted to use approximately 297,708 GJ of energy. Approximately 92% of this is attributed to the new manufacture of materials to replace recyclable material left *in situ*.

Table 7.4: Energy use and atmospheric emissions for the *in situ* pipelines and umbilicals

Decommissioning aspect	Energy (GJ)	Emissions (Tonnes)			
		CO_2	NO_x	SO_2	CH_4
Vessel and helicopter use	22,783	1,690	31	2.1	0.14
Onshore transportation	0.00	0.00	0.00	0.00	No data
Recycling	0.00	0.00	0.00	0.00	No data
New manufacture to replace recyclable materials left *in situ* or taken to landfill	274,925	19,587	19	33.5	No data
Total	***297,708***	***21,278***	***50***	***35.6***	***0.14***

7.3.6 Pipelines, Umbilicals and Jumper/ Spools Removal

Estimated energy use and atmospheric emissions during full removal of the jumpers/ spools and pipeline/ umbilical sections by cut and lift are detailed within Table 7.5. The operations are predicted to use 29,422 GJ of energy. Approximately 95% of this is attributed to vessel and helicopter use.

Table 7.5: Energy use and atmospheric emissions for decommissioning the pipelines, umbilicals and jumper/ spools

Decommissioning aspect	Energy (GJ)	Emissions (Tonnes)			
		CO_2	NO_x	SO_2	CH_4
Vessel and helicopter use	28,034	2,080	37.97	2.6	0.17
Onshore transportation	47	3	0.04	0.00	No data
Recycling	1,341	133	0.21	0.52	No data
New manufacture to replace recyclable materials left *in situ* or taken to landfill	0.00	0.00	0.00	0.00	No data
Total	***29,422***	***2,216***	***38.22***	***3.12***	***0.17***

7.3.7 Mattresses

Estimated energy use and atmospheric emissions during full removal of the 200 to 250 concrete mattresses protecting the pipelines, umbilicals, jumpers and spools are detailed within Table 7.6. The operations are predicted to use 5,963 GJ of energy. Approximately 73% of this is attributed to vessel and helicopter use.

Table 7.6: Energy use and atmospheric emissions for decommissioning the mattresses

Decommissioning aspect	Energy (GJ)	Emissions (Tonnes)			
		CO_2	NO_x	SO_2	CH_4
Vessel and helicopter use	4,333	321	5.85	0.4	0.03
Onshore transportation	392	28	0.36	0.01	No data
Recycling	0.00	0.00	0.00	0.00	No data
New manufacture to replace recyclable materials left *in situ* or taken to landfill	1,238	1,089	6.68	0.12	No data
Total	***5,963***	***1,438***	***12.89***	***0.53***	***0.03***

7.4 Impacts on Sensitive Receptors

Gaseous emissions from the proposed decommissioning activities include CO_2, CH_4, NO_x, SO_x and Volatile Organic Compounds (VOCs) and these have the potential to impact sensitive receptors in the area. The direct effect of the emission of CO_2, CH_4 and VOCs is the implication for climate change (CH_4 has 21 times the global climate change potential of the main greenhouse gas CO_2 (IPCC, 2007)) and contribution to regional level air quality deterioration through low-level ozone production. The indirect effects of low level ozone include deleterious health effects, as well as damage to vegetation, crops and ecosystems.

The direct effect of NO_x, SO_x and VOC emissions is the formation of photochemical pollution in the presence of sunlight. Low level ozone is the main chemical pollutant formed, with by-products that include nitric and sulphuric acid and nitrate particulates.

The effects of acid formation include contribution to acid rain formation and dry deposition of particulates.

The main environmental effect resulting from the emission of SO_2 is the potential to contribute to the occurrence of acid rain; however the fate of SO_2 is difficult to predict due to its dependence on weather.

The exposed offshore conditions will promote the rapid dispersion and dilution of these emissions. Outside the immediate vicinity of the Rubie/ Renee decommissioning activities, all released gases would only be present in low concentrations. The Rubie/ Renee Facilities are located approximately 115 km east of the nearest UK coastline. There are no proposed or designated conservation sites located in close proximity that would be impacted by these atmospheric emissions.

Harbour porpoise is the only Annex II species recorded with frequent sightings in the vicinity of the Rubie/ Renee Facilities. In the open conditions that prevail offshore, the atmospheric emissions generated during the decommissioning activities would be readily dispersed. The atmospheric emissions from the proposed activities are therefore considered unlikely to have any effect on marine mammals.

In summary, the atmospheric emissions from the Rubie/ Renee decommissioning activities are therefore unlikely to have any effect on sensitive receptors.

7.5 Cumulative and Transboundary Impacts

The Rubie/ Renee Facilities are located approximately 60 km west of the UK/ Norwegian median line. Under the offshore conditions, the quantity of additional air emissions produced is unlikely to create any measurable transboundary impacts.

The potential cumulative effects associated with atmospheric emissions produced by the decommissioning activities include a contribution to climate change by emission of greenhouse gases, acidification (acid rain) and local air pollution. The total emissions from the proposed decommissioning operations (25,627 tonnes CO_2) represent 0.16% of the total annual CO_2 offshore emissions from the UKCS (16,393,119 tonnes CO_2; OGUK, 2012).

7.6 Proposed Mitigation Measures

Mitigation measures to minimise atmospheric emissions and energy consumption are detailed within Table 7.7.

Table 7.7: Mitigation Measures

Planned mitigation measures
Vessels will be audited as part of selection and pre-mobilisation.
All generators and engines will be maintained and operated to the manufacturers' standards to ensure maximum efficiency.
Vessels will use ultra-low sulphur fuel in line with MARPOL requirements.
Work programmes will be planned to optimise vessel time in the field.
Fuel consumption will be minimised by operational practices and power management systems for engines, generators and other combustion plant and maintenance systems.
All mitigation measures will be incorporated into contractual documents of subcontractors.

7.7 Conclusions

The following conclusions can be derived:

- The total energy usage resulting from decommissioning the Rubie/ Renee Facilities is estimated to be 342,457 GJ of which 81% can be attributed to the manufacture of new materials to replace those made unavailable to society by decommissioning the pipelines *in situ* in the seabed and the disposal of concrete mattresses to landfill. Standard mitigation measures have been identified to minimise energy usage by project vessels.
- Emissions from the decommissioning activities will have a localised effect on air quality. The impact on air quality is unlikely to affect any receptors in the Rubie/ Renee area as the impact is expected to be limited to the immediate vicinity of the operations. For this reason, there is unlikely to be a significant transboundary or cumulative impact on air quality.
- Emissions from the decommissioning activities will contribute to greenhouse gas emissions and have a non-significant cumulative and transboundary impact. Emissions will be kept to a practicable minimum. Total CO_2 emissions generated from the proposed decommissioning operations will represent a very small proportion (0.16%) of the of the total annual CO_2 offshore emissions from the UKCS.

8.0 UNDERWATER NOISE

This section discusses underwater noise generated as a result of the decommissioning operations for the Rubie/ Renee Facilities. The section also assesses the potential for environmental impact and outlines mitigation measures to minimise underwater noise.

Sound is important for many marine organisms with marine mammals, fish and certain species of invertebrates having developed a range of complex mechanisms for both the emission and detection of sound (Richardson *et al.*, 1995). Cetaceans (whales, dolphins and porpoises) use sound for navigation, communication and prey detection. Thus anthropogenic underwater noise has the potential to impact on marine mammals (Southall *et al.,* 2007; Richardson *et al.,* 1995). Underwater noise may cause animals to become displaced from activities potentially interrupting feeding, mating, socialising, resting or migration. This may impact body condition and reproductive success of individuals or populations (Southall *et al.,* 2007; Richardson *et al.,* 1995). Feeding may also be affected indirectly if noise disturbs prey species (Southall *et al.,* 2007; Richardson *et al.,* 1995).

Human activities at sea such as shipping, geophysical surveys, blasting and drilling generate underwater noise. The characteristics of the noise produced vary with the type of activity. In general, sound can be characterised with reference to two features, the frequency at which it is emitted (measured in hertz; Hz) and the strength or intensity of the sound (measured in decibels; dB). Sound levels in the marine environment diminish with distance from a source by dispersion in three dimensions and absorption by the water (Richardson *et al.*, 1995). Sound can be categorised as continuous noise where there are no sudden rises or falls in pressure or impulsive noise.

8.1 Regulatory Requirements

Underwater noise generated from the decommissioning of the Rubie/ Renee Facilities will be managed in accordance with current legislation and standards as detailed within Appendix A.

8.2 Approach

The underwater noise likely to be generated during the proposed Rubie/ Renee Facilities decommissioning operations has been assessed.

8.3 Sources of Potential Impact

The predominant sources of sound include various types of vessels, including DSVs, and underwater tools (e.g. cutting tools).

8.3.1 Vessels

It is likely that most forms of oil and gas decommissioning activities are typically dominated by vessel noise which is continuous. Broadband source levels for these activities rarely exceed about 190 dB re 1 μPa m, even for a vessel using dynamic positioning (DP) and are typically much lower (Hannay & MacGillivray, 2005; Genesis, 2011). Whilst continuous noise can mask biologically relevant signals such as echolocation clicks, the sound levels are below the threshold levels for Temporary

Threshold Shift (TTS) in cetaceans according to the Southall *et al.* (2007) criteria (Genesis, 2011).

The level and frequency of sound produced by vessels is related to vessel size and speed, with larger vessels typically producing lower frequency sounds (Richardson *et al.*, 1995). Noise levels depend on the operating status of the vessel and the number of vessels present on site and can therefore vary considerably with time. In general, vessels produce noise over the range 100 Hz to 10 kHz, with strongest energy over the range 200 Hz to 2 kHz.

The subsea noise levels generated by surface vessels used during the decommissioning phase are unlikely to result in physiological damage to marine mammals. Depending on ambient noise levels, sensitive marine mammals may be locally disturbed by noise from a vessel in its immediate vicinity; however, the impact is not expected to be significant.

8.3.2 Underwater tool use including cutting and drilling

The main underwater tool use during the Rubie/ Renee Field decommissioning will be for cutting using diamond wire cutting equipment. There is currently little published data on the sound generated by underwater cutting or other tools. Peak source levels of 148 to 180 dB re 1 µPa are reported for a range of diver operated tools including cutters with most energy in the frequency range 200 to 1,000 Hz (Anthony *et al*., 2009). Since tool use episodes tend to be intermittent and of short duration it will not be considered further.

8.3.3 Ambient noise

Ambient or background noise in the ocean results from sounds generated by physical factors such as wind and waves; by marine mammal vocalisations; and by other shipping.

8.4 Impact on Sensitive Receptors

Underwater noise can affect the behaviour of or may cause injury to several different marine taxa, in particular fish and marine mammals such as pinnipeds (seals, sea lions, and walruses) and cetaceans (whales, dolphins and porpoises). Underwater noise impact assessments primarily focus on cetaceans as these organisms are EPS (JNCC, 2010).

8.4.1 Fish

Many species of fish use sound for location of prey, avoidance of predators and for social interactions. The inner ear of fish including elasmobranchs (sharks, skates and rays) is very similar to that of terrestrial vertebrates, and hearing is understood to be present among virtually all fish (NRC, 2003). The sensory systems used by fish to detect sounds are very similar to those of marine (and terrestrial) mammals and hence sounds that damage or in other ways affect marine mammals could have similar consequences for fish (Popper, 2003).

A comprehensive review by Popper & Hastings (2009) on the effects of anthropogenic sound on fishes concluded that there are substantial gaps in the knowledge that need to be filled before meaningful noise exposure criteria can be developed.

8.4.2 Pinnipeds

Pinnipeds can produce a diversity of sounds. Their sounds are used primarily in critical social and reproductive interactions (Southall *et al*., 2007). Available data suggest that most pinniped species have peak sensitivities between 1 and 20 kHz (NRC, 2003).

The Rubie/ Renee Field is approximately 115 km east of the nearest UK coastline so it is unlikely that grey and common seals would be found regularly in the vicinity of the proposed development.

8.4.3 Cetaceans

Harbour porpoise, white-beaked dolphin, white-sided dolphin, killer whale and minke whale have been recorded as present in the area and are considered in this underwater noise assessment (Section 4.3).

Characterisation of hearing sensitivities

There are major differences in the hearing capabilities of different marine mammal species and, consequently, vulnerability to impact from underwater noise differs between species. Southall *et al.* (2007) classified the "hearing types" of different marine mammal species (Table 8.1).

Table 8.1: Functional cetacean hearing groups

Cetacean functional hearing group	Estimated auditory bandwidth	Species sighted in the Rubie/ Renee Field area
Low-frequency	7 Hz – 22 kHz	Minke whale
Mid-frequency	150 Hz – 160 kHz	White-beaked dolphin White-sided dolphin Killer whale
High-frequency	200 Hz – 180 kHz	Harbour porpoise

Sources: Southall *et al.* (2007); UKDMAP, (1998)

Thresholds for injury and disturbance to marine mammals

The noise level perceived by an animal (the "received noise level") depends on the level and frequency of the sound when it reaches the animal and the hearing sensitivity of the animal. In the immediate vicinity of a high sound level source, noise can have a severe effect causing a Permanent Threshold Shift (PTS) in hearing; leading to hearing loss and ultimately, with increasing exposure, to physical injuries which are occasionally fatal. However, at greater distance from a source the noise decreases and the potential effects are diminished (Nedwell & Edwards, 2004); possibly causing the onset of only a temporary shift in hearing thresholds (TTS-onset). Hearing sensitivity, in terms of the range of frequencies and sound levels that can be perceived, varies with species and the minimum level of sound that a species is able to detect (the "hearing threshold") varies with frequency (Nedwell *et al*., 2007; Southall *et al*., 2007).

Zones of injury or disturbance

The proposed precautionary threshold for zero-to-peak Sound Pressure Levels (SPL) that are likely to lead to injury (PTS) in each of the three functional hearing groups of

cetaceans is 230 dB re 1 µPa (Southall *et al*., 2007). However; there is no consensus about the threshold for disturbance to marine mammals for different noise types in the literature.

Comparison of these sound thresholds with the potential sound levels expected to be generated by the decommissioning operations suggests that no cetaceans will be injured. It is likely that marine mammals will exhibit some severe avoidance behaviour within about 100 m of the centre of operations (BMT Cordah, 2013).

8.5 Cumulative and Transboundary Impacts

The Rubie/ Renee Facilities are located approximately 60 km from the UK/ Norwegian median line. At this distance, noise levels associated with the decommissioning activities would attenuate to a level lower than that likely to cause injury or disturbance to any cetacean species and hence there are unlikely to be any transboundary impacts.

8.6 Proposed Mitigation Measures

It is worth noting that JNCC (2010) do not consider noise from vessel activity to pose a risk of injury to marine mammals (JNCC, 2010). The noise impact assessment undertaken supports this view, showing that there is unlikely to be any significant impact. It is therefore considered unlikely that further mitigation measures will be required outside of those identified below:

- Machinery and equipment will be in good working order and well-maintained.
- The number of vessels utilising DP at any one time will be minimised and restricted to supply and anchor handling vessels.
- Work programmes will be planned to optimise vessel time in the field.
- Diamond wire cutting equipment will be used to make the subsea cuts rather than explosives.
- During decommissioning operations, regular observations for marine mammals in the area will be made and the cetacean observation logs made available to JNCC.

8.7 Conclusions

Records indicate previous sightings of five cetacean species within the study area during the period when decommissioning activities are scheduled to take place. These species are all subject to regulatory protection from injury and disturbance.

Broadband source levels for the proposed activities rarely exceed about 190 dB re 1 µPa m and are typically much lower. This does not exceed the thresholds for injury to cetaceans (Southall *et al.*, 2007).

Depending on ambient noise levels, sensitive marine mammals may be locally disturbed by noise from a vessel in its immediate vicinity. Although there is a degree of uncertainty associated with the noise levels generated by each vessel and activity, it follows that the sound levels for each decommissioning method are proportional to the number of vessels on site at any one time. Overall any potential impact to marine mammals is not significant for any of the decommissioning methods and will only result in minimal disturbance.

9.0 SEABED FOOTPRINT

This section discusses potential short and long-term environmental impacts associated with seabed disturbance during the decommissioning of the Rubie/ Renee Facilities. The measures taken or planned by Endeavour to minimise these impacts are detailed in Section 9.4.

9.1 Regulatory Requirements

Disturbance to the seabed generated from the decommissioning of the Rubie/ Renee Facilities will be managed in accordance with current legislation and standards as detailed within Appendix A.

9.2 Approach

Decommissioning of the Rubie/ Renee Facilities including the wells, subsea infrastructure, pipelines, umbilicals, jumpers/ spools and mattresses will require work at, or near, the seabed which may result in short-term disturbance to background seabed sediments (Table 9.1).

Table 9.1: Summary of potential sources of seabed disturbance and resulting in environmental impacts from each decommissioning activity or outcome

Decommissioning activity/outcome	Environmental Impact				
	Water column		Seabed sediments		
	Release of contaminants	Suspended matter	Release of contaminants	Burial and smothering	Change in habitat
Removal of wellheads	-	Short-term	-	Short-term	-
Removal of subsea infrastructures	-	Short-term	-	Short-term	-
Removal of surface umbilicals, jumpers and spools	Short-term	Short-term	Short-term	Short-term	-
Removal of concrete mattresses	-	Short-term	-	Short-term	-
Rock placement over pipelines, pipeline and umbilical ends	-	Short-term	-	Long-term	Long-term
Presence of the *in situ* pipelines and umbilicals.	-	-	Long-term	-	-

Short-term environmental impacts associated with seabed disturbance during the decommissioning of the Rubie/ Renee Facilities include:

- Removal of each subsea wellhead and guide base during well P&A.
- Removal of the subsea infrastructure (RPM and COS).
- Removal of umbilicals (PL1626) and jumpers/ spools.
- Removal of the protective concrete mattresses.

In addition, decommissioning the six pipelines and two umbilicals *in situ* may lead to some long-term impacts arising from the physical presence of rock covering exposed areas of the *in situ* pipelines and the pipeline and umbilical ends.

The magnitude of impacts arising from these activities and outcomes are described in the following sections.

9.3 Sources of Potential Impact

Decommissioning the Rubie/ Renee Facilities will require work at, or near, the seabed that may result in disturbance to the seabed sediments and water column. Structures and materials to be removed and the approximate seabed area of disturbance are presented in Table 9.2.

Table 9.2: Structures to be removed or deposited and seabed impact

Structure	Dimensions	Quantity	Seabed impact (km²)
Subsea wells			
Wellhead protective structure	2 m x 2 m	4	0.000016
Subsea infrastructure			
RPM	15 m x 6 m	1	0.00009
XOS	4 m x 4.6 m	1	0.00002
Total			*0.00011*
Surface laid umbilicals, jumpers and spools (including wet stored)			
Umbilical PL1623.1	$^{3}/_{8}$" x 40 m	1	0.0004
Umbilical PL1623.2	$^{3}/_{8}$" x 40 m	1	0.0004
PL 1621	6" x 40 m	1	0.0061
PL 1622	2" x 40 m	1	0.0020
spools PL1616	$6^{5}/_{8}$" x 20 m	2	0.0088
spools PL1617	$6^{5}/_{8}$" x 20 m	2	0.0088
spools PL1618	$6^{5}/_{8}$" x 20 m	2	0.0088
spool PL1620	$6^{5}/_{8}$" x 60 m	1	0.0131
spool PL1624	$6^{5}/_{8}$" x 20 m	1	0.0044
spool PL1625	$6^{5}/_{8}$" x 20 m	1	0.0044
PL1616	8" x 160 m	1	0.0039
PL1617	8" x 160 m	1	0.0039
PL1618	8" x 160 m	1	0.0039
PL1620	4" x 160 m	1	0.0038
Total			*0.0725*
Mattresses			
Concrete mattresses	6 m x 3 m	250	0.0045
Rock-placement *(deposited on the seabed)*			
Graded rock	1.983 km x 0.005 km	16,900 tonnes	0.012

9.3.1 Subsea wellheads

Well decommissioning activities for the Rubie production well, the Renee production wells and the Renee water injection well include (Section 3):

- The P&A and removal of wellheads from the Rubie well and two Renee wells;
- Removal of the guide base and protection structure for each of the four wells.

Removal of the four subsea wellheads will impact a seabed area of approximately 16 m^2 (4 m x 4 m). Direct impact from handling of heavy inventory such as subsea wellheads, will be performed in a controlled manner which is expected to be localised in immediate vicinity to the equipment itself.

9.3.2 Subsea infrastructure

The recommended option for decommissioning the RPM and COS is full removal through cutting techniques as outlined in Section 3 with subsequent lifting operations.

Removal of the RPM and COS will impact a seabed area of approximately 114 m^2 (96 m^2 and 18 m^2). These structures will be lifted onto a CSV and the operations are expected to take approximately 0.5 days.

9.3.3 Pipelines, umbilicals and jumper/ spools removal

The pipelines, umbilicals, jumpers and spools at the Rubie/ Renee Facilities have been flushed disconnected from the COS, RPM and the associated wellheads, and left in place (Section 3).

The six pipelines and associated two umbilicals will be left *in situ* (Section 3), while the remaining two umbilicals (PL1623.1 and 1623.2) and jumpers and spools will be fully removed from the seabed through cutting techniques as outlined in Section 3 with subsequent lifting operations.

Removal of umbilicals, the jumpers and spools will impact a seabed area of approximately 0.073 km^2. The total duration for these removal operations is expected to be 9 days.

9.3.4 Mattresses

The recommended option for decommissioning the 200 to 250 concrete mattresses is removal. The mattresses cover an area of approximately 45 m^2 and will be moved aside and gathered together on the seabed. They will then be removed from the seabed by lifting them onto a CSV (Section 3). The removal of the mattresses from the seabed is expected to take approximately five days.

9.3.5 Rock-placement

The recommended option for leaving the six pipelines and associated two umbilicals *in situ* (Section 9.3.3) is to place graded rock over the pipeline and umbilical ends and areas of exposed pipeline. Approximately 16,900 tonnes of rock will be required to provide sufficient cover for the pipelines and umbilicals, resulting in a footprint of approximately 0.012 km^2.

9.4 Impact on Sensitive Receptors

The types of impact arising from the Rubie/ Renee Facilities decommissioning activities and outcomes can be summarised as:

- Sediment disturbance.
- Habitat change.
- Long-term presence of the *in situ* pipelines and umbilicals.

These impacts are assessed in the following sections to determine the potential scale of the impacts to fauna and to local sediment quality.

Table 9.1 presents a summary of the potential sources of seabed bed disturbance and the resulting environmental impacts.

9.4.1 Sediment disturbance

As detailed in Section 9.3, several decommissioning activities could cause disturbance to seabed sediments.

The pre-decommissioning environmental survey around the Renee and Rubie well locations suggests that contamination of the seabed has been limited, or that the benthic community at the inner stations have recovered from an initially more highly disturbed state (Fugro ERT, 2011).

The macrofaunal community of the Rubie/ Renee Facilities area is typical of the wider CNS, and survey results for the area indicate that the benthic community at the inner stations surrounding the well locations have recovered from an initially more highly disturbed state (Fugro ERT, 2011).

Sediments that are re-suspended as a result of the decommissioning activities will drift with seabed currents before settling out over adjacent areas of seabed. The lateral spread of the re-suspended sediments is expected to be limited due to the low subsea currents in the Rubie/ Renee Facilities area (Section 4.2) and at worst this could have a minor impact on the local community. In extreme cases, re-suspended sediments might smother surrounding benthic communities, but otherwise this impact area will be limited to the immediate vicinity of the disturbance. Such impact can be comparable to the natural burial of fauna from sediment movement due to subsea currents.

Following completion of the well activities, the natural physical processes of sediment transportation and biological settlement are expected to restore the seabed habitat to its original condition. Upon cessation of the subsea decommissioning activities, it is expected that the resettled sediment will be quickly recolonised by benthic fauna typical of 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).

Removal of the structures on the seabed and the placement of rock will physically disturb the benthic fauna living on or in the sediment in the localised area. Additionally, a small number of demersal and pelagic fish might be temporarily disturbed by the removal of the structures. However, fish are highly mobile organisms and are likely to avoid areas of re-suspended sediments and turbulence during the activities.

The potential release of contaminants from the sediments may affect the early life stages of some fish species, but this will be localised and is not likely to have an impact on these species' populations or their long-term survival.

9.4.2 Habitat change

Habitat change will result from the introduction of hard substrate into a predominantly soft substrate environment. Leaving the six pipelines and two umbilicals *in situ* and

covering the pipeline and umbilical ends and exposed areas with graded rock would result in a modification of the substrate and habitat type in the local area.

Placement of the approximately 16,900 tonnes of graded rock will have a minor impact on the structure of the seabed in these areas. The impact will be limited to approximately 0.012 km².

Sediment analysis of the Rubie/ Renee area indicated little variation in the sediment type which were classified as moderate to poorly sorted, medium silts (Section 4; Fugro ERT, 2011). The proposed rock-placement will result in a local impact (0.012 km^2) that is not likely to constitute a significant impact. Additionally, the existing rock-placement along the pipelines will remain *in situ* as part of the decommissioning. As organisms associated with hard substrates will be naturally present in the area, areas of rock-placement will create a relatively small additional rocky habitat along the pipeline route for epibenthic organisms. Such organisms typically include tubeworms, barnacles, anemones, hydroids, tunicates and bryozoans, which are commonly found on submerged rocky outcrops, boulders and offshore structures rather than on sediment.

The seabed feature that will result from the rock-placement may provide habitats for crevice-dwelling fish (e.g. ling, conger eel and wolf fish) and crustaceans (e.g. squat lobsters and crabs) and may attract fish species to the site (Lissner *et al*., 1991).

9.4.3 Long-term presence of the *in situ* pipelines and umbilical

The long-term consequences of leaving the pipelines and umbilicals *in situ* are expected to result from the slow corrosion of the pipelines and umbilicals over time, leading eventually to pipeline collapse, leaving a trace of corroded metal buried under the sediments and rock-placement mass.

Structural degradation of the pipeline and umbilicals will be a long-term process caused by corrosion of their outer layer and internal components and the eventual collapse of the pipelines and umbilicals under their own weight and that of the overlying rock dump. Through-wall corrosion of the pipelines and umbilicals, it is anticipated that failure would only begin to occur after many decades (i.e. >60 years; HSE, 1997).

The pipelines and umbilicals were flushed and cleaned, and filled with inhibited seawater or potable water prior to being left *in situ*. The inhibited seawater or potable water will be released into the sea causing a short-term impact to the water and sediment quality. Additionally, the copper and aluminium-zinc-indium alloy from the umbilcal and pipeline sacrificial anodes, originally intended to prevent corrosion, will slowly dissipate into the sea. The expected slow release of these metals and the inhibited seawater is expected to have a negligible impact on the local environment, as the erosion of the rock dump covered pipeline is expected to be slow and a relatively small amount of material would be redistributed over the surrounding sediment.

Corrosion in seawater of the structural steel components of the pipelines and umbilcals will form ferric hydroxide (rust) which is relatively insoluble and environmentally benign. Natural erosion of the rock dump is likely to be caused by current movements.

9.5 Cumulative and Transboundary Impacts

Following completion of the Rubie/ Renee Facilities Decommissioning Programme the only inventory and facilities that will be left post decommissioning are the six pipelines and two associated umbilicals (Section 3). The pipelines and umbilicals are trenched and buried, with exposed areas and ends buried under rock. The residual impacts associated with the Rubie/ Renee Facilities decommissioning operations are from the long-term presence of the buried pipelines.

Rock-placement over the exposed areas of the pipelines and the pipeline and umbilical ends would alter the character of a very small proportion of the seabed. It is estimated that the total footprint area following the placement of rock over these pipelines will be approximately 0.012 km^2. The placement of rock over the small areas of the pipelines, and pipeline and umbilical ends will introduce a hard, rock habitat.

The Rubie/ Renee is located 60 km west of the UK/ Norwegian median line. Decommissioning activities are not anticipated to create any transboundary impacts.

9.6 Proposed Mitigation Measures

Mitigation measures to minimise atmospheric emissions and energy consumption are detailed within Table 9.3.

Table 9.3: Mitigation Measures

Potential sources of impact	Planned mitigation measures
Subsea equipment cutting and lifting	Cutting and lifting operations of subsea equipment will be controlled by ROV to ensure accurate placement of cutting and lifting equipment and minimise any impact on seabed sediment.
Rock-placement	A rock-placement vessel or ROVSV will be used. The rock mass will be carefully placed over the designated areas of the pipelines by the use of an ROV controlled fall pipe equipped with cameras, profilers, pipe tracker and other sensors as required. This will control the profile of the rock covering and accurate placement of rock over the pipeline to ensure rock is only placed within the planned footprint with minimal spread over adjacent sediment, minimising seabed disturbance. The profile of the rock-placement will allow fishing nets to trawl over the rock unobstructed. Suitably graded rock will be used to minimise the risk of snagging fishing gear.

9.7 Conclusions

Rock-placement activities associated with the *in situ* pipelines and umbilicals will impact the sediment through long-term, localised modification of the seabed over an estimated area of 0.012 km^2 and a transient physical disturbance caused by suspension of material into the water column. This impact will be mitigated by controlled rock-placement to minimise seabed footprint. The profile of the rock-placement will allow fishing nets to trawl over the rock unobstructed.

10.0 SOCIETAL IMPACTS

This section assesses the potential societal impacts associated with the physical presence of subsea structures in the Rubie and Renee Fields and the vessels required for their removal.

10.1 Regulatory Requirements

Disturbance to the seabed generated from the decommissioning of the Rubie/ Renee Facilities will be managed in accordance with current legislation and standards as detailed within Appendix A.

10.2 Approach

The following concerns have been raised during the consultation with Stakeholders (Section 5) and the Risk Assessment processes (Section 6):

- Physical presence of decommissioning vessels causing potential interference to other users of the sea.
- Damage to or loss of gear as a result of subsea obstructions left *in situ*, posing potential snagging risks.

The magnitude of impacts arising from these activities and outcomes are described in the following sections.

10.3 Sources of Potential Impact

For structural removal and rock-placement operations, it is expected that maximum of six vessels could be present in the area at any one time. The vessel spread may be composed of DSV; CSVs; rock-placement vessels; guard vessels; reel vessels; trenching vessels; fishing trawlers and survey vessels. The maximum time that vessels are expected to be on site is 49 days.

Based on Section 4, other users of the sea in the vicinity of the Rubie and Renee Fields have been identified as those involved in or responsible for:

- commercial fisheries;
- shipping;
- submarine cables; and
- oil and gas activities.

Of these, the focus is placed on commercial shipping and fishing vessels, owing to their proximity to the development location.

As outlined in Section 3, pipelines PL1616; PL1617, PL1618, PL1620, PL1624 and PL1625 and umbilicals PL1619 and PL1626 will be left *in situ,* trenched and buried. The placement of rock will be used to protect the pipelines and umbilicals where they are exposed or vulnerable. The long-term presence of the rock could create a snagging hazard for fishing trawlers.

10.4 Impact on Sensitive Receptors

The receptors impacted by decommissioning the Rubie/ Renee Facilities may include:

- commercial shipping; and
- commercial fishing.

The long term physical presence of the pipelines, umbilicals and rock increases the potential for interaction with fishing gear, leading potentially to a loss of catch/ revenue for fishermen. There may also be the potential to disrupt previously established shipping operations in the area, whilst vessels carry out removal and rock-placement operations. These receptors are assessed in the following sections to determine the potential scale of the impacts.

10.4.1 Commercial shipping

Commercial shipping traffic density in UKCS Blocks 15/21, 15/26, 15/27 and 15/28, is low-medium (DECC, 2009c). The majority of shipping volume comprises offshore industry shipping activity and cargo voyages. Operations are expected to take a maximum of 49 days and therefore the effects on the commercial shipping industry will be limited and transient.

10.4.2 Commercial fishing

With respect to commercial fishing further potential impacts include the loss of access to fishing grounds during decommissioning activities and the impedance to fishing gears by subsea structures. However, once the subsea infrastructure that is to be removed is off the seabed the risk to fishing activities will be reduced.

Demersal fish constitute a significant proportion of species caught in the Rubie/ Renee area (35%, 29% and 40% in 2009, 2010 and 2011, respectively; Marine Scotland, 2013b). Fishing for demersal fish involves towing the nets directly over the seabed to target mainly finfish species such as haddock and cod which are found near the seabed. Seabed-focussed otter trawls (where large rectangular otter boards keep the mouth of the trawl net open) is the main method of fishing in ICES rectangle 48F1 (Marine Scotland, 2013b). This method of fishing has the potential to interact with subsea pipelines left *in situ* and rock-placement. The weight and width of fishing gear and the nature of the benthic substrate to a large extent determines the degree of impact.

When trawling over sections of a pipeline with rock-placement, graded rock could be dragged off by bottom-towed fishing gear and spread over the seabed. In addition, the rock may cause wear and tear on the net, damage fish when caught and damage or crush the fish when unloaded.

Over-trawling studies conducted by the Norwegian Institute of Marine Research to assess the risk of pipelines with rock-placement to bottom trawling fishing gears concluded that the lighter types of fishing gear with a weighted ground line were not suitable for crossing pipelines with rock-placement (Soldal, 1997). However, fishermen trawling trial areas with heavy net trawl gear towed their gear without reported difficulty (Soldal, 1997).

With respect to Rubie/ Renee decommissioning, the pipelines will be buried with a minimum cover of 0.6 m above the top of the lines. Rock-placement used to cover

vulnerable areas of pipeline/ umbilical, will be shaped to render it over-trawlable. The profile of the rock-placement will be designed to withstand several trawler strikes at the same location before the rock protection would be compromised. Endeavour will perform remedial works on any compromised sections should this ever occur.

Eventually, the pipelines and umbilicals will collapse in their trenches and the rock and backfill would settle to fill the small void. Throughout this period of disintegration, and after collapse, the whole length of the pipelines and umbilicals will remain trenched, covered with backfill and rock and be over-trawlable.

10.5 Cumulative and Transboundary Impacts

The pipelines, umbilicals and associated rock-placement are all localised and within UK waters, so there will be no cumulative or transboundary impacts.

10.6 Proposed Mitigation Measures

The planned mitigation measures that will be undertaken to minimise the impact of the long-term presence of rock, pipelines and umbilicals arising from the decommissioning of the Rubie/ Renee Faciltities are given in Table 10.1.

Table 10.1: Mitigation Measures

Potential source of impact	Planned mitigation measures
Physical presence of decommissioning vessels causing potential interference to other users of the sea	• Prior to commencement of operations, the appropriate notifications will be made and maritime notices posted. • All vessel activities will be in accordance with national and international regulations. • Appropriate navigation aids will be used to ensure other users of the sea are made aware of the presence of vessels.
Damage to or loss of gear as a result of subsea obstructions left *in situ*, posing potential snagging risks	• The use of a fall pipe on the rock-placement vessel and the use of ROV supervision during rock-placement operations would ensure that the rock was placed in the correct position. • A fisheries liaison officer will be present during rock-placement operations • On-going consultation with fisheries representatives such as the Scottish Fishermen's Federation (SFF) • The placement of rock will be designed to be over-trawlable • Subsea rock-placement will be included on navigational charts • Post-decommissioning seabed clearance and an over-trawlability survey to ensure that the rock-placement gradient is within acceptable limits
Long term environmental impacts of the physical presence of the pipelines, umbilicals and rock on the seabed.	• Post-decommissioning monitoring of routes of the buried pipelines to ensure that the lines remain adequately buried and protected, as agreed with DECC and other stakeholders. • Remedial intervention in the event that burial and protection is found to be inadequate. These mitigation measures recognise Endeavour's indefinite liability for the pipeline materials left *in situ*.

10.7 Conclusions

The transient loss of access to the area during decommissioning operations is unlikely to have a significant impact on other users of the sea (i.e. commercial shipping and fishing)

as traffic levels in the area of the Rubie and Renee Fields are currently low-medium and the impacts will be transient.

There is potential for loss of fishing gear when trawling over rock-dumped sections of the pipeline. However, previous over-trawling tests indicate that the risk is minimal when using heavy net trawl gear. Damage/ loss of fishing gears will be mitigated against through a series of measures, including supervised rock-placement, rock-placement design, inclusion on navigational charts and a post-decommissioning over-trawlability survey. Representatives of the fishing community (e.g. the SFF) will be consulted at all stages of the process. Overall, the impact for the fishing community is assessed to be minor.

11.0 DISCHARGES TO SEA

This chapter provides a brief summary of potential discharges to sea, the legislative framework within which such discharges are governed and a description of likely discharges resulting from the Rubie/ Renee decommissioning operations. It does not, however, include unplanned discharges during accidental events, which are covered in Section 12.

11.1 Approach

During Rubie/ Renee decommissioning and associated vessel operations, three discharge streams could lead to contaminated fluid entering the marine environment, namely:

1. Treated water from the linefill used to protect the pipelines and umbilicals from corrosion.
2. Residual oil trapped in pipework or dissolved in the linefill in the pipelines that had previously been pigged and flushed to render them hydrocarbon free.
3. Hydraulic oil that may still be present in some of the umbilicals.
4. Operational discharges from vessels of drainage water, bilge water, ballast water, sewage, grey water and macerated galley waste.

This chapter assesses the magnitude of impacts arising from these discharge streams and outlines the mitigation measures that Endeavour proposes to put in place.

11.1.1 Treated water

Following cessation of production in 2009, the Rubie/ Renee subsea pipelines (not including umbilicals) were rendered hydrocarbon free by flushing with seawater, then flooded with seawater dosed with 1,500 ppm of the corrosion inhibitor, RX-2030.

It is believed that all of the Rubie/ Renee production umbilicals have been cleaned, via a series of flushes and filled with potable (treated) water.

As the majority of the pipelines and umbilicals will be capped and left *in situ (*Section 3*)*, it is anticipated that the treated water will also remain *in situ* and only be released gradually after through-wall corrosion occurs and the integrity of the pipelines and umbilicals progressively fail. It is anticipated that failure would only begin to occur after many decades (i.e. >60 years; HSE, 1997).

Release of treated water would be driven by the gradual collapse of the corroding pipeline under the weight of overlying sediments. Pathways from the pipelines and umbilicals to the receptors would be via the interstitial spaces in seabed sediments, overlying rock-placement where applicable and the water column. Release would therefore be so gradual and prolonged that the effects on the receiving marine environment would be likely to be negligible. The corrosion inhibitor in the pipelines would also be likely to exhaust well before release had occurred.

Notwithstanding, any chemicals to be used and discharged during the proposed decommissioning operations will be subject to chemical risk assessment and permit under the Offshore Chemicals Regulations 2002. Because the chemical regime will be

subject to a separate permit, the ES is not required to replicate the risk assessment to be carried out under the permit.

11.1.2 Residual oil

The Rubie/ Renee production pipework has been cleaned, via a series of flushes, to an oil-in-water content of <30 ppm. On cutting the pipelines, it is anticipated that trapped or dissolved oil will seep out slowly rather than flow positively on return to the surface, as the system is not pressurised. Similarly, oil may seep out from perforations caused by through-wall corrosion of the trenched and buried pipelines. In both cases, these will be small, slow flowing and isolated releases, rather than larger instantaneous events. Owing to the small quantity/ low concentration of oil and the expected nature of release, it is expected that the oil will disperse within a short distance of the release point and that any impact will be transient and short lived.

11.1.3 Hydraulic Fluid

Hydraulic oils are water-soluble PLONOR (Poses No or Low Risk) chemicals which have low environmental toxicity and are governed by permits for use and discharge under Offshore Chemicals Regulations 2002.

The Rubie/ Renee production umbilicals have been cleaned, via a series of flushes and are filled with potable water. However on cutting the umbilicals, it is anticipated that some residual hydraulic oil may seep out slowly rather than flow positively on return to the surface, as the system is not pressurised. Similarly, hydraulic oil may seep out from perforations caused by through-wall corrosion of the trenched and buried umbilicals. In both cases, these discharges would be small, slow flowing and isolated releases, rather than larger instantaneous events. Owing to the small quantity/ low concentration of hydraulic oil and the expected nature of release, it is expected that the hydraulic oil would disperse within a short distance of the release point and that any impact will be transient and short lived.

11.1.4 Discharges from Operating Vessels

The sources of potential pollutants from the operating vessels, along with proposed control and mitigation measures are summarised in Table 11.1.

Table 11.1: Sources of pollution from operating vessels with control and mitigation measures

Discharges from Operating Vessels	Environmental Risk	Control and Mitigation Measures
Overboard discharge of non-hazardous drains	• Slight deterioration in seawater quality around point of discharge.	Non-hazardous drains, by their design, discharge only non-hazardous rainwater which may be slightly contaminated with oily deposits. Access points for non-hazardous deck drains are controlled, so any spillages on deck will not enter the drainage system, but will be cleaned up. Non-hazardous drains are designed to take storm and rain water run-offs from the decks.
Discharge of treated bilge water	• Slight short-term deterioration in seawater quality around the discharge point.	Compliance with MARPOL which requires: • Oil-water separation and filtration equipment, monitoring and discharge to ensure oil concentration is compliant with current limits (15 ppm oil-in-water concentration). • Retention of the bulk oil fraction after separation, for recycling or incineration onshore. UK or International Pollution Prevention Certificate for vessel drainage systems. Vessel audits to ensure compliance.
Discharge of ballast water	• Discharge of sediments and water in the ballast tanks can introduce non-native planktonic and benthic species into the water column, impacting water quality and organisms in a localised area immediately around the discharge point.	• Endeavour will adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments, adopted in 2004. • If applicable, adherence to ballast water guidance. Since April 2008, the Helsinki and OSPAR Commissions have issued General Guidance on the voluntary Interim application of the D1 Ballast Water Exchange Standard. The guidance requests that vessels entering NE Atlantic waters exchange all their ballast tanks at least 200 nmiles from the nearest land, in waters at least 200 m deep. • Endeavour will ensure good practice for vessel management to minimise risk.
Overboard discharge of sewage and macerated galley waste	• Localised increase in BOD (Biological Oxygen Demand) around the point of discharge (caused by bacterial degradation of the sewage). • Slight deterioration in seawater quality around point of discharge • Input of organic nutrients could result in localised increase in productivity in fish, plankton and micro-organisms.	• Sewage will be treated prior to disposal at sea or contained and shipped to shore. • Vessels will be audited to ensure compliance. • Food waste will be macerated as required by MARPOL and The Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008; this will aid its dispersal and decomposition in the water column.

11.2 Impacts to Sensitive Receptors

The above decommissioning discharges into the water column are potentially toxic to plankton, benthos and fish in the immediate vicinity of the discharge. Away from the discharge site, bioaccumulation in the food chain may potentially occur if the materials released are bioavailable (DTI, 2001).

These impacts are assessed in the following sections to determine the potential scale of the impacts to the fauna in the immediate vicinity of the discharge.

11.2.1 Plankton

Some localised toxicity to planktonic organisms may result from the release of treated water, hydraulic fluid and residual oil discharged during the proposed Rubie/ Renee decommissioning operations.

The localised release of treated or contaminated water is likely to become rapidly diluted within the water column to levels below those that may cause lethal or sub-lethal effects to the planktonic community (Lee and Neff, 2011; Neff, 2002).

Consequently, a short-term permitted discharge of treated or contaminated water should not present a major risk to the viability of the plankton community.

11.2.2 Benthic Environment

Treated or contaminated water has the potential to cause short-term toxicity or long-term impacts from harmful levels of bioaccumulation within the benthic community (DTI, 2001). The extent of these impacts depends on water column depth, dispersion rates, current speed and dilution (Lee and Neff, 2011).

Water depth at the Rubie/ Renee Facilities ranges between 113 and 150 m, and it is anticipated that the treated or contaminated water discharged during decommissioning activities will dilute to levels that are too low to cause harm to benthic organisms. Therefore, it is unlikely that benthic organisms will be impacted.

11.2.3 Fish and Shellfish

As pelagic finfish are highly mobile, it is unlikely that there will be an impact on the finfish community. In a mesocosm study on the impacts of produced water on finfish, no negative impacts were observed (Gamble *et al*., 1987). There is little likelihood of fish, shellfish or other epibenthic organisms being impacted due to the treated or contaminated water dispersion rates.

11.2.4 Protected Habitats and Species

No Annex I habitats of conservation importance were identified within the Rubie/ Renee Fields (Fugro ERT, 2011). The closest Annex I habitat (Scanner Pockmark SAC/ SCI) is located approximately 24 km from the Rubie/ Renee Fields, therefore the release of contaminated water will have no effect on this area. The short-term release of contaminated water is unlikely to have any effect on marine mammals or Annex II species. The low number of animals in the area coupled with their high mobility suggests that no discernible impact will be observed.

11.3 Cumulative and Transboundary Impacts

The release of treated or contaminated seawater to the marine environment during Rubie/ Renee infrastructure decommissioning may result in a short-term, localised impact on marine organisms close to the discharge point. It is unlikely that there will be any cumulative impacts as a result of permitted discharge of inhibited seawater during the decommissioning activities.

The Rubie/ Renee Fields are located approximately 60 km west of the UK/ Norway median line and since all identified impacts would be within UK waters, no transboundary impacts are anticipated.

11.4 Conclusions

Discharges to sea of treated water, hydraulic fluid, residual oil, as well as discharges from operating vessels during decommissioning activities will result in localised effects which will have negligible impact on the wider marine environment.

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12.0 ACCIDENTAL EVENTS

This section evaluates the impact of accidental spills and describes planned prevention measures to reduce their probability. It also discusses proposed contingency measures and mitigation strategies in the event of a significant hydrocarbon release.

Owing to the dynamic physical conditions of the marine environment, an accidental release of hydrocarbons or other chemicals can result in a complex pattern of pollution distribution and impact to the marine environment. As part of the ES process it is necessary to estimate the extent and impact of an unplanned release of hydrocarbons, critically assess the effects of such an event on key receptors, and identify suitable prevention strategies and effective response measures.

12.1 Regulatory Requirements

Any potential accidental spill associated with the decommissioning of the Rubie/Renee Facilities will be managed in accordance with current legislation and standards as detailed within Appendix A.

12.2 Approach

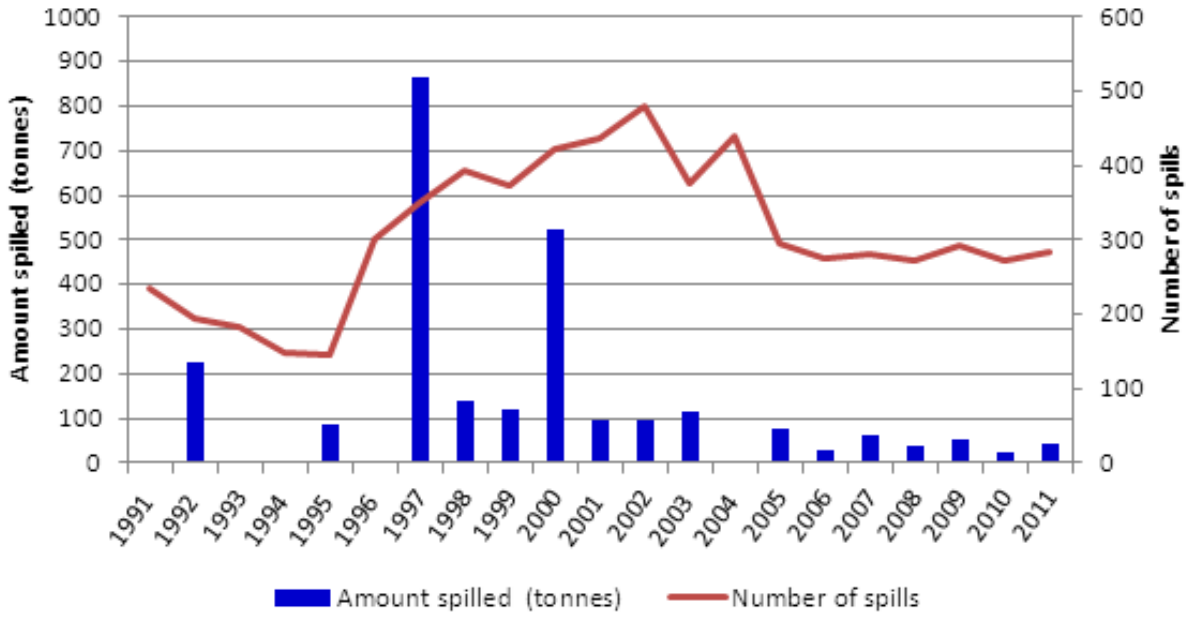
All offshore activities carry a potential risk of a hydrocarbon or chemical spillage to sea. During the period 1975 to 2005, a total of 16,930 tonnes of oil was discharged from 5,225 individual spill events on the UKCS (UKOOA, 2006). Analysis of spill data between 1975 and 2005 shows that 46% of spill records related to crude oil, 18% to diesel and the other 36% to condensates, hydraulic oils, oily waters and other materials (UKOOA, 2006).

During 2011, a total of 284 oil spills on the UKCS were reported to DECC, nine of which were greater than 1 tonne. A total of 242 chemical spills on the UKCS were reported to DECC during this period, 41 of which were greater than 1 tonne (DECC, 2013b). The likelihood of an oil spill occurring in the UKCS rose from 1975 to 2011 with increased oil and gas activity. Figure 12.1 shows both the amount of oil spilled and the total number of spills recorded annually (regardless of spill size that are < 1 tonne) on the UKCS between 1991 and 2011 (DECC, 2013b).

12.3 Sources of Potential Impacts

The Rubie/ Renee subsea wells have been suspended or P&A'd, and the production lines are disconnected and fluid filled with inhibited seawater ready for decommissioning. Endeavour have undertaken a hazard identification and spill probability assessment focusing on the remaining Rubie/ Renee subsea infrastructure. The following scenarios have been identified as potential sources for hydrocarbon spillages at the Rubie/ Renee Facilities:

- Loss of fluids from suspended subsea wellheads.
- Sinking of a vessel due to collision releasing diesel to the sea.
- Worst case diesel spill from a vessel.
- Accidental fuel (diesel or aviation) spillage during refuelling.
- Diesel tank remedial loss.



Source: DECC (2013)

Figure 12.1: Number of spills and spill amounts on the UKCS from 1991 to 2011

The environmental impact of a spill depends on numerous factors including:

- Location and time of the spill.
- Spill volume.
- Hydrocarbon or chemical properties.
- Prevailing weather/ metocean conditions.
- Environmental sensitivities.
- Efficacy of the contingency plans.

The worst case hydrocarbon spill scenario for the Rubie/ Renee Facilities would be from a well blowout; however, there are no historical data available on the frequency of oil spills from suspended wellheads. In addition, the probability of a spill occurring from one of the wellheads is low, as the wells have a two-barrier control system in place.

An uncontrolled well blowout scenario is only considered credible whilst well intervention operations are on-going. Given that the reservoir is depleted and watered out, the need for relief well drilling is considered unlikely. Additionally, low pressure of the well would cause it to self-kill within maximum of 30 days.

12.3.1 Hydrocarbon Properties

The fate and effect of a spill is dependent on the physical and chemical properties of the hydrocarbon. Hydrocarbons used in, or present at the Rubie/ Renee Facilties include diesel, aviation fuel and Rubie/ Renee crude.

The Rubie/ Renee crude is classified as an ITOPF Group II light oil, which indicates the oil will remain afloat on the sea surface in the event of a spill to sea.

Diesel and aviation fuel have very high levels of volatile components, evaporating quickly on release. The low asphaltene content in the diesel prevents emulsification, reducing persistence of these fuels in the marine environment. Owing to its characteristics and subsequent behaviour when released, diesel oil and aviation fuel are not considered to offer a significant threat to the environment in comparison with the risks posed from a spill of Rubie/ Renee crude oil.

12.3.2 Overview of the Modelling Undertaken

Spill modelling was undertaken for potential spill scenarios at the Rubie/ Renee Facilities to identify a worst-case release, its fate and behaviour, area of impact (including potential beaching locations) and likelihood of crossing transboundary lines. Table 12.1 summarises the modelling scenarios undertaken.

Table 12.1: Modelling scenario summary

Scenario	Quantity lost (m^3)	Release duration h (days)	Rate	Model duration (days)	Wind direction (°)
Trajectory - towards UK coastline					
T1a: Diesel spill	2,250*	1 (0)	-	0.5**	68.1
T2a: Blow-out until well cap	4,800***	720 (30)	6.63 m^3/h	6**	68.1
Trajectory - towards UK/Norwegian median line					
T1b: Diesel spill	2,250*	1 (0)	-	0.5**	237.8
T2b: Blow-out until well cap	4,800***	720 (30)	6.63 m^3/h	7**	237.8
Stochastic					
S1: Blow-out until well cap	4,800***	720 (30)	160 m^3/day	Not applicable	

*This represents the instantaneous release of a vessel's total fuel inventory.

**Time until amount of oil at sea became insignificant (< 5% of oil mass remaining at surface).

***This value represents a maximum daily release rate of oil (159 m^3/day) from the Rubie/ Renee wells during production stage. This figure far exceeds the likely total spill from any scenario for the Rubie/ Renee suspended wells.

The assessment was conducted using Sintef's Oil Spill Contingency and Response (OSCAR) model, which can simulate the fate, weathering and dispersion of oil in three dimensions. OSCAR supports several model types, but they can generally be characterised as being either trajectory (deterministic) or stochastic. These models combine:

- Weathering algorithms to determine changes in slick physical properties as it spreads.
- Three-dimensional transport processes acting on the oil due to the current, wind, waves, diffusion and buoyancy in the ocean surface layer.

- Changes due to evaporation, emulsification and natural dispersion of hydrocarbons.

Worst case hydrocarbon spill scenarios were modelled for the Rubie/ Renee Suspended Well Oil Pollution Emergency Plan (OPEP) (Endeavour, 2013c). The results of the OPEP modelling are representative of the impact of a potential accidental discharge of diesel and a well blowout (before a well cap is installed).

One stochastic and four trajectory scenarios were undertaken for the Renee Production Well (P1), using a release date of 01 January, with average annual air and sea surface temperatures of 9.6°C and 10°C, respectively. The model ran for 153 simulations with start dates evenly spread over one year.

12.3.3 Trajectory Modelling Results

Diesel Spill

The trajectory models predict that no beaching will occur under either scenario and the amount of surface diesel will become insignificant after 12 hours (Table 12.2; Figure 12.2a). The spill is unlikely to cross the UK/ Norwegian median line (Table 12.2; Figure 12.2b).

Oil Release

In the case of a release of crude oil, the model predicts that the hydrocarbons on the sea surface will not beach before the amount of oil remaining on the sea surface becomes insignificant (Table 12.2; Figure 12.3a). Surface oil is predicted to cross the median line after 2 days and 18 hours and would become insignificant after 6 to 7 days (Table 12.2; Figure 12.3b).

Table 12.2: Results from Trajectory Model Scenarios

Scenario	Time until crosses UK/ Norway median		Time until surface oil is insignificant*		Impact to shore	
	Wind to UK	Wind to median	Wind to UK	Wind to median	Wind to UK	Wind to median
Diesel Spill	Not applicable	Not applicable	12 hours	12 hours	No beaching	No beaching
Oil release (blow-out until well cap)	Not applicable	2.7 days	6 days	7 days	No beaching	No beaching**

*Time until amount of oil at sea became insignificant (<5% of oil mass remaining on the sea surface)

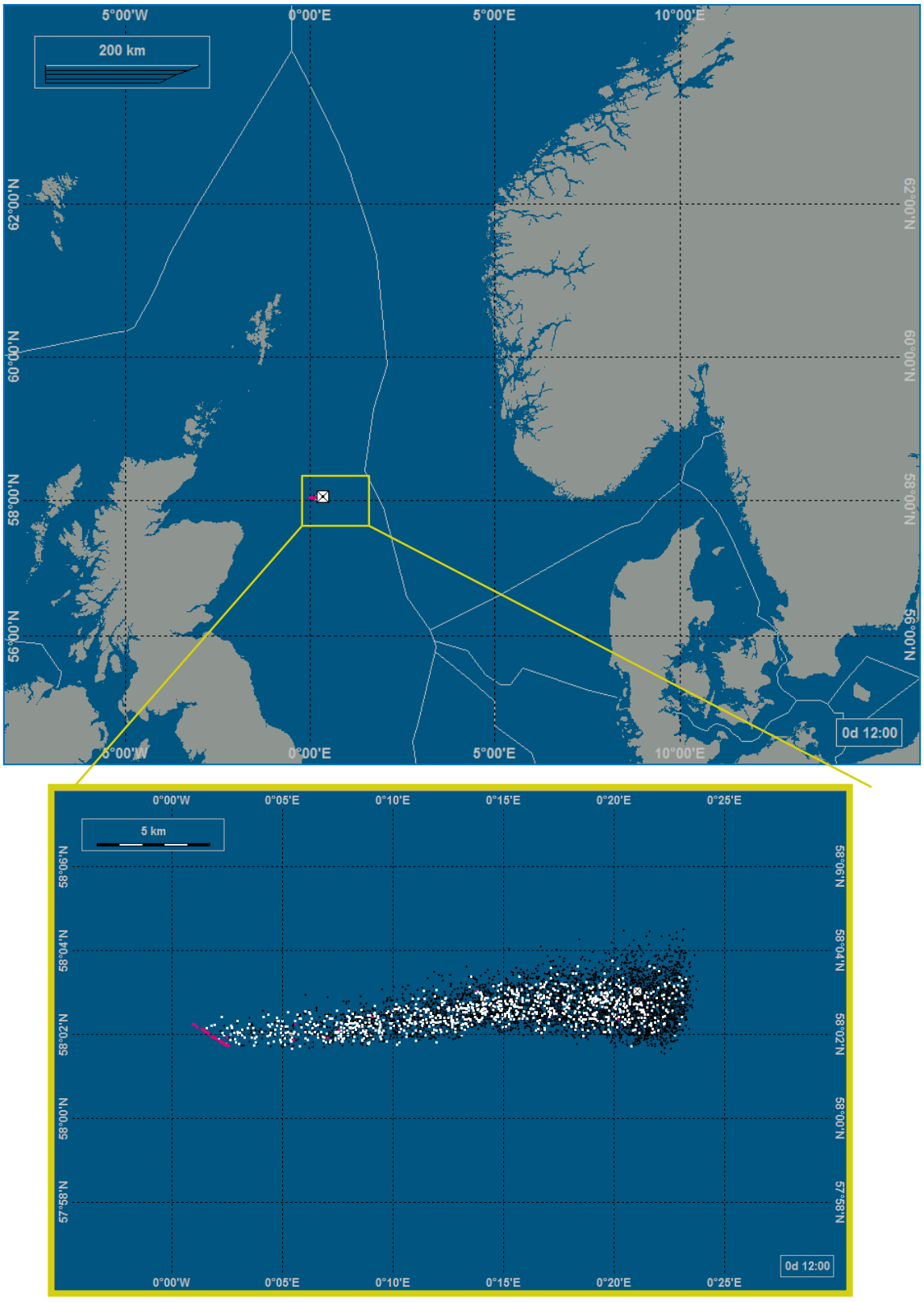


Figure 12.2a: Scenario T1a - Diesel spill towards UK coastline at the time when surface oil (thickness < 0.003 mm in pink) becomes insignificant. Hydrocarbon droplets (diameter 0 - 10 µm) in the water column (in white) and dissolved particles (in black)

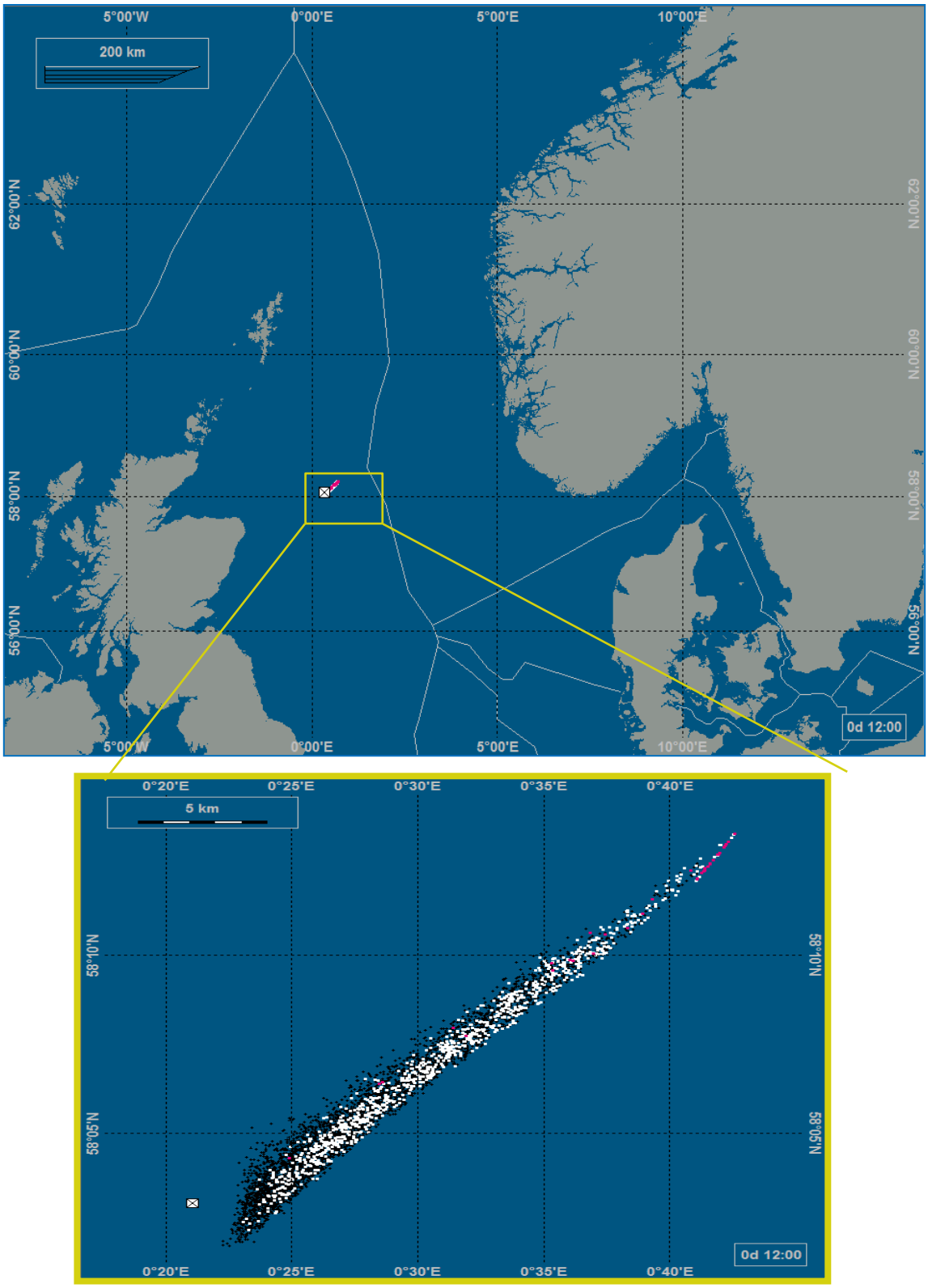


Figure 12.2b: Scenario T1b - Diesel spill towards median line at the time when surface oil (thickness < 0.003 in pink) becomes insignificant. Hydrocarbon droplets (diameter 0 - 10 µm) in the water column (in white) and dissolved particles (in black)

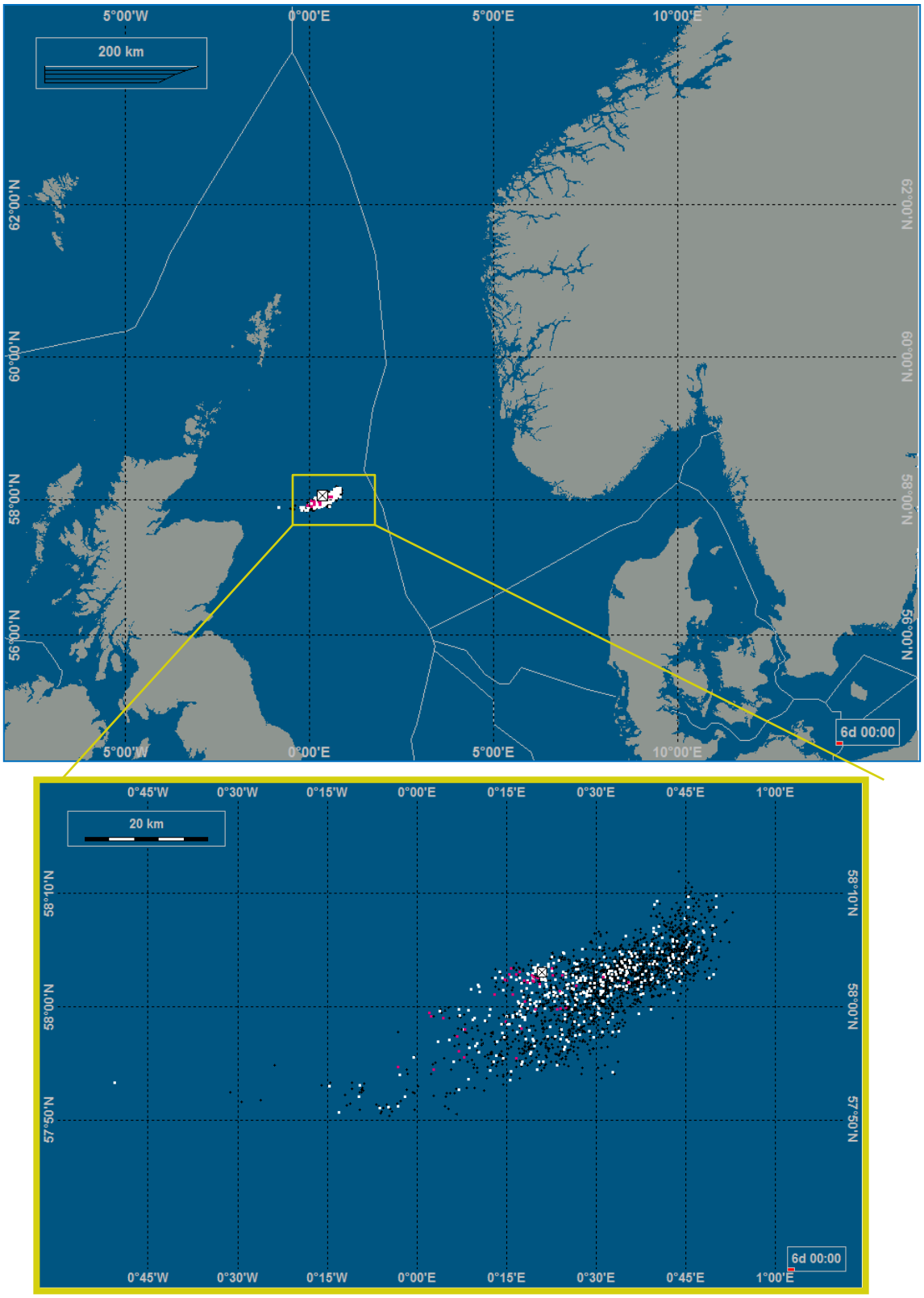


Figure 12.3a: Scenario T2a - Oil release towards UK coastline under well blow-out at the time when surface oil (thickness < 0.003 in pink) becomes insignificant. Hydrocarbon droplets (diameter 0 - 10 µm) in the water column (in white) and dissolved particles (in black)

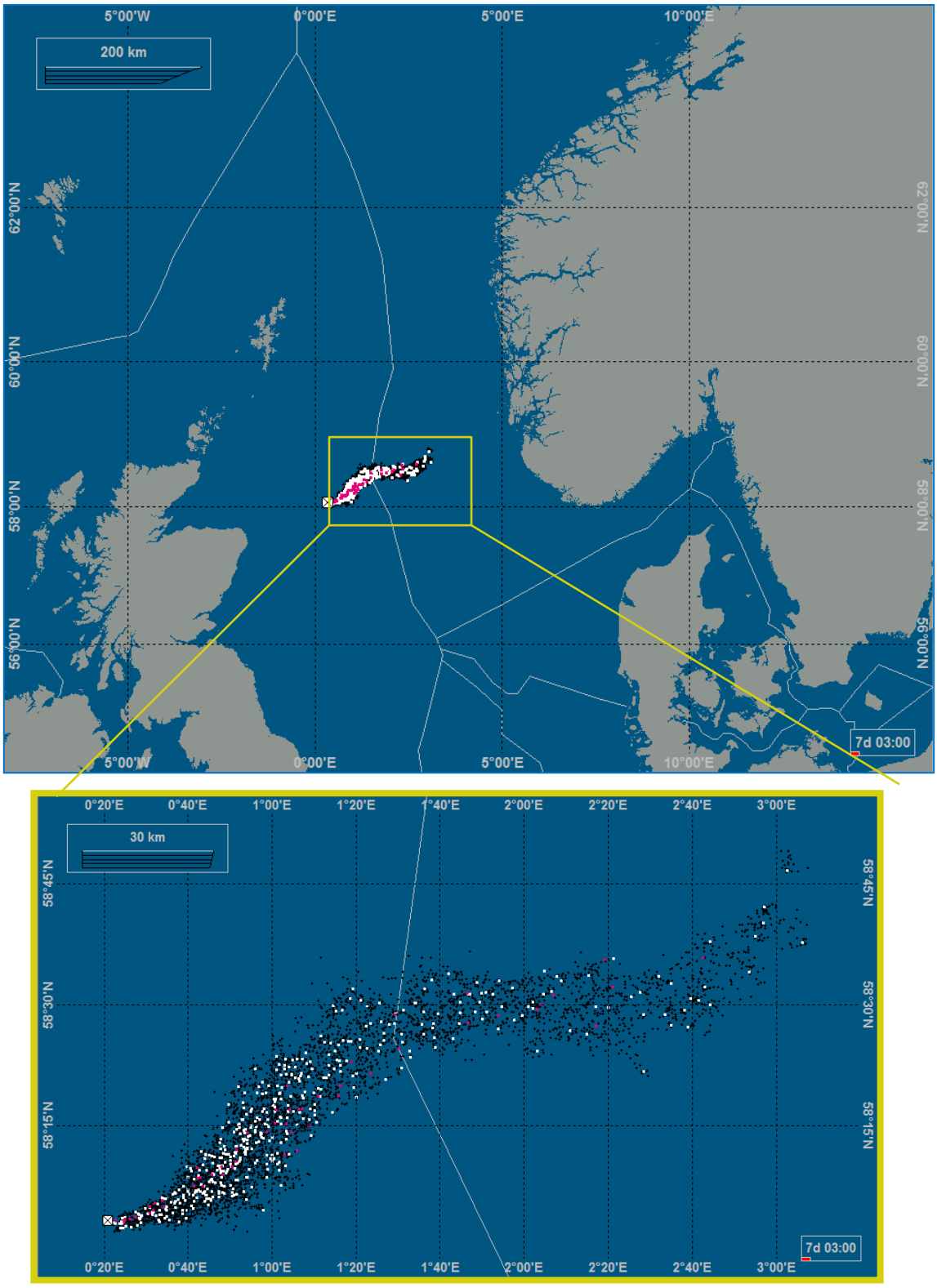
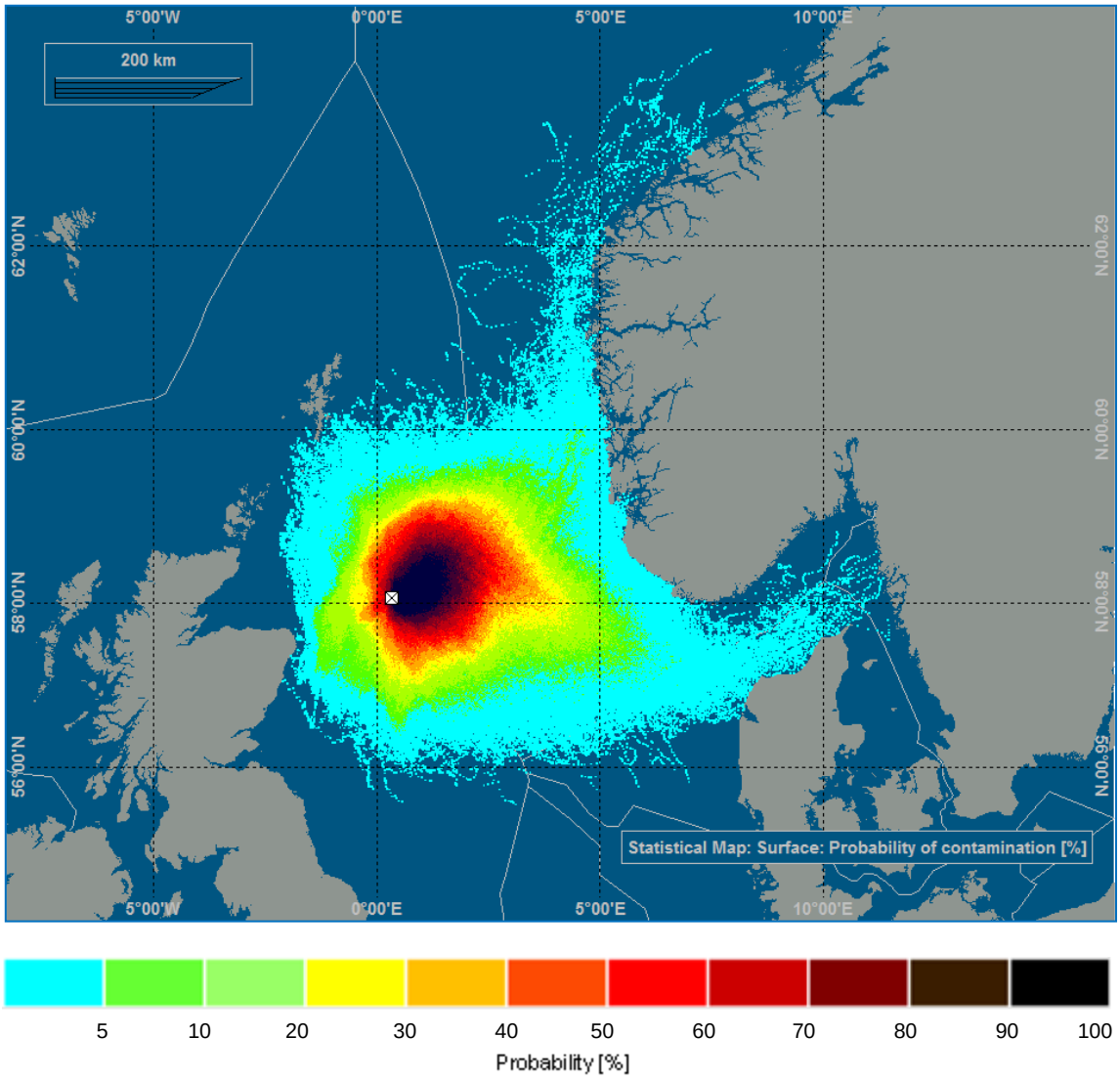


Figure 12.3b: Scenario T2b - Oil release towards median line under well blow-out at the time when surface oil (thickness < 0.003 in pink) becomes insignificant. Hydrocarbon droplets (diameter 0 - 10 µm) in the water column (in white) and dissolved particles (in black)

12.3.4 Stochastic Modelling Results

The quantity and persistence of the hydrocarbons released suggests a large surface signature of contamination (Figure 12.4). The furthest extent of a spill would run to the north (Figure 12.4). There is a minimal chance of beaching (≤ 5%) along the Norwegian coastline, increasing to approximately 20% in a few locations on the coasts of Hordaland and Rogaland. Beaching probabilities in the UK, in Sweden and in Denmark are negligible (≤ 5%). The maximum amount of oil that came ashore in any one simulation was 21 tonnes.



Note that the plot represents chance as a percentage of an area of sea surface experiencing contamination from a spill. It is not a true reflection of the extent that a potential spill would cover. Hydrocarbons would not only cross the median line but also beach in many locations around the North Sea. The model suggests that there is a higher probability of hydrocarbons beaching in Norway. Beaching may also occur in the UK, Fair Isle, Sweden and Denmark.

Figure 12.4: Scenario S1 – Probability plot of sea surface contamination from oil release under blow out

12.4 Impacts to Sensitive Receptors

Although the likelihood of a hydrocarbon spill at the Rubie/ Renee Facilities is remote, there is a potential risk to organisms in the immediate marine environment if a spill were to occur. As the potential spill is likely to be on the surface planktonic and benthic communities are unlikely to be influenced by an accidental spill from the Rubie/ Renee Facilities. Other communities, including fish, birds and marine mammals may be impacted. In the unlikely case of well blow out and oil beaching coastal communities and inshore protected areas may be affected.

12.5 Cumulative and Transboundary Impacts

There is a potential for transboundary transport of contaminants. Modelling predicts that the most likely trajectory for an accidental spill will cross the median line. Depending on the size of the spill, in the event of an oil spill entering Norwegian waters it may be necessary to implement the NORBRIT Agreement (the Norway-UK Joint Contingency Plan). The NORBRIT Agreement sets out command and control procedures for pollution incidents likely to affect both parties, as well as channels of communication and available resources. The MCA Counter Pollution and Response Branch also has agreements with equivalent organisations in other North Sea coastal states under the Bonn Agreement 1983. Applicable international arrangements are further described in Appendix A.

No cumulative impacts are expected from a release of diesel fuel or well blow-out unless a similar spill was to occur in the immediate vicinity.

12.6 Proposed Mitigation Measures

The response to all spills is detailed in the Rubie/ Renee Suspended Well OPEP. Endeavour's philosophy is to maintain well control at all stages of well planning, construction, production, suspension and decommissioning activities. Endeavour has a comprehensive Well Integrity Management Systems (WIMS) to ensure the integrity of all wells within its operations. Endeavour has adopted the Oil & Gas UK industry standards for well integrity and competence assurance and uses dedicated Well Monitoring Practices to provide an independent examiner with the necessary survey and data monitoring protocols.

12.7 Conclusions

The conclusions from an impact assessment for an accidental hydrocarbon release include:

- The worst case scenario for hydrocarbon release from the Rubie/ Renee Facilities would result from a well blow-out.
- Diesel spills will disperse and dilute quickly, with no impact to coastline.
- The probability of a hydrocarbon spill occurring is low and does not contribute to the overall spill risk in the area.
- The Renee/ Rubie OPEP response will ensure that all hydrocarbon spills are dealt with efficiently.

13.0 WASTE

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'. For example, some activities will involve the manual removal of chemicals stored within the spools and jumpers, whereas other activities will involve the individual lift of components onto a vessel for subsequent transportation and disposal onshore. The sequence and quantities of controlled waste generated at any one time will depend on the processes used for dismantling, such as single lift, and the subsequent treatment and disposal methods.

Three key challenges associated with waste management for the Rubie/ Renee Facilities are:

- The generation of large quantities of controlled waste within short timeframes which requires detailed planning to manage the logistics associated with the transport to shore, temporary storage and onward treatment/ disposal of materials.
- The potential for so-called "problematic" materials to be generated due to the cross–contamination of non-hazardous waste with substances that have hazardous properties which result in the material being classified as special waste. Special 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. Outside of Scotland such material is referred to as hazardous waste.
- The problem 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 special waste or non-hazardous waste.

In accordance with the DECC Guidance Notes under the Petroleum Act 1998 (DECC, 2011) which affirms that the disposal of such installations should be governed by the precautionary principle, Endeavour 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.

13.1 Waste Generation

Typical non-hazardous waste will include scrap metals (steel, aluminium and copper), concrete and plastics that are not cross-contaminated with special waste and can therefore be removed and recovered for reuse, recycling or landfill. Special waste will include oil contaminated materials and chemicals. Many types of special waste generated during decommissioning are routinely generated during production and maintenance of offshore installations. However, the decommissioning process may generate significantly greater quantities of both non-hazardous waste and special waste when compared to routine operations and as such requires careful management.

The likely types and quantities of materials associated for the following facilities are provided within Section 3:

- materials comprising the main subsea structures and facilities (Section 3; Table 3.4); and

- materials comprising line (pipelines and associated umbilicals), spool and jumper facilities (Section 3: Table 3.4).

13.1.1 Radioactive Waste

No NORM wastes are known to be present in the Rubie/ Renee Field. In the unlikely event that such wastes are detected, NORM will be managed in line with current legislative requirements (Appendix A). The Radioactive Substances Act 1993 Amendment (Scotland) Regulations 2011 regulates the handling, storage, transfer and disposal of such waste. Endeavour has an existing 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 Scottish Environment Protection Agency (SEPA).

13.1.2 Draining, Flushing Purging and Venting

During initial decommissioning activities, the in-field pipework and wellheads were drained and flushed with inhibitor. These initial cleaning activities removed gross hydrocarbons liquids, chemicals, gases and other hazardous inventories from the system.

The disposal route proposed for all effluent arising from the drain-down and flushing of hydrocarbon systems was via the closed drains system to the oil surge tanks. From here, effluent was pumped directly to the oil export pipeline via a temporary pump. Effluent from chemical containing systems was routed to the hazardous drains system and received in the slops tank before being pumped to the surge tanks.

13.2 Regulatory Requirements and Corporate Standards

There is no waste related legislation that specifically covers decommissioning activities, but some aspects of existing waste legislation are relevant (Appendix A).

Whether a material or substance is ‘waste’ is determined by EU law. The EU Waste Framework Directive (WFD) (2006/12/EC) defines ‘directive waste’ as “any substance or object in the categories set out in Annex 1 of the Directive which the holder discards or intends or is required to discard”. Annex 1 provides a list of definitions and includes a general category – “Any materials, substances or products which are not contained in the above categories”.

It is the responsibility of the producer or duty holder to decide whether a substance or object is waste. The action of removal and transfer of redundant installations and infrastructures during decommissioning to shore falls within the legal definition of waste; and the responsibility for determining whether a substance or object is waste lies with the Operator.

Having determined the substance or object is waste, subsequent storage, handling, transfer and treatment of the waste generated is then governed by a number of regulations. A breakdown of the legislation is available in Appendix A.

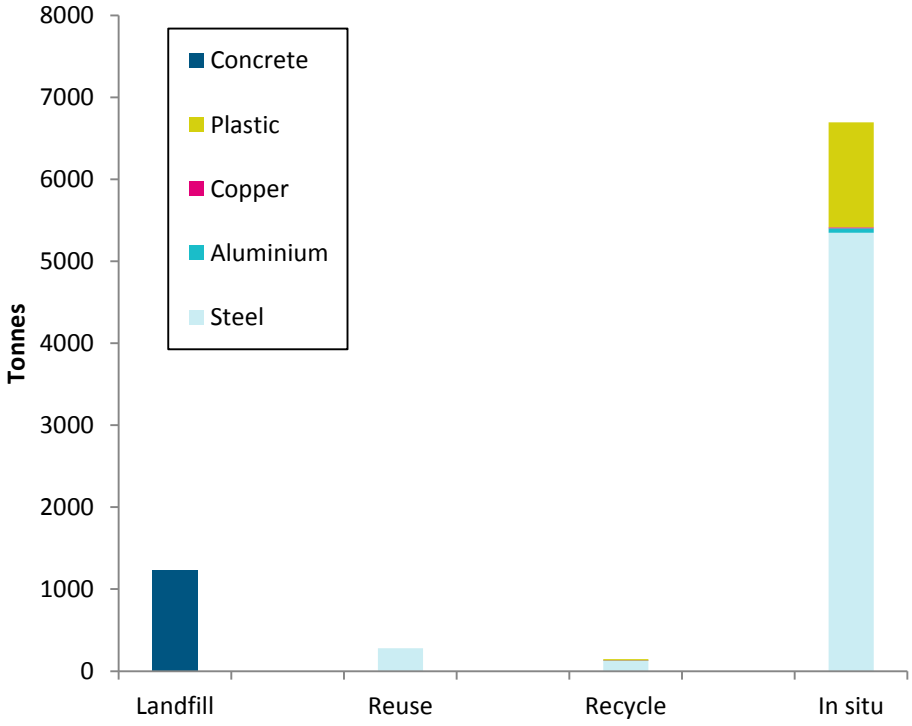
13.3 Waste Management

DECC Guidance Notes (2011) require that the decommissioning decisions are consistent with the waste hierarchy and the Decision recognises that, in line with the waste hierarchy, the reuse of an installation is first in the order of preferred decommissioning options. A demonstration of how Endeavour intends to implement the waste hierarchy is also included in the Decommissioning Programme for the Rubie/ Renee Facilities (BMT Cordah, 2013).

Non-hazardous materials, such as scrap metal, concrete, and plastics not contaminated with hazardous (special) waste, will be removed and recovered for reuse or recycling (with the exception of the pipelines remaining *in situ*). Steel and other scrap metal are estimated to account for the greatest proportion of materials inventory from the Rubie/Renee flowlines and wellheads to be transported onshore.

Where necessary, hazardous waste resulting from the dismantling of the Rubie/ Renee Facilities will be pre-treated to reduce hazardous properties or, in some cases, render it non-hazardous prior to recycling or landfilling. Under the Landfill Directive, pre-treatment will be necessary for most hazardous wastes which are destined to be disposed of to landfill sites. Other non-hazardous waste which cannot be reused or recycled will be disposed of to a landfill site.

Table 13.1 outlines the fate of decommissioned material, while Figure 13.1 represents the ideal disposal routes graphically.



Note: Depending on the conditions of pipeline material recovered during decommissioning, a small proportion may be sent to landfill.

Figure 13.1: Bar chart of the estimated tonnage and predicted disposal routes of decommissioned material.

Table 13.1: Fate of Rubie/ Renee Waste

	Facility	Recommended decommissioning option	Destination
Subsea wells, structures and protective structures	Crossover Structure (COS)	Removal	Recycling
	Renee Production Manifold (RPM)		
	Renee water injection wellhead 15/27 -7		Recondition and reuse
	Renee production wellhead 15/27- 6y		
	Renee production wellhead 15/27- 8		
	Rubie production wellhead 15/28b-7z		
	Mattresses (200 - 250)		Possible re-use in construction; otherwise landfill
Umbilicals	DUBS to Renee umbilical (PL1619.1 -8)	Leave *in situ*	Leave *in situ*
	Renee to Rubie umbilical (PL1626.1-8)		
Pipelines	8” production pipeline (PL1616)	Leave *in situ*	Leave *in situ*
	8” production pipeline (PL1617)	Leave *in situ*	Leave *in situ*
	4” Renee to AH001 Gas lift pipeline (PL1618)		
	8” Renee to AH001 water injection pipeline (PL1620)		
	Rubie to Renee production pipeline (PL1624)		
	3” Renee to Rubie gas lift pipeline (PL1625)		
Jumpers	Rubie production well to Rubie manifold production pipeline (PL1621)	Cut and Lift	Recycling
	Rubie manifold to Rubie production well gas lift pipeline (PL1622)		
	Two chemical jumpers (PL1623.1 & 2)		
	Two chemical jumpers (PL1626.1 & 2)		
Spools	RBM Spools (3 x 4" and 6 x 8" spools)	Cut and Lift	Recycling
	COS Spools (3 x 4" and 9 x 8" spools)		
	RPM Spools (1 x 2"; 2 x 3"; 3 x 4"; 1 x 6" and 6 x 8" spools)		
	Rubie wellhead Spools (2 x 4" and 2 x 8" spools)		

Figure 13.2 shows the estimated percentages of material expected to be disposed of in landfill, to be recycled/ re-used and to remain *in situ*. The majority of the Rubie/ Renee Facilities will remain *in situ*. It is anticipated that approximately 1,000 tonnes of material including the wellheads will be re-used or recycled, although it is possible that surplus material (concrete in particular) will be disposed of at landfill sites.

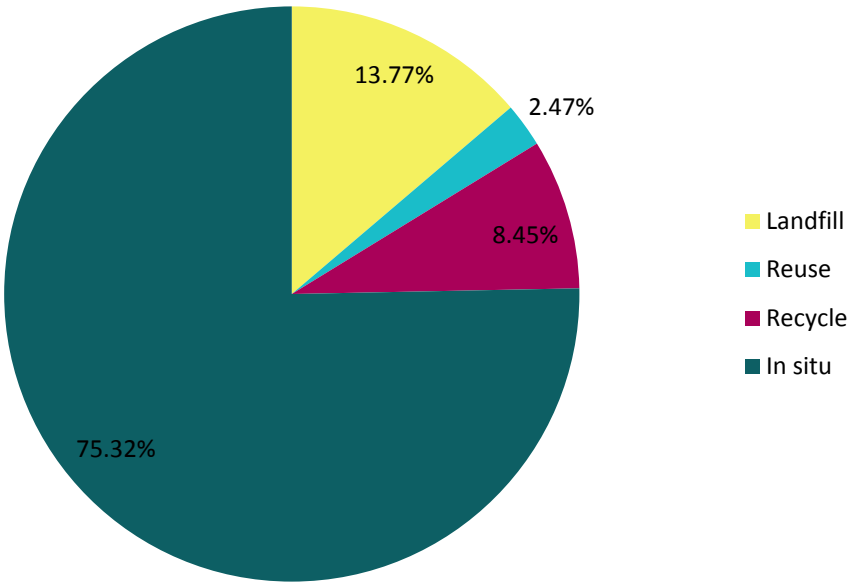


Figure 13.2: Pie chart of estimated disposal location percentages

13.3.1 Environmental Management System

The management of waste generated from operations and drilling activities is already addressed by Endeavour through an ISO14001 certified Environmental Management System (EMS) (Section 14). The EMS includes a documented procedure for waste management which is designed to ensure that all waste generated during Endeavour's offshore production and drilling operations are managed according to the Company's HSE policy and relevant legislation.

Specifications to manage the waste generated during decommissioning will conform to the requirements of Endeavour's EMS. In order to achieve this it will be necessary to:

- Undertake a review of the EMS and update it to ensure that significant environmental impacts and legislative requirements as a result of waste generation and treatment during decommissioning are adequately recorded and assessed, and any requirements for operational controls or other management actions are identified.
- Prepare a Waste Management Plan for individual decommissioning projects.

13.3.2 Contractor Management

Waste management activities include the handling, storage and treatment of waste offshore, the transfer of waste to a waste treatment or dismantling yard for further

storage, handling and treatment as appropriate, and then further transfer to the final disposal or treatment point. Many of these activities will be conducted by contractors and sub-contractors on behalf of Endeavour. Although Endeavour will not be undertaking the actual physical work, the legal liability, i.e. Duty of Care, for all waste generated from decommissioning remains with Endeavour for the duration of the programme.

The selection and management of contractors by Endeavour is managed through the contractor control processes and procedures. Specific actions to support the management and minimisation of waste generated by contactors during decommissioning will include:

- Ensuring that waste management issues are included during the contract procurement process, for example consideration of contractor past HSEQ-MS performance, during the procurement process.
- Ensuring that waste management issues are covered within the contractor interface documents, for example HSEQ-MS performance measurement including waste Key Performance Indicators (KPIs) and competency training.
- Engaging with contractors to identify effective technical solutions that support waste minimisation with the reuse and recycling of waste, if possible.

The procedures and processes for waste and contractor management will be embedded in the EMS, detailing actions, roles and responsibilities of personnel from within Endeavour and the various contractors working on an individual decommissioning project.

13.3.3 Measuring and Monitoring Performance

Measuring and monitoring performance is an important element of an EMS and Endeavour already has a number of mechanisms in place to do this. With respect to the management and minimisation of waste during decommissioning the key areas for action are as follows:

- monitoring legislative compliance; and
- measuring performance for achieving waste minimisation.

A number of methods will be used to ensure effective monitoring of waste management activities including, for example, auditing of contractors and disposal sites.

14.0 ENVIRONMENTAL MANAGEMENT

This section describes the relevant corporate policies and the means by which Endeavour will manage the environmental aspects of the Rubie/ Renee decommissioning. The section also states the environmental commitments which will be met during decommissioning and provides a delivery mechanism for these commitments.

14.1 Endeavour HSE Policy

Endeavour takes all reasonable precautions to achieve the goal of harm-free operations. The HSE Policy (Figure 14.1) is Endeavour's public commitment to conducting business in a manner that protects the health and safety of people and preserves the integrity of the environment within which they operate. It is endorsed by top management who are responsible for ensuring its implementation. Line managers have primary responsibility for ensuring compliance with the Policy and for effective communication of the policy commitments and requirements to their staff.

14.2 The Endeavour Management System

Endeavour's Health, Safety, Environmental and Quality Management Systems (HSEQ-MS) are certified to the International Standards ISO 14001:2004 (environment) and OHSAS 18001:2007 (health and safety). The scope of certification, which was achieved in 2010, covers oil and gas exploration, project development, production and suspension/ decommissioning activities on the UKCS and associated offshore activities.

Endeavour is committed to managing all potential environmental aspects and impacts associated with its activities on the UKCS. The HSEQ policy is endorsed by Endeavour's top management and they are responsible for ensuring its implementation. Line managers have primary responsibility for ensuring compliance with the Policy and for effective communication of the policy commitments and requirements to their staff.

Endeavour's HSEQ-management system follows the 'plan, do, check, act' model (Figure 13.2) which aims to drive continual improvement. Endeavour's "Environmental Management Manual" summarises the main responsibilities for environmental management and the environmental elements of the HSEQ management system.

In addition to the Policy and Manual, the management system includes the procedures and guidance required to provide effective control of the environmental aspects of the Company's operations. The continuing suitability of the management system is monitored and procedures are modified as required to ensure that they continue to be adequate for current operations.

Endeavour's management system arrangements include the setting of environmental objectives and requirements on the specific training and competence required to ensure that personnel are able to fulfil their obligations effectively.

Endeavour

Health, Safety and Environmental Policy Statement

Endeavour International Corporation and its affiliated companies place a high value on conducting business with respect and care for people and the environment. Adhering to high performance standards in the area of Health, Safety and Environmental (HS&E) is an integral part of our operations and underpins each action we take. We continually strive to promote the safety, health and wellbeing of our employees, contractors and local communities while maintaining the quality of the environment in which we operate.

Through management leadership and employee involvement, Endeavour intends to:

- Comply with all applicable HS&E laws, rules and regulations and other requirements
- Prevent pollution, reduce wastes and emissions, and conserve energy and other natural resources by minimising the environmental risks associated with our operations
- Prevent incidents and maintain effective emergency preparedness, response and recovery programs
- Continually improve HS&E performance results with a management system designed to establish goals and assess performance
- Ensure every employee understands and is responsible and accountable for HS&E performance while conducting their daily business activities
- Work with suppliers, contractors and stakeholders to achieve HS&E performance consistent with Company objectives
- Promote open communication throughout the organisation, the community and with applicable regulatory agencies on HS&E matters

Our ultimate goal at Endeavour International is to work 'each day injury and incident free'. We take responsibility for these policy principles through the commitments and actions of each employee.

William L. Transier
Chairman, Chief Executive Officer & President

27th May 2009

Figure 14.1 Endeavour's HSE policy

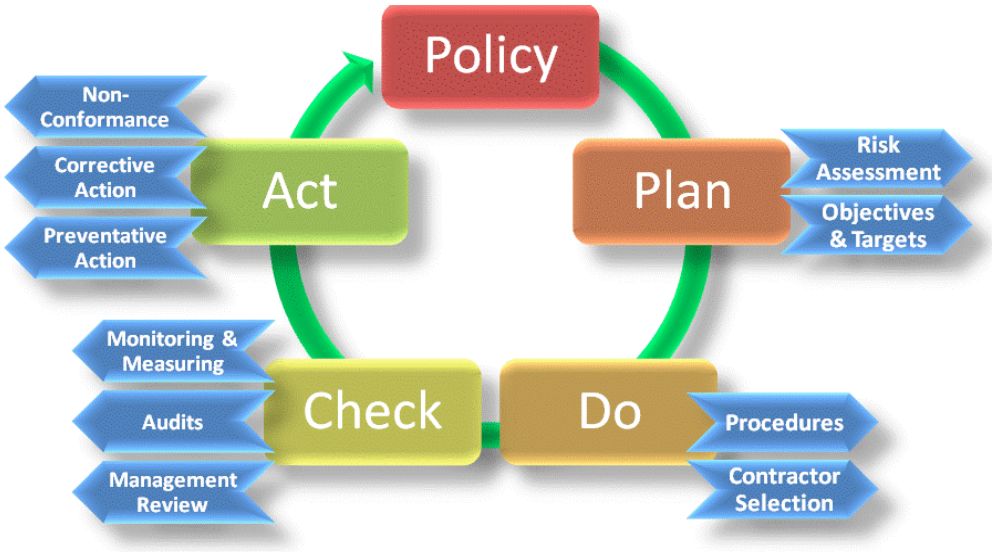


Figure 14.2: The 'Plan, Do, Check, Act' Model

Endeavour uses a focussed arrangement of in-house expertise and contracted services to assist in achieving the aims of its HSE Policy. This arrangement allows Endeavour to concentrate its in-house expertise on core activities and the management of contractors and use the best available contracted service to provide support. Examples of contracted services are as follows:

- **Document Control** – Quality control, version management and archiving are managed on Endeavour's behalf by Wood Group ODL who are recognised as a leading provider of document control services.
- **Training Management System (TMS)** – Endeavour uses Petrofac TMS to manage its training matrices, booking, record keeping and reminder service.
- **Competency Management System (CMS)** – In addition to the provision of TMS services, Endeavour uses Petrofac's Skills XP system to record competence standards and assessments for its staff.
- **Emergency Response Management** – Endeavour uses the services of Petrofac and Oil Spill Response Limited (OSRL) to provide ER resources and management. This allows Endeavour to take advantage of considerable resources and experience gained across the industry.
- **Medical Services** – Abermed provide Endeavour with a range of medical and health services including medical assessment, health promotion and 24 hour medical advice.
- **Drilling Management** – Endeavour uses SPD to provide comprehensive management of the drilling service including well design, service company management, regulatory approvals and day to day management of drilling operations.
- EPC Offshore Limited have been contracted to provide Endeavour with **Project Management Resources and Services.**

14.3 Interface with Contractors and Partners

Contractors' services are procured in accordance with Endeavour's Procurement Framework and audited in accordance with the Endeavour HSEQ management system. Endeavour's procedure for selecting contractors includes an assessment of their environmental management capability and utilises a dedicated Contractor Management and Selection framework.

On vessels associated with decommissioning operations, the appropriate contractor's management system will be the primary tool for managing environmental aspects. Endeavour has a dedicated auditing procedure to ensure that contractors' systems are adequate and consistent with Endeavour's HSEQ policy.

Bridging Documents between Endeavour and their contractors and partners will cover the emergency response interfaces, identify the management structure and division of responsibilities, define the methodology for undertaking the work programme and outline the emergency response procedures during decommissioning. As the owner and licence operator of both the Rubie and Renee Facilities, Endeavour retains an ultimate liability for both the decommissioning of the facilities and the pipelines that remain *in situ* in the seabed.

14.4 Environmental Management Commitments

Endeavour is committed to minimising the environmental impact of its activities. Continuous improvement in environmental performance is sought through effective project planning and implementation, emission reduction, waste minimisation, waste management and energy conservation. Endeavour's commitments for the decommissioning of the Rubie/ Renee Facilities are listed in Table 14.1.

14.5 Environmental Monitoring

Decommissioning operations will be conducted under the relevant licences and permits applied for by Endeavour. Monitoring and reporting to the regulator and internally will be conducted in accordance with relevant legislation and these licences and permits. Additionally, a post-decommissioning seabed monitoring programme will be agreed in consultation with DECC, and implemented and reported in accordance with the programme and Endeavour's HSEQ management system.

Endeavour has arrangements in place for monitoring HSEQ performance and compliance with legislation, company policy, standards and procedures. Two approaches to monitoring are applied: active (providing feedback on performance) and reactive (providing information on incidents, accidents and near misses). Appropriate performance measures will be established for monitoring progress against achievement of defined goals and targets and appropriate arrangements will be in place to ensure the effective collation and reporting of this performance data.

14.6 Performance Monitoring (Inspection, Audit and Corrective Actions)

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 audits.

Table 14.1: Rubie/ Renee Decommissioning Project Commitments

Issue	Commitment	Project Phase	
		Design	Execution
Environmental responsibilities	Key environmental responsibilities, duties, communication, reporting and interface management arrangements of Endeavour and the main contractors involved in the decommissioning activities will be agreed, documented and communicated at the appropriate stages of the project.	✓	✓
EMS	The contractors will have in place an EMS that aligns with the Endeavour EMS.	✓	✓
	Vessels will be subject to audits as part of Endeavour selection and pre-mobilisation and management system requirements.	✓	✓
Delivery of commitments	The commitments made within this ES will be incorporated into operational work programmes, plans and procedures. Programmes will be tracked to ensure that commitments and mitigation measures are implemented throughout the project.	✓	✓
Atmospheric emissions	Vessels will be audited as part of selection and pre-mobilisation.		✓
	Vessels will use ultra low sulphur fuel in line with MARPOL requirements.		✓
	Work programmes will be planned to optimise vessel time in the field.	✓	✓
	Fuel consumption will be minimised by operational practices and power management systems for engines, generators and other combustion plant and maintenance systems.	✓	✓
	All mitigation measures will be incorporated into the contractual documents of any subcontractors.	✓	
Underwater noise	During decommissioning operations, regular observations for marine mammals in the area will be made and the cetacean observation logs made available to JNCC.		✓
	Offshore vessels will avoid concentrations of marine mammals and maintain a steady course and speed when possible.		✓
	The operation of well-maintained equipment during the decommissioning activities will ensure that the noise of operating machinery is kept as low as possible during the decommissioning operations.		✓
	The number of vessels travelling to, or standing by the Rubie/ Renee Fields will be kept to the minimum.		✓
Seabed disturbance	Cutting and lifting operations of subsea equipment will be controlled and any impact on seabed sediment will be minimised.		✓
	Rock-placement will be minimised to reduce seabed footprint and profiled to minimise the risk of snagging to fishing gear.	✓	✓
	Post-removal surveys of the seabed will be carried out to identify significant anomalies and dropped objects.		✓
Societal	Other sea users will be alerted to the decommissioning activities by consultation.	✓	
	Kingfisher alerts, notices to mariners, use of guard vessels, and fisheries liaison officers will be issued, where appropriate.		✓
	A guard vessel will be present to alert third party vessels, where appropriate.		✓

Issue	Commitment	Project Phase	
		Design	Execution
	Over-trawlability tests will be conducted to ensure that fishing gear can readily pass over the rock-placement installed for pipeline protection.		
	The number of vessels travelling to, or standing by the Rubie/ Renee Fields will be kept to the minimum.		✓
Waste	A waste management plan will be developed	✓	✓
	Regular internal and third party audits will be carried out to assess the effectiveness of and conformity to, waste management procedures.		✓
	Staff will undergo appropriate training and will be notified of the segregation and disposal requirements for each category of waste.		✓
Discharges to Sea	The management of ballast water will meet International Maritime Organization (IMO) guidelines.	✓	✓
	Chemical selection will be governed by the Endeavour chemical selection philosophy and in accordance with Offshore Chemicals Regulations 2002 (as amended).	✓	
	Where required, chemicals, fuel and lubrication oil storage areas will be bunded in order to contain drips and spills, and minimise the risk of overboard discharge.		✓
Accidental Spills and Dropped Objects	All efforts will be made to minimise dropped objects lost overboard.		✓
	Surveys will be undertaken to assess the presence and potential recoverability of any lost objects from the Rubie/ Renee Facilities wherever practicable.		✓
	Where possible, dropped objects will be recovered. Should significant dropped objects remain on the seabed, HM Coastguard will be informed immediately of any potential hazard to shipping, and a navigation warning issued.		✓

15.0 CONCLUSIONS

This EIA is an important management tool used to ensure that environmental considerations are incorporated into Endeavour's decommissioning planning and decision making. This ES presents the findings of an EIA which compared and assessed potential options for decommissioning of the Rubie/ Renee Facilities. It provides information for the evaluation of environmental consequences from the proposed activities.

15.1 Key Concerns

Following identification of interactions between the proposed decommissioning activities and the local environment, an assessment of potentially significant environmental impacts, and the stakeholder consultation, the key environmental concerns identified for impact assessment were as follows:

- Effects of energy use and atmospheric emissions (Section 7).
- Effects of underwater noise generated during decommissioning activities (Section 8).
- Effects of seabed disturbance during decommissioning operations (Section 9).
- Effects of physical presence of rock-placement on decommissioned facilities (Section 10).
- Effects of discharges to sea during decommissioning operations (Section 11).
- Non-routine events – spillage of hydrocarbons and other fluids (Section 12).

15.2 Key Sensitivities

The marine environment where the Rubie/ Renee Facilities are located is typical of the central North Sea. While recognising that there are certain times of the year when populations of seabirds, fish spawning and commercial fisheries are vulnerable to oil pollution, the conclusion is that the area is not particularly sensitive to the proposed activities.

There are no known Annex I habitats in the area of the Rubie/ Renee Facilities. Harbour porpoise were the only Annex II species of the Habitats Directive recorded within and around the Rubie/ Renee Facilities. They exhibit very high abundance in July and December, with mid-low abundance during January, February, April, June, August, September and October (UKDMAP, 1998).

15.3 Endeavour's Commitments

Endeavour's mitigation strategies to minimise the impact on the above environmental concerns is in line with current industry best practice. Endeavour have an established EMS which will be used to ensure that the proposed mitigation measures are implemented (Section 14).

The preventative measures proposed should be sufficient to reduce the risk of these unplanned events to a level that is as low as reasonably practicable, or to control and mitigate the effects in the event of their occurrence. Endeavour's commitments for the Rubie/ Renee Facilities Decommissioning project are summarised in Table 14.1.

The overall risk to the environment from both routine and accidental events is therefore considered to be negligible or minor. In addition, incremental cumulative impacts of the activities will be minimal and there will be no transboundary effects. The integrity of statutory conservation sites designated or likely to be designated under the Habitats Directive is not considered to be at risk.

15.4 In Summary

This ES concludes that the environmental risk reduction measures to be taken by Endeavour should provide sufficient safeguards to minimise impact to the local environment. Monitoring during the implementation of these safeguards, including the provision of post- decommissioning surveys of the *in situ* pipelines and umbilicals, will ensure that the commitments made and strategies and control measures employed represent best environmental practice.

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Appendices

Appendix A: Summary of Environmental Legislation

This appendix presents a summary of the key regulatory drivers applicable to the Rubie/ Renee Facilities Decommissioning project as well as the policy, legal, and administrative framework within which this EIA was carried out.

Table A.1: Decommissioning

Regulatory Body	Legislation	Summary of Requirements
DECC, MMO, Marine Scotland	Petroleum Act 1998	The Petroleum Act 1998 sets out requirements for undertaking decommissioning of offshore installations and pipelines including preparation and submission of a Decommissioning Programme.
	Energy Act 2008	Part III of the Energy Act 2008 amends Part 4 of the Petroleum Act 1998 and contains provisions to enable the Secretary of State to make all relevant parties liable for the decommissioning of an installation or pipeline; provide powers to require decommissioning security at any time during the life of the installation and powers to protect the funds put aside for decommissioning in case of insolvency of the relevant party.
	Food and Environment Protection Act 1985 Marine (Scotland) Act 2010 Marine and Coastal Access Act 2009	The Marine and Coastal Access Act (MCAA) and Marine (Scotland) Act will replace and merge the requirements of FEPA Part II (deposits to the sea) and the Coast Protection Act (navigation). FEPA Part II remains in force in Scottish territorial waters to cover reserved activities (within 3 n miles). Many offshore sector activities are exempt from the acts; however certain activities including deposits of substances or articles in the seabed during abandonment and decommissioning operations are covered.
	OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations	Lays down the general principle of forbidding the dumping and the leaving wholly or partly in place of disused offshore installations in the maritime area covered by the OSPAR Convention. The Decision recognises potential difficulties in removing large steel jackets weighing more than 10,000 tonnes and concrete gravity base structures and provides a facility for derogation from the main rule of complete removal such that the option of leaving the jacket footings or concrete structure in place may be considered.
	International Maritime Organisation (IMO) Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone 1989	These Guidelines and Standards represent the "generally accepted international standards" as mentioned in UNCLOS, Article 60, which prescribes that any installations or structures which are abandoned or disused shall be removed to ensure safety of navigation and to prevent any potential effect on the marine environment.
	OSPAR Recommendation 2006/5 on a management scheme for offshore cuttings piles	This recommendation outlines the approach for the management of cuttings piles offshore. The first stage of the Recommendation is to be carried out within two years of the Recommendation coming into effect with the second stage completed in a predetermined timeframe laid out in stage 1. This Recommendation entered into force from 30 June 2006.

Table A.2: General

Regulatory Body	Legislation	Summary of Requirements
Maritime and Coastguard Agency (MCA)	MARPOL 73/78	The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes and covers pollution by oil, chemicals, harmful substances in packaged form, sewage and garbage. The MCA has regulatory authority over those aspects of the offshore oil and gas industry that fall under the MARPOL Convention 73/78, including machinery space discharge, sewage discharges and garbage at sea. The Convention currently includes six technical Annexes: Annex I Regulations for the Prevention of Pollution by Oil (entered into force 2 October 1983) Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force 2 October 1983) Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force 1 July 1992) Annex IV Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003) Annex V Prevention of Pollution by Garbage from Ships (entered into force 31 December 1988) Annex VI Prevention of Air Pollution from Ships (entered into force 19 May 2005)

Table A.3: Environmental Impact Assessment

Regulatory Body	Legislation	Summary of Requirements
DECC	Council Directive on the Assessment of the Effects of Certain Public and Private Activities on the Environment - 85/337/EEC (the EIA Directive) as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC. EC Directive 2012/92/EU on the assessment of the effects of certain public and private projects on the environment	The EIA Directive (85/337/EEC) has been in force since 1985 and applies to a wide range of defined public and private projects, which are defined in Annexes I and II: Annex 1: all projects listed in Annex I are considered as having significant effects on the environment and require a mandatory EIA. Typical projects include, for example: Extraction of petroleum and natural gas for commercial purposes where the amount extracted exceeds 500 tonnes/day in the case of petroleum and 500,000 cubic metres/day in the case of gas. Pipelines with a diameter of more than 800 mm and a length of more than 40 km: for the transport of gas, oil, chemicals; for the transport of carbon dioxide (CO_2) streams for the purposes of geological storage, including associated booster stations. Installations for storage of petroleum, petrochemical, or chemical products with a capacity of 200,000 tonnes or more. The EC Directive 2012/92/EU revokes the 85/337/EEC and 97/11/EC Directives and amends the 2003/35/EC directive. The 2012/92/EU lists two classes of project to which the Directive applies: Annex 1 Projects for which environmental assessment is mandatory; and Annex 2 projects for which EA is discretionary. Under 2012/92/EU, oil and gas developments are listed as Annex 1 projects.

Table A.3 (continued): Environmental Impact Assessment

Regulatory Body	Legislation	Summary of Requirements
	The Offshore Petroleum Production and Pipe-lines (Assessment of Environmental Effects) Regulations 1999 (as amended 2007)	These Regulations implement the EIA Directive with regard to the offshore oil and gas industry. The Regulations require an environmental impact assessment (EIA) and the associated public consultation document (Environmental Statement (ES)) to be submitted for certain projects, these are: Developments which will produce 500 tonnes (approximately 3,750 barrels) or more per day of oil or 500,000 cubic metres or more per day of gas (not including well testing). Pipelines of 800 mm diameter and 40 kilometres or more in length. Other activities are subject to a discretionary process where either an ES or a PON15 (seeking a Direction that an ES is not required) needs to be submitted. Typically this discretionary approval covers: The drilling of all wells Developments, either stand-alone or incremental, producing less than 500 tonnes of oil per day or 500,000 cubic metres of gas per day Construction of pipelines of less than 800 mm diameter and 40 kilometres in length
	OSPAR Recommendation 2010/5 on assessments of environmental impact in relation to threatened and/or declining species and habitats	The purpose of this Recommendation is to support the protection and conservation of species and habitats on the OSPAR List of threatened and/or declining species and habitats, through assessments of environmental impacts of human activities. When assessments of environmental impacts of human activities that may affect the marine environment of the OSPAR (Oslo and Paris Conventions) maritime area are prepared, Contracting Parties should ensure they take account of the relevant species and habitats on the OSPAR List of threatened and/or declining species and habitats (OSPAR Agreement 2008/6).

Table A.4: Territorial Waters

Regulatory Body	Legislation	Summary of Requirements
-	Territorial Sea Act 1987 Territorial Waters Order	Defines the extent of the territorial sea adjacent to the British Islands.

Table A.5: Atmospheric Emissions

Regulatory Body	Legislation	Summary of Requirements
MCA	MARPOL 73/78 Annex VI the Prevention of Air Pollution from Ships	Annex VI is concerned with the control of emissions of ozone depleting substances, NOx, SOx, and VOCs and require ships (including platforms and drilling rigs) to be issued with an International Air Pollution Certificate following survey. This annex set limits on sulphur oxide and nitrogen oxide emissions from ship exhausts as well as particulate matter and prohibit deliberate emissions of ozone depleting substances. Emissions arising directly from the exploration, exploitation and associated offshore processing of seabed mineral resources are exempt from Annex VI, including the following: emissions resulting from flaring, burning of cuttings, muds, well clean-up emissions and well testing; release of gases entrained in drilling fluids and cuttings; emissions from treatment, handling and storage of reservoir hydrocarbons; and emissions from diesel engines solely dedicated to the exploitation of seabed mineral resources.
DECC	The National Emission Ceilings Regulations 2002	There regulations transpose EC Directive on national emission ceilings for certain atmospheric pollutants 2001/81/EC into UK law and set national ceilings and a requirement for the development of a reduction programme for SOx, NOx and VOCs and set out the UK government commitment for achieving a reduction of atmospheric emissions by 2010 and thereafter not to exceed the amounts specified in the Schedule of that pollutant.
	The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008 (as amended 2010) Directive 2012/33/EU (amending Directive 1999/32/EC)	These regulations implement Annex VI of MARPOL (the International Convention for the Prevention of Pollution from Ships 73/78) in the UK. The 2010 Amendments primarily implement provisions concerning the sulphur content of marine fuels contained in Council Directive 1999/32/EC. The Directive sets maximum sulphur content for fuel including heavy fuel oil and gas oil including marine fuel.
	Climate Change Act 2008 Climate Change (Scotland) Act 2009	The Act sets up a framework for the UK to achieve its long-term goals of reducing greenhouse gas emissions and to ensure actions are taken towards adapting to the impact of climate change. The Act enables a number of elements, including amongst others; setting medium and long-term emissions reduction targets in statute, introduction of a system of carbon budgeting which constrains the total amount of emissions in a given time period, a new reporting framework for annual reporting of the UK's greenhouse gas emissions, creation of an independent advisory body (the Committee on Climate Change). As a result of the Act and the 2009 Order, the current legally-binding targets for the net UK carbon account are: 34% reduction by 2020 and 80% reduction by 2050, against a 1990 baseline.

Table A.5 (continued): Atmospheric Emissions

Regulatory Body	Legislation	Summary of Requirements
DECC	Offshore Combustion Installations (Prevention and Control of Pollution) Regulations 2001 as amended by: Energy Act 2008 (Consequential Modifications) (Offshore Environmental Protection) Order 2010) EU Emissions Trading Scheme (EU Directive 2003/87/EC) UK Emissions Trading Scheme as amended Offshore Combustion Installations (Prevention and Control of Pollution) (Amendment) Regulations 2007 EC Directive 2010/75/EU (Industrial Emissions Directive)	These regulations implement Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC) in the context of offshore oil and gas combustion installations. The aim of IPPC is to consider environmental impacts holistically and to achieve a higher level of environmental protection. The Regulations apply only to combustion installations with a combined rated thermal input exceeding 50 MW(th) and a PPC Permit will be required in order to operate a qualifying offshore installation. The permit will be granted with conditions that include provisions based on best available techniques, emission limits, and monitoring requirements. The 2007 Amendment Regulations implement the amendments made to EC Directive 96/61 by the Public Participation Directive 2003/35/EC and bring in tighter requirements for public consultation as part of the permit application process. The Council Directive 96/61/EC is now replaced by the Industrial Emissions Directive (EC Directive 2010/75/EU). However the new directive has not yet been implemented in the UK. The Industrial Emissions Directive came into force on 6 January 2011 and merges seven directives into one including the Integrated Pollution Prevention and Control (IPPC) Directive and Large Combustion Plant (LCP) Directive. The main thrust of the directive is to increase the use of "best available techniques" (BATs), an obligation to ensure that industrial operators use the most cost-effective techniques to achieve a high level of environmental protection. Member States have 2 years in which to implement the Directive into national legislation.
	The Fluorinated Greenhouse Gases Regulations 2009	The objective of these Regulations is to reduce the emissions of fluorinated gases including hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride as covered by the Kyoto Protocol. These gases have been developed to replace ozone depleting substances such as CFCs and HCFCs but are long-lived powerful greenhouse gases. The Regulations include requirements on the leakage detection and labelling requirements of systems such as refrigeration systems, air-conditioning units and heat pumps that use these gases. Fluorinated gases are also used for fire fighting offshore
	The Ozone Depleting Substances (ODS) Regulation 2013	Revised regulation in February 2013 is based on the 2011 regulations, which revoke and replace the previous regulations. These Regulations make provision in the UK for EC Regulation 1005/2009 which controls the production, impact, export, placing on the market, recovery, recycling, reclamation and destruction of substances that deplete the ozone layer.

Table A.5 (continued): Atmospheric Emissions

Regulatory Body	Legislation	Summary of Requirements
	Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. The Greenhouse Gas Emissions Trading Scheme Regulations 2005 (as amended) The Carbon Accounting Regulations 2009	The European Union Emissions Trading Scheme (EU ETS) is one of the primary drivers for reducing carbon dioxide emissions within the EU by introducing a cost element. A permit to emit greenhouse gases (at present only carbon dioxide) must be obtained for qualifying installations – for the upstream oil & gas industry, this applies to stationary installations with a combined rated thermal input of >20 MW(th) and flaring. In practice this generally means that production platforms will require a permit whereas mobile drilling units are at present exempt. The Regulations are being implemented in stages; Phase I has been implemented and Phase II is currently in operation. Phase III will be in force during 2013-2020. Amended regulations came in force on 1 January 2013, replacing the Greenhouse Gas Emissions Trading Scheme Regulations 2005. These Regulations implement the Directive 2003/87/EC.
DECC	The Greenhouse Gas Emissions Data and National Implementation Measures Regulations 2009 EU Decision 2011/278/EU on determining the transitional EU wide rules for the harmonised free allocation of emission allowances in accordance with Article 10a of the EU ETS Directive Commission Regulation (EU) No: 1210/2011 concerning the auctioning of EU ETS allowances Commission Regulation (EU) No: 1193/3011 concerning the establishment of a single Union wide EU ETS Registry	Allowances for existing operators under Phase III have been notified following an extensive data collection and benchmarking exercise. As of 30 June 2011, all other applicants will now need to apply through the New Entrants Reserve (NER). Installations that have entered under Phase I or Phase II will already have new allocations issued under Phase III. There are two phases to NER applications: Phase 1 - before "normal" operations - allocations based on independently verified emissions; and Phase 2 - after start of "normal" operations - allocations based on average of two months of highest activity in a 90 day period after start of "normal" operations x 12. Normal operations are defined as a continuous 90 day period of operating at a minimum of 40% of design capacity.

Table A.6: Access to Environmental Information and Public Participation

Regulatory Body	Legislation	Summary of Requirements
DECC	Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC The Environmental Information (Scotland) Regulations 2004	This Directive transposes the first pillar of the Aarhus convention on access to information into EU legislation. This Directive requires all public authorities to provide members of the public with access to environmental information, and to actively disseminate the environmental information they hold. The information must be provided to any person at their request, without them having to prove an interest and at the latest within two months of the request being made. The Directive is implemented in Scotland by The Environmental Information (Scotland) Regulations 2004.
	Public Participation Directive (PPD) 2003/35/EC	Provides for public participation in the preparation of environmental plans, programmes and projects with significant environmental impacts. See section on environmental impact assessment.

Table A.7: Conservation and Biodiversity

Regulatory Body	Legislation	Summary of Requirements
DECC, JNCC, SNH, DEFRA	The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 as amended	These Regulations make provision for implementing the Birds Directive and Habitats Directive in relation to marine areas where the United Kingdom has jurisdiction beyond its territorial sea. The Regulations make provision for the selection, registration and notification of sites in the offshore marine area (European Offshore Marine Sites) and for the management of these sites. Competent authorities are required to ensure that steps are taken to avoid the disturbance of species and deterioration of habitat in respect of the offshore marine sites and that any significant effects are considered before authorisation of certain plans or projects. Provisions are also in place for issuing of European Protected Species (EPC) licences for certain activities and for undertaking monitoring and surveillance of offshore marine sites. The Amendment Regulations make various insertions for new enactments (e.g. new Birds Directive) and also devolve certain powers to Scottish Ministers. Most recent amendments to the 2007 and 2010 regulations are: The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2011 The Conservation of Habitats and Species (Amendment) Regulations 2011.
	The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 as amended 2007	Secretary of State set out these Regulations to consider whether a “Habitats Regulatory Assessment” should be undertaken prior to granting a licence under the Petroleum Act 1998. Habitats Regulatory Assessment is the formal assessment by the Competent Authority of the impacts of a plan or project on the integrity of (a) Natura 2000 site(s). Habitats Regulatory Assessment is a process separate from the EIA requirements, but which should run alongside and concurrently with the EIA requirements. The 2007 amendments also extend this requirement to all UK waters. These regulations implement European Directives for the protection of habitats and species in relation to oil and gas activities carried out in whole or in part on the UKCS. In particular these are the Council Directive 92/43 on the conservation of natural habitats, wild fauna and flora and Council Directive 79/409 on the conservation of wild birds. The 2007 amendments extend the requirements to all UK waters.
	Marine and Coastal Access Act 2009 Marine (Scotland) Act 2010 Marine Licensing (Exempted Activities) (Amendment of the Marine Licensing (Exempted Activities) Order 2013	These two Acts introduce a framework for the development of a new planning system for the marine area and ensure greater protection for the marine environment and biodiversity. However, oil and gas activities are generally exempted from the Act(s) since an environmental regime/regulator is already in place under DECC. The Act(s) will apply to a number of activities e.g: removal of materials from the seabed (including structures), deposit of materials during decommissioning, disturbance of the seabed, use of explosives and installation of certain types of cables. DECC will retain responsibility for offshore installation enforcement activities, and the Marine Management Organisation & Devolved Authorities will take responsibility for "at sea" enforcement of oil and gas activities. The Amendment Order details a number of activities exempt from the requirement for a MCAA licence.
	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

Table A.8: Emergency Response

Regulatory Body	Legislation	Summary of Requirements
DECC	The Offshore Installations (Emergency Pollution Control) Regulations 2002	The Regulations give the Representative of the Secretary of State for Energy and Climate Change (SOSREP) powers to intervene in the event of an incident involving an offshore installation where there is, or may be, a risk of significant pollution, or where an operator is failing or has failed to implement effective control and preventative operations.
	The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended 2011)	Under these Regulations, it is an offence to make an unlawful release of oil, i.e. a release of oil other than in accordance with the permit granted under these Regulations for oily discharges (e.g. produced water etc.). However, it will be a defence to prove that the contravention arose because of something that could not have been reasonably prevented, or that it was due to something done as a matter of urgency for the purposes of securing the safety of any person. PON 1 reporting.
	Merchant Shipping Act 1995	The Merchant Shipping Act 1995 implements in the UK the OPRC Convention. The aim of the OPRC Convention is to increase the level of effective response to oil pollution incidents and to promote international co-operation to this end. The Convention applies to ships and offshore installations and requires operators to have in place Oil Pollution Emergency Plans (OPEP), which are approved by the body that is the National Competent Authority for the Convention.
	The Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation) Regulations 1998 (as amended 2001)	The Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998 introduce into UK law the oil spill planning requirements and legal oil spill reporting requirements of the OPRC Convention.

Table A.9: Environmental Liability

Regulatory Body	Legislation	Summary of Requirements
SEPA, MS and SNH	Directive 2004/35/EC of the European Parliament and the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.	The Environmental Liability Directive enforces strict liability for prevention and remediation of environmental damage to 'biodiversity', water and land from specified activities and remediation of environmental damage for all other activities through fault or negligence. The EC has published a communication (the Communication) on "facing the challenge of the safety of offshore oil and gas activities". The European Commission is set to review the liability regime applicable to offshore petroleum activities and is: proposing amendments to the Environmental Liability Directive (2004/35/EC, as amended by Directive 2006/21/EC) so that it covers environmental damage to all marine waters (as defined in the Marine Strategy Framework Directive 2008/56/EC); re-considering introducing a mandatory requirement for operators to provide financial security in the event that a major accident occurs; and considering, in a guidance document interpreting existing legislation, the applicability of the Waste Framework Directive (2008/98/EC) to oil spills
	The Environmental Liability (Scotland) Regulations 2009 as amended 2011	These Regulations implement the EC Environmental Liability Directive in Scotland. The regulations oblige operators of certain activities to take preventative measures where there is an imminent threat of environmental damage, and to remediate any environmental damage caused by their activities.

Table A.10: Chemicals, drainage and oily discharges

Regulatory Body	Legislation	Summary of Requirements
DECC, Marine Scotland, CEFAS	The Offshore Chemicals Regulations 2002 (as amended 2011)	The Offshore Chemicals Regulations 2002 implement the OSPAR Decision (2000/2) and OSPAR Recommendations (2000/4 and 2000/5) introducing a Harmonised Mandatory Control System for the use and reduction of the discharge of offshore chemicals. The Regulations introduced a permit system for the use and discharge of chemicals offshore and include a requirement for site specific risk assessment. Chemicals used offshore must be notified through the Offshore Chemical Notification Scheme (OCNS) and chemicals are ranked by hazard quotient, using the CHARM model. Applications for permits are made via the submission of the relevant PON15 (i.e. chemicals for drilling: PON 15B; pipelines: PON 15C; production: PON 15D; decommissioning: PON 15E; and workovers and well interventions: PON 15F). Amendments in 2011 to the Offshore Chemicals Regulations and the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2010. The principal aim is to make unlawful unintentional releases of chemicals and oil that arise through accidents / non-operational discharges by broadening accordingly the definitions of "offshore chemical" and "discharges" and incorporating a new concept of "release".
	Convention for the Protection of the Marine Environment of the North East Atlantic 1992 (OSPAR Convention) OSPAR Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings OSPAR Recommendation 2006/5 on a Management Regime for Offshore Cuttings Piles.	The OSPAR Convention (in particular Annex III) is the main driver for reductions in oily discharges to the North Sea. The UK as a contracting party to the Convention is therefore obliged to implement any Decisions and Recommendations made by the Commissions. Certain decisions made under the earlier Paris Convention also still stand. OSPAR Decision 2000/3 that came into effect on 16 January 2001 effectively eliminates the discharge of organic phase fluids (OPF) (oil based (OBF) or synthetic based (SBF) drilling fluids) or cuttings contaminated with these fluids. Use of OPF is still allowed provided total containment is operated. The use of diesel-oil-based drilling fluids is prohibited. The discharge of whole OPF to the sea is prohibited. The mixing of OPF with cuttings for the purpose of disposal is not acceptable. The discharge of cuttings contaminated with oil based fluids (OBF) (includes OBF and SBF) greater than 1% by weight on dry cuttings is prohibited. The use of OPF in the upper part of the well is prohibited. Exemptions may be granted by the national competent authority for geological or safety reasons. The discharge into the sea of cuttings contaminated with synthetic fluids will only be authorised in exceptional circumstances. Authorisations to be based on the application of BAT/BEP. Best Available Techniques described within the Decision include recycling, recovery and reuse of muds. The OSPAR 2006/5 Recommendation sets out measures to reduce pollution from oil or other chemicals from cuttings piles.
	The Merchant Shipping (Prevention of Oil Pollution) Regulations 1996 (as amended)	These Regulations give effect to Annex I of MARPOL 73/78 (prevention of oil pollution) in UK waters and have been amended by the Merchant Shipping (Implementation of Ship-Source Pollution Directive) Regulations 2009 described above. They address oily drainage from machinery spaces on vessels and installations. The North Sea is designated a “Special Area”, within which the limit for oil in discharged water from these sources is 15ppm. Vessels and installations are required to hold a valid UKOPP (UK Oil Pollution Prevention) or IOPP (International Oil Pollution Prevention Certificate). Vessels and drilling rigs are also required to hold a current, approved Shipboard Oil Pollution Emergency Plan (SOPEP) which is in accordance with guidelines issued by the Marine Environment Protection Committee of the International Maritime Organisation (IMO).

Table A.10 (continued): Chemicals, drainage and oily discharges

Regulatory Body	Legislation	Summary of Requirements
DECC, Marine Scotland, CEFAS	Merchant Shipping Act 1995 International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78	Arrangements for Survey and Certification Part VI of the Merchant Shipping Act, 1995 makes provision for the prevention of pollution from ships. It implements in the UK the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78. MARPOL defines ships to include offshore installations and relevant provisions of MARPOL are applied to offshore installations. Annex 1 of MARPOL relates to prevention of oil pollution and has provisions for machinery space drainage that are applied to offshore platforms: Vessels of 400 GT or above (which includes FSU) are permitted to discharge processed water (i.e. Oily Drainage Water) from Machinery Space Drainage as long as the oil content without dilution, does not exceed 15 ppm of the oil in water.
	PARCOM Recommendation 86/1 of a 40 mg/l Emission Standard for Platforms	The PARCOM Recommendation 86/1 provision of a 40 mg/l performance standard for platforms is applicable, and remains in force for discharges of displacement water, drainage water and ballast water, which are not covered under MARPOL. The maximum concentration of dispersed oil must not exceed 100 mg/l at any time.
	The REACH Enforcement Regulations 2008	These enforce Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) which require chemical users to demonstrate the safe manufacture of chemicals and their safe use throughout the supply chain. Under REACH, the users of chemicals as well as their manufacturers and importers have a responsibility to ensure that the risks to both human health and the environment are adequately assessed.
	The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended 2011)	These Regulations replaced the Prevention of Oil Pollution Act 1971 (“POPA”) and are a mechanism to continue implementation on the UKCS of OSPAR Recommendation 2001/1. Discharges of reservoir oil associated with drilling from a floating storage unit (FSU) must be covered by an OPPC Term Permit, whereas discharges from a production installation are covered by an OPPC Life Permit. Operators are required to regularly report actual oil discharge in order that adequate monitoring can be achieved. These regulations do not apply to those discharges regulated under the Offshore Chemicals Regulations 2002, the Merchant Shipping (Prevention of Oil Pollution) Regulations 1996 (as amended) or the Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008. Amendments in 2011, via the Offshore Chemicals Regulations and the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2010 introducing new concept of “release “ and “ offshore installation” which encompasses all pipelines . The concentration of dispersed oil in produced water discharges as averaged over a monthly period must not exceed 30 mg/l, whereas the maximum permitted concentration must not exceed 100 mg/l at any time. The quantity of dispersed oil in produced water discharged must not exceed 1 tonne in any 12 hour period.

Table A.11: Waste handling and disposal

Regulatory Body	Legislation	Summary of Requirements
EA/ SEPA	International Convention for the Prevention of Pollution from Ships (MARPOL) 1973 Annex V, as amended	Annex V: Prevention of pollution by garbage from ships (entered into force December 1998). Deals with the different types of garbage and specifies the distances from land and the manner in which they may be disposed of. The Annex also designates Special Areas (including the North Sea) where the disposal of any garbage is prohibited except food wastes. The dumping of plastics at sea is also prohibited by this Annex.
	Environmental Protection Act 1990	This Act, and associated regulations, introduces a "Duty of Care" for all controlled wastes. Waste producers are required to ensure that wastes are identified, described and labelled accurately, kept securely and safely during storage, transferred only to authorised persons and that records of transfers (waste transfer notes) are maintained for a minimum of two years. Carriers and waste handling sites require licensing. This Act and associated Regulations brought into effect a system of regulation for "controlled waste". Although the Act does not apply to offshore installations, it requires operators to ensure that offshore waste is handled and disposed of onshore in accordance with the "Duty of Care" introduced by the Act.
	Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. The Waste (Scotland) Regulations 2011	The European Parliament introduced a new Directive, 2008/98/EC, on waste and repealing certain Directives. The Directive lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving efficiency of such use. The 2011 Scotland Regulations make a number of amendments to a variety of Scottish waste legislation to transpose aspects of Directive 2008/98/EC on waste into Scottish law.
	The Environment Protection (Duty of Care) Regulations 1991	Under these Regulations any person who imports, produces, carries, keeps, treats or disposes of Controlled Waste has a duty to take all reasonable steps to ensure that their waste is handled lawfully and safely. Special/Hazardous Waste is a sub-category of Controlled Waste (see also Special Waste Regulations).
	The Controlled Waste Regulations 1992 (as amended)	This legislation does not strictly apply offshore. However, because the offshore disposal of garbage is prohibited then all wastes must be transferred to shore for disposal. Once onshore, the wastes must meet the requirements of onshore legislation when being disposed of. These regulations must therefore be considered offshore to allow onshore requirements to be met, for example the identification and appropriate documentation of these wastes. These regulations define household, industrial and commercial waste for waste management licensing purposes.
Marine Scotland	Food and Environment Protection Act 1985	A licence is required under FEPA for any waste disposal in the sea or under the seabed. However, the Deposits in the Sea (Exemptions) Order 1985 exempts from FEPA licensing the deposit on site or under the seabed of any chemicals and drill cuttings. However, export of cuttings to another field for re-injection will require a licence under FEPA.
	The Merchant Shipping (Implementation of Ship-Source Pollution Directive) Regulations 2009	These Regulations implement Directive 2005/35/EC of the European Parliament and of the Council of 7th September 2005 on ship-source pollution and on the introduction of penalties for infringements. The Directive aims to achieve better enforcement of the requirements of the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL 73), as modified by the Protocol of 1978 (MARPOL 73/78).

Table A.11 (continued): Waste handling and disposal

Regulatory Body	Legislation	Summary of Requirements
SEPA	The Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008 (as amended 2010)	These Regulations implement the requirements of MARPOL 73/78 Annex IV in the UK and apply to vessels including fixed or floating platforms which operate in the marine environment and came into force on 01 February 2009. They lay out the requirements for sewage system surveys and certification and the requirements of sewage systems with an exception for fixed installations at a distance of more than 12 nautical miles from the nearest land. They also identify the requirements for a garbage management plan, garbage record books and prohibit the disposal of various types of garbage into the marine environment and define enforcement action. The 2010 Amendments correct drafting errors.
	The Special Waste Regulations 1996 as amended	These Regulations make provision for handling special waste and for implementing Council Directive 91/689/EEC of 12 December 1991 on hazardous waste. The Regulations require controlled wastes that are also considered to be special wastes because of their hazardous properties, to be correctly documented, recorded and disposed of at an appropriately licensed site. Whilst strictly speaking the Regulations do not apply offshore, waste consignments must be compliant as soon as the waste is offloaded at an onshore facility. In Scotland, The Special Waste Amendment (Scotland) Regulations 2004 amend the Special Waste Regulations 1996. They implement the revised European hazardous waste list, (incorporated into the European Waste Catalogue). They introduced new consignment note, segregation, packaging and labelling requirements. In England and Wales the Special Waste Regulations 1996 were repealed by The Hazardous Waste (England and Wales) Regulations 2005.

A.12: Low specific activity (LSA) contaminated waste (sand, sludge and scale) and Radioactive waste

Regulatory Body	Legislation	Summary of Requirements
SEPA	Radioactive Substances Act 1993 The Environmental Permitting (England and Wales) Regulations (as amended)	Onshore and offshore storage and disposal of naturally occurring radioactive materials (NORM) is regulated under the Radioactive Substances Act. Operators are required to hold, for each relevant installation, an Authorisation to store and dispose of radioactive waste such as low specific activity scale (LSA) which may be deposited in vessels and pipework. The authorisation specifies the route and methods of disposal. Records of disposal are required. The offshore use, storage and disposal of radioactive sources are regulated under the same legislation. A Registration Certificate is required to keep; transport and use sources and records must be kept. Additionally, different radionuclides have different activity thresholds over which the containing sources qualify as a High Activity Sealed Source (HASS). As of January 2008, and if applicable, HASS records must be reported to SEPA or the EA and maintenance of an inventory is required.
	The Radioactive Substances Act 1993 Amendment (Scotland) Regulations 2011	The Radioactive Substances Act 1993 has been superseded by the Environmental Permitting (England and Wales) Regulations 2010 in England and Wales but it has remained in place in Scotland. However, in Scotland there have also been consultations regarding a future exemptions regime under The Radioactive Substances Act 1993. These consultations have resulted in the Radioactive Substance Exemption (Scotland) Order 2011. This order will revoke and replace a series of exemption orders (in Scotland) made under the Radioactive Substances Act 1993 ("the Act") and its predecessor (the Radioactive Substances Act 1960) in order to rationalise the current system of exemptions and bring it into line with the structure and terminology used in the Basic Safety Standards Directive.

Table A.13: Environmental Management Systems

Regulatory Body	Legislation	Summary of Requirements
DECC	OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems by the Offshore Industry	All Operators controlling the operation of offshore installations on the UKCS are required to have in place an independently verified Environmental Management System designed to achieve: the environmental goals of the prevention and elimination of pollution from offshore sources and of the protection and conservation of the maritime area against other adverse effects of offshore activities and to demonstrate continual improvement in environmental performance. OSPAR recognises the ISO 14001: 2004 & EMS international standards as containing the necessary elements to fulfil these requirements. All operators are also required to provide a public statement of their environmental performance on an annual basis.

A.14: Licensing

Regulatory Body	Legislation	Summary of Requirements
DECC Marine Scotland	Petroleum Act, 1998 as amended The Petroleum Licensing (Exploration and Production) (Seaward and Landward Areas) Regulations 2004 (as amended 2006) The Petroleum Licensing (Production) (Seaward Areas) Regulations 2008	These Regulations consolidate with amendments the provisions of the Petroleum (Production) Regulations 1982 (as amended) in relation to (a) applications to the Secretary of State for petroleum production licences in respect of seaward areas and (b) applications to the Secretary of State for petroleum exploration licences in respect of seaward areas and landward areas below the low water line. This Act vests all rights to the nation's petroleum resources to the Crown and provides the basis for granting licences to explore for and produce oil and gas. Production licences grant exclusive rights to the holders to “search and bore for and get petroleum” in specific blocks. Licences generally contain a number of environmental restrictions and conditions. Under the terms of a Licence, licence holders require the authorisation of the Secretary of State prior to conducting activities such as installing equipment or drilling of wells in the licence area. Consent to flare or vent hydrocarbons is also required from DECC under the terms of the Model Clauses incorporated into Production Licences. Licence conditions will include environmental issues e.g. time constraints in sensitive areas. The model clauses of the licence require the licensee to appoint a fisheries liaison officer.
	UK Marine & Coastal Access Act 2009	The UK Marine & Coastal Access Act has gained Crown Assent, thus becoming an Act of Parliament and entering UK law. The Act provides executive devolution to Scottish Ministers of the new marine planning and conservation powers in the offshore region (12-200 nautical miles), coinciding with the existing executive devolution of marine licensing. The Scottish Bill will legislate for marine planning, licensing and conservation activities in the inshore region.

Table A.15: Ballast water

Regulatory Body	Legislation	Summary of Requirements
MCA	International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management - BWM) – adopted 2004	Objective to prevent, minimise and ultimately eliminate the transfer of harmful aquatic organisms and pathogens though control and management of ships' ballast water and sediments. Helsinki and OSPAR Commissions General Guidance on the Voluntary Interim has set out an application of the D1 Ballast Water Exchange Standard. Under this regulation, all tankers > 150 GRT and all ships > 400 GRT in the UK are required to have in place United Kingdom Oil Pollution Prevention Certificate (UKOPP) or IOPP Certificate and Ballast Water Exchange Management plan. It is required all vessels entering the North East Atlantic to exchange the ballast water at least 200 nmiles from the nearest land and at least 200 metres deep.

A.16: Transboundary Impacts

Regulatory Body	Legislation	Summary of Requirements
DECC	Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)	The 1991 UNECE Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention) requires any country that has ratified the convention to consider the transboundary environmental effects of industrial projects and activities, including offshore hydrocarbon exploration and productions activities. The Convention requires that if the activity is found to cause a significant adverse transboundary impact then the party undertaking the activity shall, for the purpose of ensuring adequate and effective consultations, notify any potentially affected country as early as possible.

A.17: Location of Structures

Regulatory Body	Legislation	Summary of Requirements
DECC	Coast Protection Act 1949 (as extended by the Continental Shelf Act 1964) Energy Act 2008	This Act provides that where an obstruction or danger to navigation is caused, or is likely to result, the prior written consent of the Secretary of State is required for the citing of the offshore installation - whether mobile or permanent - in any part of the UK designated areas of the Continental Shelf. In practice, this means that consent must be obtained for each drilling operation and for all offshore production facilities. The issuing of 'consent to locate' under the Coast Protection Act Regulations 1949 section 34, part II, to an individual or organisation and provides an indication that impacts have been considered with respect to navigation, the local habitat within the proposed area and that no significant impacts would occur as a consequence of the proposed offshore installation The 1949 Act was extended by Section 4 (1) of the Continental Shelf Act 1964 to all parts of the UK Continental Shelf where oil and gas exploration and development is taking place. The provisions of the Coast Protection Act were transferred to the Energy Act 2008 Part 4A by the Marine Coastal Access Act 2009 (MCAA) and Marine Scotland Act 2010 (MSA) to cover navigation considerations relating to exempted exploration or production/storage operations. Consent to locate provisions of the Energy Act Part4A came into force in April 2011. On 11th October 2012 DECC launched its consultation on the Part 4A consenting provisions, which will provide an opportunity to update the Coast Protection Act regime currently being implemented on behalf of the Department of Transport. The consultation closing date was the 30th November 2012.
	Continental Shelf Act 1964	This act extends the UK government's right to grant licences to explore and exploit the UKCS.
	The Continental Shelf (Designation of Areas) (Consolidation) Order 2000	This Order consolidates the various Orders made under the Continental Shelf Act 1964 which have designated the areas of the continental shelf within which the rights of the United Kingdom with respect to the sea bed and subsoil and their natural resources are exercisable
	Marine and Coastal Access Act 2009 and Marine (Scotland) Act 2010	The Marine and Coastal Access Act (MCAA) and Marine (Scotland) Act will replace and merge the requirements of FEPA Part II (deposits to the sea) and the Coast Protection Act 1949 (navigation). The licensing provisions of these Acts enter into force in April 2011. See also Marine & Coastal Access Act 2009 & The Marine (Scotland) Act 2010.

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APPENDIX B: NON-SIGNIFICANT IMPACTS

This Appendix provides the justification for the environmental risks that were considered to be "low" during the Environmental Risk Assessment (Section 6) and were excluded from further investigation within the main Environmental Statement.

Table B.1. Justification for the exclusion of non-significant (low risk) environmental effects from further investigation in the decommissioning EIA: Surface-laid seabed infrastructure.

Aspect	Environmental Impact or Risk	Proposed Control and Mitigation	Justification
Surface laid seabed infrastructure: Planned operations			
• Disconnect jumpers between seabed infrastructure. • Unlatch wellheads from casing and lift to surface. • Retrieval of mattresses to surface vessel. • Retrieval of jumpers to surface vessel.	• Disturbance to seabed, sediments, benthos, fish and shellfish. • Some associated deterioration of water quality. • Potential for debris to remain on the seabed.	• Post-decommissioning a debris survey will be undertaken to remove any objects remaining on the seabed.	• The area of seabed that will be disturbed as a result of decommissioning activities will be localised and very small. Re-colonisation will occur after operations had ceased.
Surface laid seabed infrastructure: Planned End-points			
• Re-use or recycling of jumpers • Recycling of RPM, COS and wellheads • Small amounts of material recycled	• Reuse beneficial to other commercial users of the land and removes the impact of gaseous emissions during recycling. • Temporary disruption to local communities and other commercial users of the land.	• Materials are re-used where possible	• Strict compliance with legislation on wastes and emissions. • Any disruptive impacts will be temporary.
• ***Surface laid seabed infrastructure: Unplanned Operations***			
• Removing of dropped objects	• Disturbance to seabed, water quality and benthos. • Potential obstruction to commercial fishing	• Adherence to lifting and handling procedures and use of certified equipment for lifting.	• Major items will be recovered from the seabed, therefore no long term impact would be anticipated.

Aspect	Environmental Impact or Risk	Proposed Control and Mitigation	Justification
	and other commercial users of the sea.	• Requirement to retrieve major items of debris from the seabed after operations, in compliance with relevant legislation.	• Loss of individual hand-tools and other minor items of equipment will not constitute a threat to species, habitats or fishing.

Table B.2. Justification for the exclusion of non-significant (low risk) environmental effects from further investigation in the decommissioning EIA: Leaving the buried pipeline *in situ*

Aspect	Environmental Impact or Risk	Proposed Control and Mitigation	Justification
Leaving the buried pipelines and umbilicals in situ: Planned operations			
• Subsea cutting of pipelines	• Disturbance to sediments and potential for debris to remain on the seabed. • Temporary deterioration of the water quality • Potential effect on benthos, finfish, shellfish and sea mammals.	• Post-decommissioning a debris survey will be undertaken to remove any objects remaining on the seabed.	• The area of seabed that will be disturbed as a result of decommissioning activities will be localised and very small. Re-colonisation will occur after operations had ceased. • Any deterioration of water quality will be short-term.
Leaving the buried pipelines in situ: Unplanned End-points			
• Offshore mitigation activities (rock placement/ cut and lift)	• Disturbance to seabed, sediments, benthos, fish and shellfish. • Some associated deterioration of water quality. • Possible obstruction to fishing/ snagging hazard. • Potential obstruction to commercial shipping and other users of the sea from activities.	• Adherence to lifting and handling procedures and use of certified equipment for lifting. • Requirement to retrieve major items of debris from the seabed after operations or deposit rock on the seabed, will be undertaken in compliance with relevant legislation.	• The area of seabed that will be disturbed as a result of decommissioning activities will be localised and very small. Re-colonisation will occur after operations had ceased. • During operations there will be a temporary loss of a very small area for fishing and navigation. However, the potential area that will be affected by the physical presence of the vessels will be insignificant and the effects will be transitory.

Table B.3. Justification for the exclusion of non-significant (low risk) environmental effects from further investigation in the decommissioning EIA: Removal of surface laid flowlines

Aspect	Environmental Impact or Risk	Proposed Control and Mitigation	Justification
Removal of surface laid flowlines: Planned End-points			
• Recycling of flowlines	• Re-use is beneficial to other commercial users of the sea and removes the impact of gaseous emissions during recycling	• Materials are re-used where possible	• Strict compliance with legislation on wastes and emissions. • Impact could be beneficial if materials are re-used
• Seabed recovers to natural state	• Beneficial to seabed sediments and benthos	• N/A	• Recovery of the seabed only has short-term beneficial impacts
Removal of surface laid flowlines: Unplanned operations			
• Spillage of chemicals	• Some associated deterioration of water quality. • Disturbance to benthos, plankton, fish and shellfish. • Temporary disruption to commercial fishing, shipping, and other users of the land.	• All chemicals will be risk-assessed and presented in the appropriate permit for statutory approval from the DECC. • Chemicals will be selected in order to minimise hazards to the environment in accordance with Offshore Chemicals Regulations 2002 (as amended).	• Chemicals will have been approved by the DECC and risk assessments will indicate the potential for any environmental impact. • Discharges will be rapidly dispersed and diluted in the offshore environment and will not be expected to significantly impact the benthos, water column or fish. • The quantity used will be minimised as far as practicable.

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APPENDIX C: ENERGY AND EMISSIONS FACTORS

Table C1: Energy consumption and gaseous emissions factors used in the calculations for the recycling of materials

Material	Energy consumption (GJ/tonne)	Gaseous emissions (tonnes)				Source*
		CO_2	NO_x	SO_2	CH_4	
Standard steel	9	960	1.6	3.8	ND	IoP (2000)
Aluminium	15	1,080	1.3	17	ND	IoP (2000)
Copper	25	300	ND	120	ND	IoP (2000)
Zinc	10	480	ND	ND	ND	University of Bath (2008)
Plastics*	20	693	ND	ND	ND	Harvey (2010); DEFRA/ DECC(2011)

* Mid range energy consumption for 'Plastics' from Harvey (2010); CO_2 expressed as CO_2 equivalent emissions from open loop manufacture of plastics from recycled and raw materials from DEFRA/DECC (2011)

Table C2: Energy consumption and gaseous emissions factors used in the calculations for the new manufacture of materials

Material	Energy consumption (GJ/tonne)	Gaseous emissions (tonnes)				Source*
		CO_2	NO_x	SO_2	CH_4	
Standard steel	25.0	1,889	3.5	5.5	ND	IoP (2000)
Aluminium	215.0	3,589	4.1	24.9	ND	IoP (2000)
Copper	100.0	7,175	20	200	ND	IoP (2000)
Zinc	65.0	24	0.3	3.7	ND	IoP (2000)
Plastics*	105	3,179	ND	ND	ND	Harvey (2010); DEFRA/DECC(2011)
Cement**	1.0	880	5.4	0.1	ND	IoP (2000)

* Mid range energy consumption for 'Plastics' from Harvey (2010); CO_2 expressed as CO_2 equivalent emissions from open loop manufacture of plastics from recycled and raw materials from DEFRA/DECC (2011) ** Portland cement provides the nearest equivalent data for concrete manufacture

Table C3: Energy consumption and gaseous emissions factors used in the calculations for fuel use

Fuel type	Energy consumption (GJ/tonne)	Gaseous emissions (tonnes)				Source*
		CO_2	NO_x	SO_2	CH_4	
Marine diesel	43.1	3,200	59.0	4	0.270	UKOOA (2002)
Aviation fuel	46.1	3,200	12.5	4	0.087	UKOOA (2002)
Diesel fuel	44.0	3,180	40	1	ND	IoP (2000)

Table C4: Fuel consumption rates used in the calculations for vessel fuel consumption.

Vessel	Energy consumption factors (tonnes/day)			Source*/comments
	In port	In transit	Working	
DSV	3	22	18	Endeavour *pers comm.* 2013
Standby vessel/ Guard vessel	1	12	4	Endeavour *pers comm.* 2013
CSV/ supply vessel	3	27	12	Endeavour *pers comm.* 2013
Survey vessel	3	24	15	Endeavour *pers comm.* 2013
Rock dump vessel	2	8	15	Endeavour *pers comm.* 2013
Fishing Trawler	-	5	5	Endeavour *pers comm.* 2013