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REPSOL SINOPEC RESOURCES UK LIMITED

Beatrice Decommissioning

Beatrice Decommissioning Draft EIA Scoping Report

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Hartley Anderson Limited
Marine Environmental Consultancy

Beatrice Decommissioning

Draft Environmental Impact Assessment Scoping Report

Prepared for

Repsol Sinopec Resources UK Limited

April 2017

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GLOSSARY AND ABBREVIATIONS

Term	Explanation
ASFB	Association of Salmon Fishery Boards
BAT	Best Available Techniques as defined in Appendix 1 of the OSPAR Convention (OSPAR 2007)
Beatrice AD	Beatrice Alpha Drilling Platform
Beatrice AP	Beatrice Alpha Production Platform
Beatrice B	Beatrice Bravo Platform
Beatrice C	Beatrice Charlie Platform
BEIS	Department for Business, Energy and Industrial Strategy, formerly DECC (the Department of Energy and Climate Change)
BEP	Best Environmental Practice as defined in Appendix 1 of the OSPAR Convention
Biota	The collective term for fauna and flora at a particular location
BNOC	British National Oil Corporation
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
Concrete mattress	A series of concrete blocks usually connected by polypropylene ropes resembling a rectangular mattress, used for the weighting and/or protection of seabed structures including pipelines
CoP	Cessation of Production: the stage at which, after all economic development opportunities have been pursued, an agreement is sought from the Oil & Gas Authority (OGA) that hydrocarbon production may cease at a particular field. The economic criterion for deciding CoP is typically the point at which the value of the hydrocarbons produced no longer covers the true costs of production.
CSS	Conductor Support Structure (at Beatrice Bravo)
DP	Dynamic Positioning: the use of thrusters and real time positional information to maintain the location of a vessel
Drill cuttings	Rock from the wellbore resulting from the mechanical action of the drill bit
Drilling template	A structure fixed to the seabed through which wells may be pre-drilled prior to the installation of a platform
DTI	Department of Trade and Industry (relevant regulatory functions now within BEIS and OGA)
EIA	Environmental Impact Assessment
ENVID	Environmental Issues Identification
GHG	Greenhouse gas
GWP	Global Warming Potential: an emissions metric used to indicate the contribution of a certain greenhouse gas to radiative forcing, accounting for the atmospheric lifetime of a given gas relative to carbon dioxide (the principal greenhouse gas)
HAL	Hartley Anderson Limited
HSE	Health Safety and Environment
Hydraulic workover unit	A rig which can be constructed on site and used to perform certain well operations, including well abandonment
Jacket	The structure comprising the “legs” of the installation connected together by horizontal and diagonal trusses and usually made of welded tubular steel. The jacket is typically secured to the seabed by piles
Jack-up rig	A mobile floating drilling rig typically with three long triangular truss legs which can be lowered to the seabed to provide stability once on location

Term	Explanation
JNCC	Joint Nature Conservation Committee
km	kilometre: 1,000m, equivalent to 0.54 nautical miles
LSA/NORM	Low Specific Activity/Naturally Occurring Radioactive Materials: found in certain scales which deposit in wellbores and topsides production tubing
LTOBM	Low Toxicity Oil Based Mud
Mariculture	The cultivation of marine species such as shellfish, finfish and seaweed within coastal waters
MoD	Ministry of Defence
Modular unit	Similar to a hydraulic workover unit, a mobile modular rig which can be used to undertake certain well operations which generally do not require drilling
MPA	Marine Protected Area
NUI	Normally Unmanned Installation: an installation with minimal facilities which is not permanently crewed and is controlled from a remote location (e.g. other platform or shore)
OBM	Oil Based Mud
OGA	Oil & Gas Authority
OIM	Offshore Installation Manager
OPEP	Oil Pollution Emergency Plan
OWF	Offshore Wind Farm
P&A	Plug and Abandon (wells)
PMF	Priority Marine Feature
ROV	Remotely Operated Vehicle: a small, unmanned submersible used for inspection and the carrying out of some activities such as valve manipulation
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation: established under the Habitats Directive
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation
SNCB	Statutory Nature Conservation Bodies: in this instance the Joint Nature Conservation Committee and Scottish Natural Heritage
SNH	Scottish Natural Heritage
SOPEP	Shipboard Oil Pollution Emergency Plan
SPA	Special Protection Area: established under the Birds Directive
SSCV	Semi-Submersible Crane Vessel: a large crane vessel comprising a series of pontoons which provide a stable platform allowing heavy lifting operations
SWT	Scottish Wildlife Trust
Topsides	The collective name for the many drilling, processing, accommodation and other modules which when connected together make up the upper section of the platform which rests on the installation jacket
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association (now Oil & Gas UK)
Water injection	The process of injecting water into dedicated water injection wells, typically to maintain the pressure in a hydrocarbon reservoir to sustain hydrocarbon flow
WBM	Water Based Mud

Term	Explanation
WDC	Whale and Dolphin Conservation
Well conductor	A short pipe initially driven into the wellbore during well construction to prevent the upper hole section, which is generally drilled in unconsolidated sediment, from collapsing

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1 INTRODUCTION

Repsol Sinopec Resources UK Limited (Repsol Sinopec Resources UK) have prepared this scoping document to provide stakeholders with an overview of the proposed decommissioning activities for the Beatrice Field Development and to continue to invite early input from the stakeholders to key issues and areas of concern. Repsol Sinopec Resources UK therefore encourages comment on the proposed activities and would like consultees to bring to their attention any relevant issues that should be addressed.

1.1 Background

Repsol Sinopec Resources UK is planning for the future decommissioning of the Beatrice Field which was in production from 1981 until the agreed cessation of production date in March 2015. To fulfil Repsol Sinopec Resources UK's HS&E policy and in line with regulator guidance, the Decommissioning Programme for the Beatrice Field offshore facilities will be supported by an Environmental Impact Assessment (EIA) of the various activities associated with the decommissioning.

Repsol Sinopec Resources UK is in the process of updating and revising their Decommissioning Programme for those Beatrice facilities for which they have liability, namely:

- The Beatrice Alpha complex comprising the bridge linked Beatrice Alpha Drilling (AD) and Beatrice Alpha Production (AP) platforms, Beatrice Bravo (B) and Beatrice Charlie (C) platforms
- All subsea infrastructure associated with the above platforms including cables, flowlines, templates and mattresses
- Beatrice AD, B and C platform wells
- The main oil export line and the power import cable, both connected to Beatrice AP from coastal locations in the Moray Firth
- The two offshore wind turbines and their power cables

The terms of legislative provisions relating to decommissioning such facilities, and decommissioning guidance from the regulator, are such that the Beatrice platforms and wind turbines must be removed in their entirety and a comparative assessment of options is required to determine the best decommissioning method for the pipelines and cables – more details are provided in Section 2.

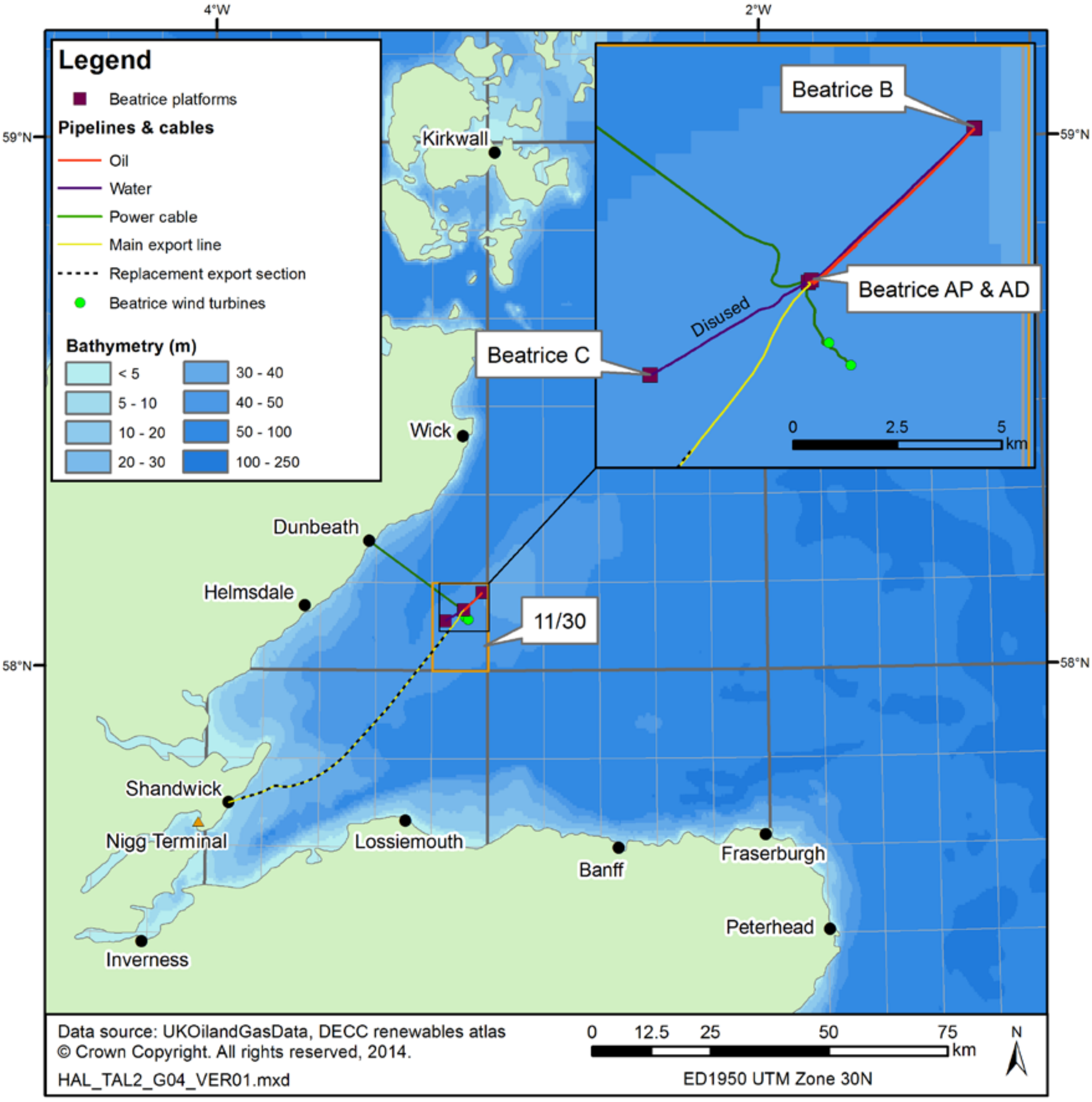
The Nigg Oil Terminal is not part of the scope of the Beatrice Field decommissioning programme.

1.2 Location of the Beatrice Field and Associated Facilities

The Beatrice Field is located in the outer Moray Firth (UKCS Block 11/30a) approximately 22km from the east Caithness cliffs (Figure 1.1). The Beatrice AD and Beatrice AP platforms are centrally located in the field, with the Beatrice B and Beatrice C platforms located 5.6km to the northeast and 5km to the southwest of the Alpha complex respectively.

Beatrice B is connected to Beatrice AP by flowlines and Beatrice C is no longer connected to any other facility, having ceased operation in 1998. Crude oil is exported from Beatrice AP through a 67km submarine pipeline which makes landfall at Shandwick, and a buried 9km onshore section of pipeline carries the crude to the Nigg Oil Terminal. The onshore section of pipeline from Shandwick Bay to Nigg is not part of the offshore decommissioning programme as this is covered under separate onshore legislation and an application to decommission the onshore section of pipeline will be made to SEPA. Power is supplied to the facilities from the onshore electricity grid by a 25km submarine cable from Dunbeath, and from the two offshore wind turbines which are located to the south of the Beatrice Alpha complex.

Figure 1.1 – Location of the Beatrice Offshore Facilities



1.3 The EIA Process

The EIA process and resultant decommissioning EIA report will consider the range of issues relevant to the decommissioning of the Beatrice Field facilities. This will include, activities relating to the different decommissioning options available, and post-decommissioning monitoring. The assessment will consider issues from both offshore activities and the onshore disposal of the installations.

Consistent with BEIS guidance (DECC 2011a), the EIA will assess the potential effects of the selected decommissioning option on the environment and climate change, and describe the proposed measures to avoid, reduce, and if possible remedy significant adverse effects. It will cover:

- All potential impacts on the marine environment, including exposure of biota to contaminants, other biological impacts arising from physical effects, impacts on mariculture, and interference with other legitimate uses of the sea
- All potential impacts on other environmental receptors, 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
- Other consequential effects on the physical environment which may be expected to result from the selected option
- Potential impacts on amenities, the activities of communities and on future uses of the environment
- The EIA will also identify any likely impacts on sites and species of designated conservation importance (including Natura 2000 sites), propose any suitable mitigation and provide sufficient information to allow the competent authority (the Department for Business, Energy and Industrial Strategy, BEIS) to conduct further appropriate assessment [1] if necessary
- The results of the EIA process will be documented in an EIA Report for decommissioning, highlighting environmental sensitivities, identifying potential hazards, assessing/predicting risks to the environment and identifying practical mitigation and monitoring measures to be carried forward into the final Decommissioning Programme. The EIA Report will form part of the information base submitted to BEIS as part of the draft Decommissioning Programme for the Beatrice Field.

1.4 The Purpose of this Scoping Document

This document outlines the initial scoping stage of the EIA process, the outcome of which will contribute to the assessment documented in the EIA Report. Repsol Sinopec Resources UK has contracted Hartley Anderson Limited (HAL) to prepare this document on their behalf.

To identify environmental issues associated with Beatrice decommissioning early in the planning process, Repsol Sinopec Resources UK commenced early engagement with a number of stakeholders and statutory bodies in 2014 (see Sections 5.2 and 7.2). Distribution of this scoping report adds to the early engagement. As part of scoping for the EIA, Repsol Sinopec Resources UK is consulting with a range of organisations, and the public. This consultation is intended to contribute to the assessment process by ensuring early identification of questions, concerns and potentially useful information sources so they

[1] Appropriate Assessment (AA) is undertaken by the competent authority where a likely significant effect on European sites (e.g. SACs and SPAs) has been identified for certain activities as part of a plan or project.

can be appropriately considered in the assessment. In particular Repsol Sinopec Resources UK wants to ensure that:

- We are aware of all relevant environmental information for the assessment
- We have identified stakeholder issues and concerns to be considered in the EIA process

To facilitate scoping consultation, this document provides:

- A brief history and overview of the field and its facilities and a summary of the proposed decommissioning options (Section 2)
- A description of the environment relevant to the decommissioning programme (Section 3) and studies commissioned to support decommissioning (Section 4)
- A description of the scoping and EIA methodology (Section 5)
- An initial identification of key environmental issues (Section 6)

The consultation process associated with the EIA for decommissioning the Beatrice facilities is outlined in Section 7, including the stages in the EIA process when consultation will take place, and how stakeholders and the public can engage in the process. The outcome of the scoping consultation will be documented in the decommissioning EIA Report which will be published online[2] when the Beatrice Decommissioning Programme is submitted for public consultation.

1.5 Decommissioning Indicative Timeline

It is anticipated that the consultation draft Decommissioning Programme will be submitted to the regulator and be available for public consultation in Q1 2018, with approval (subject to any revision) expected in Q3 2018.

The current schedule for platform and subsea facility removal operations for the Beatrice field facilities is expected to within the window 2024 to 2027. In advance of facility removal, well plug and abandonment activities will take place, and Repsol Sinopec Resources UK will be commencing activities on Beatrice Bravo and Charlie in Q2 2017 using a jack-up rig. These abandonment activities are expected to comprise a two month scope of work on Beatrice Charlie and fifteen month scope of work on Beatrice Bravo, with activities to be completed in 2018. All relevant consents and permits for the siting of the rig and subsequent well operations will be applied for (including any environmental assessments). Well plug and abandonment on Beatrice Alpha is currently scheduled to commence in 2020 and be completed by 2024.

[2] http://www.talisman-sinopec.com/en/operations/

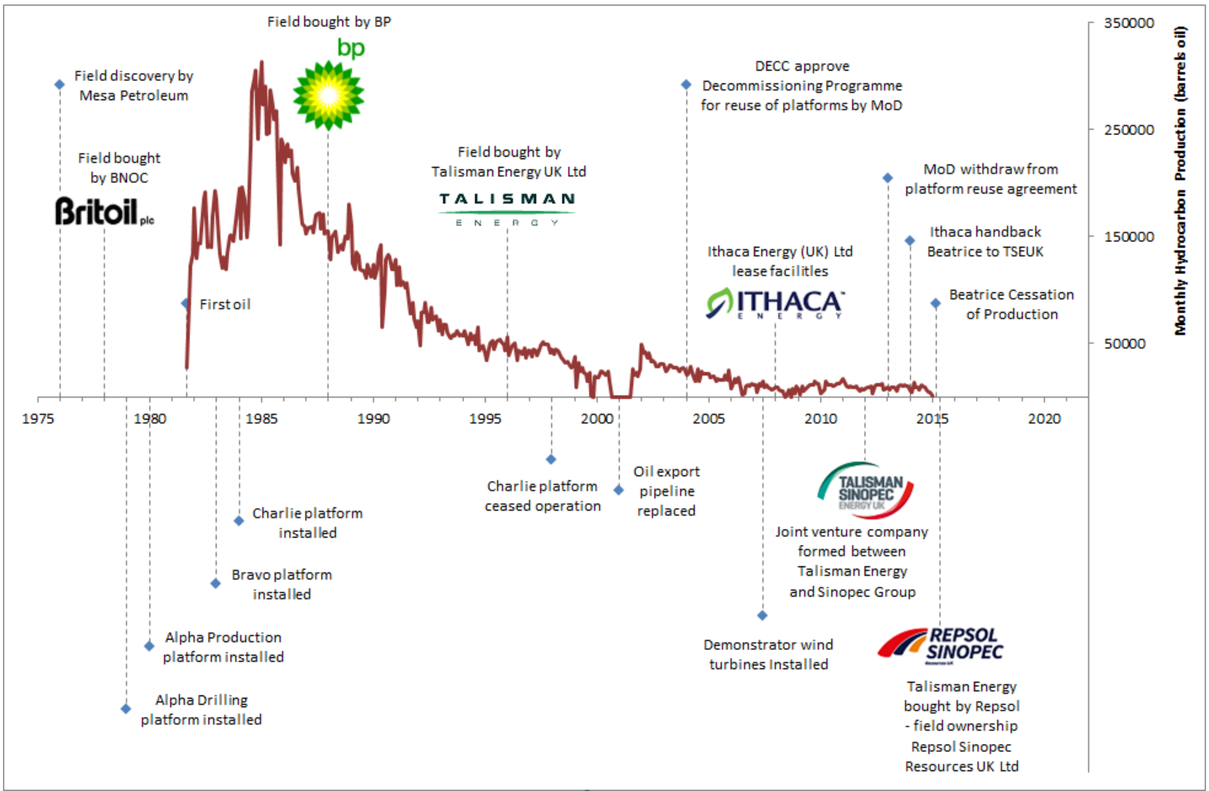
2 DESCRIPTION OF THE DECOMMISSIONING PROJECT

2.1 History and Background of the Beatrice Field

The Beatrice Field was discovered in the mid-1970s by MESA Petroleum and reached peak oil production in 1985. Figure 2.1 is an illustrative timeline of the key events during the history of the Beatrice field, including monthly production profiles, installation of infrastructure and transfer of operatorships from Mesa Petroleum in 1976 through to Talisman Energy (UK) in 1996.

Ithaca Energy (UK) Limited (Ithaca) leased the offshore facilities from Talisman Energy UK Limited in 2008, including the Nigg onshore terminal and 16” export line from Beatrice to Nigg for a minimum of three years. Talisman Energy UK Limited retained decommissioning liability for the Beatrice facilities under the terms of the lease. During Ithaca’s operatorship of Beatrice, the Jacky Field (Block 12/21c) was developed, with the installation in 2009 of a normally unmanned platform 10km to the north east of Beatrice AP. The development of Jacky extended the economic viability of the Beatrice Field for several years.

Figure 2.1 – Beatrice Field Timeline



Source: Monthly Production Profile - OGA website[3]

Ithaca handed back the Beatrice facilities to Talisman Sinopec Energy UK in January 2014 which initiated a review of potential options for continued and future field use, and ultimately led to the cessation of production at Beatrice in March 2015. Talisman Sinopec Energy UK

3 https://www.ogauthority.co.uk/data-centre/data-downloads-and-publications/production-data/ accessed 16/01/2017

a joint venture created in 2012 between Talisman Energy Inc, a global upstream oil and gas company headquartered in Canada, and Sinopec and the subsequent acquisition of the assets of Talisman Energy Inc by Repsol SA in 2015 led to the creation of Repsol Sinopec Resources UK. This new company maintains ownership and decommissioning liability of the Beatrice facilities. Ithaca will retain the decommissioning liability for the Jacky platform and its associated wells, infield pipeline and subsea structures, and these will be subject to a separate Decommissioning Programme and EIA process.

2.2 Offshore Decommissioning Regulatory Context

Under Part IV of the *Petroleum Act 1998* (as amended) and amendments to the Act through the *Energy Act 2008* (as amended), operators proposing to decommission an offshore installation or submarine pipeline must submit a Decommissioning Programme, and guidance (DECC 2011a) indicates that this must be supported by an EIA.

OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations sets out OSPAR Contracting Parties obligations on the decommissioning of offshore installations. The Decision prohibits the dumping and leaving wholly or partly in place of offshore installations. The topsides[4] of all installations must be returned to shore for reuse, recycling or final disposal on land, as must all jackets weighing less than 10,000 tonnes. Recognising that there may be difficulty in removing the footings of large steel jackets weighing more than 10,000 tonnes and concrete installations that were installed prior to 1999, there is a facility for derogation and the option of leaving the jacket footings or concrete structure in place may be considered. Such exceptions to this rule may only be granted if a comparative assessment and consultation shows that there are significant reasons why an alternative decommissioning option is preferable to complete removal. None of the Beatrice platforms fall within categories under Annex I OSPAR Decision 98/3 for which derogations may be considered, and so all platform facilities must be removed on decommissioning.

The broad decommissioning options considered to date, and outlined below, involve different engineering methods for the complete removal of the platforms for reuse, recycling or disposal onshore. The pipeline and cable removal options are to be subject to a comparative assessment (the options will also be subject to EIA) consistent with regulator guidance (DECC 2011a), primarily relating to whether certain sections are left *in situ* or retrieved, and the methods used to achieve removal and/or remediation.

A range of permits, consents and licences are required in order to undertake any of the activities which would be required to decommission the Beatrice facilities. The EIA will support permit and consent applications in due course, and a list of the required permissions, their legislative basis and the activities to which they relate will be provided in the EIA Report.

The following sections provide an overview of the Beatrice facilities relevant to the Beatrice Field Decommissioning Programme, and the possible options under consideration for their removal. Greater detail will be provided in the EIA Report, at which time a range of studies will have been undertaken to better inform the assessments of the removal options (where applicable), including environmental aspects.

[4] See the Glossary and Abbreviations section for an explanation of technical terms.

2.3 Environmental Management in Repsol Sinopec Resources UK

Repsol Sinopec Resources UK has an integrated Health, Safety and Environmental Management System and the environmental elements of the system have been independently verified as meeting the requirements of the OSPAR Recommendation 2003/5. The company's environmental commitment is outlined in its Health, Safety and Environmental (HS&E) policy (see Figure 2.2).

The policy, which is endorsed by the Managing Director, acknowledges Repsol Sinopec Resources UK's HS&E responsibilities in relation to its business activities. The policy outlines commitments to continual improvement to meet legislative requirements and accepted best practice, to assess and manage the risks and impacts associated with operations and a willingness to openly communicate these principles to company personnel and the general public.

In line Repsol Sinopec Resources UK's HS&E policy the decommissioning project HS&E targets are:

- The project shall be delivered without harm to people and without environmental incident
- The decommissioning strategies shall be designed to meet Repsol Sinopec Resources UK's overall goal of hazard management i.e. to reduce so far as is reasonably practicable the potential hazards to personnel, the environment, assets and the business
- That all potential Major Accident Hazard (MAH) events are identified and risk reduction measures are applied to mitigate and reduce any residual risk to a level so far as is reasonably practicable

Figure 2.2 – Repsol Sinopec Resources UK HS&E Policy

HEALTH, SAFETY & ENVIRONMENT POLICY

Our goal is to create a working environment such that we cause no harm to people, and where we minimise our impact on the environment.

To achieve this we will:

- Always comply with the law, or Repsol Sinopec Resources UK standards, whichever is higher;
- Operate our business to ensure proactive risk mitigation and continuous improvement;
- Set goals and targets, and measure performance against them;
- Hold ourselves and our contractors accountable to meet Repsol Sinopec Resources UK standards; and
- Communicate openly with those who may be affected by our activities.

Safe operations in all company activities is a core value. If operational results and safety ever come into conflict, we all have a responsibility to choose safety over operational results and Repsol Sinopec Resources UK will support that choice.

SAFE OPERATIONS IN ALL COMPANY ACTIVITIES IS A CORE VALUE

POS-0001, August 2016

2.4 Overview of Facilities to be Decommissioned

The Beatrice offshore facilities comprise three platform locations incorporating four topsides structures, five jacket structures, and two wind turbines centred around the main drilling and processing complex, Beatrice Alpha. The facilities to be included in the Beatrice Decommissioning Programme are summarised here (also see Figure 2.3):

Jackets, Templates and Topsides

- **Beatrice Alpha complex**: located approximately 22km from the Scottish mainland in a water depth of 45m. The complex comprises two bridge-linked platforms, a drilling and accommodation platform (Beatrice AD) and a production platform (Beatrice AP) which were installed in 1979 and 1980 respectively. Each platform comprises an eight-leg piled steel jacket and associated topsides. Amongst other processes, the topsides include modules for drilling and workover, oil processing and export, and water treatment and injection. An eight-slot drilling template is installed at Beatrice AD which allowed pre-drilling of several wells prior to jacket installation. The template is secured to the seabed by the well conductors. The jacket incorporates a conductor support frame, the lowest sections of which have been cut free from the jacket and now rest on the seabed.
- **Beatrice B**: located approximately 5.6km to the northeast of the Alpha complex in a water depth of 46m. Beatrice B comprises a six-leg piled steel jacket installed in 1983, with a smaller conductor support structure (CSS) located adjacent to the northeast of the main platform. The topsides of the Bravo jacket and CSS include modules for drilling, water injection and minimum production facilities. Beatrice B is no longer normally manned, and former accommodation, drilling and production facilities have been taken out of service. Produced fluids from Beatrice B were processed on Beatrice AP.
- **Beatrice C**: located 5km to the southwest of the Alpha complex in a water depth of 50m. Beatrice C comprises a four-leg piled steel jacket installed in 1984 as a water injection facility. The platform has only minimal topsides with no drilling facilities, and is no longer in use. All topside equipment has been placed out of service but is retained on the platform. A back-up generator is used during platform visits. Photovoltaic panels with battery storage are located on the platform in order to power navigation equipment, limited smoke detection and a telemetry link to Beatrice AD.
- **Drill cuttings piles:** a combination of water based mud (WBM), low-toxicity oil based mud (LTOBM) and oil based mud (OBM) was historically used in the drilling of some sections of wells at Beatrice AD, B and C platforms. Recent survey data (2016) indicates that there is an accumulation of discharged oil contaminated cuttings on the seabed AD which cover at least part of the seabed template and some of the lower jacket framing. No accumulations were observed at Bravo or Charlie platforms.

Wells

- There are a total of 43 wells to decommission between the three facilities: 30 at Beatrice AD, 11 at Beatrice B and 2 at Beatrice C.

Pipelines and Cables

- **Main oil export line**: The 16" diameter crude oil export line to the Nigg Oil Terminal consists of a 67km subsea pipeline (PL16[5]) from Beatrice AP to landfall at Shandwick Bay, and a 9km buried overland pipeline to Nigg. The subsea pipeline has an anti-corrosion coating comprising glass fibre reinforced enamel and asbestos felt, with a concrete outside coat. During installation the pipeline was trenched and buried to a depth of ~1m above the top of the pipeline with burial depth increasing to ~3m at the Shandwick Bay shore approach and over the land section to Nigg.
- In 2001, 59km of the subsea pipeline was replaced (PL1838, see Figure 1.1). The replacement section was epoxy coated (no concrete coat) and laid alongside (20-50m distance) the original line, and trenched and buried to a depth of 1m. The disused section of the original pipeline remains *in situ*, trenched and buried and full of inhibited water with the ends plugged.
- **Water injection lines**: The 5.6km 8" carbon steel, concrete coated infield pipeline (PL111) from Beatrice AP to Beatrice B was installed in 1980. The pipeline is buried to 1m along its length but is no longer in use and has been disconnected at Beatrice AP and is filled with inhibited seawater.
- The 4.8km 8" flexible infield pipeline (PL252) from Beatrice AP to Beatrice C was installed in 1984 in four 1km sections and one 9m section, connected together by mechanical joints. The pipeline was disconnected in 2005 so that the power cable from the wind turbines (PL2331) could be installed. The pipeline is disused but remains *in situ*, filled with inhibited seawater. The Beatrice AP end of the pipeline is secured by sandbags and a single concrete mattress.
- **Infield production pipelines:** The 5.6km 6" carbon steel concrete coated pipeline (PL112) from Beatrice B to Beatrice AP was originally installed in 1980, with a 1.5km section (PL112A) being replaced in 2004. The pipelines are buried to 1m along their length, with concrete mattresses covering an exposed section downstream of its tie in point. The pipeline is no longer in use and is filled with inhibited seawater.
- **Subsea cables:** The 26km 33kV submarine power cable from landfall at Dunbeath to Beatrice AP was installed in 1987 (Beatrice is gas deficient and power is supplied to the Beatrice Alpha complex from the onshore grid). The cable is buried to 1m along its length apart from a 2.8km section seaward of the landfall where it is contained within a steel tube due to the presence of coarse substrate.
- The 5.5km 11kV submarine power cable linking Beatrice AP to Beatrice B is buried along its length, and is protected by mattresses at the platform approaches.

Seabed deposits

- **Mattresses**: concrete or grout mattresses are located at a number of strategic locations along both pipeline and cable routes. These include where pipelines and cables exit the seabed prior to connections at platforms, at pipeline and cable

[5] Note that the "PL" notation is used to identify all pipelines on the UKCS, each having a unique reference.

crossing locations, or where exposure of a pipeline or cable has led to the requirement of seabed deposits as protection structures (e.g. grout filled mattresses at each connection point along PL252 between Beatrice AP and Beatrice C). The history of pipeline and cable installation at Beatrice has led to a substantial number (>300) of these protective structures being deposited on the seabed.

- **Rock cover**: there is a quantity of rock cover overlying the Jacky 8" water injection pipeline (PL2559), 6" oil pipeline (PL2557) and power cable which traverse the disused Beatrice AP to Beatrice B oil pipeline (PL112), its replacement section (PL112A) and the disused water injection pipeline (PL111). This rock cover was placed by Ithaca as part of the Jacky development and Ithaca retains decommissioning liability for these deposits.

Wind Turbine Generators

- **Turbines:** The Beatrice Wind Farm Demonstrator project comprises two REpower 5MW turbines, each mounted on a four-leg piled steel jacket structure, located approximately 900m apart, some 1.9km southeast of Beatrice AP in a water depth of 45m. Each turbine has three rotor blades 126m in diameter, with a hub height of 88m above Lowest Astronomical Tide (LAT).
- **Cables:** The turbines are connected together in series via a 0.9km cable (PL2331), with power supplied to Beatrice A via a 1.9km long submarine cable (PL2331) (Figure 2.3). These cables are buried to a depth of 1m below the seabed, with the exception of where the cable crosses the main oil export pipeline (PL16).

This scoping document considers a range of technical options with regards to the removal of the facilities upon decommissioning, consistent with the legislation and guidance outlined in Section 2.2. The broad scope of work involved in the removal of the facilities as part of decommissioning includes:

- The plugging and abandoning of all Beatrice wells
- The flushing and cleaning of topsides and the main oil export pipeline (note that all infield pipelines relevant to the decommissioning programme have already been cleaned and disconnected)
- Removal of special wastes and topside modules and return to shore for recycling or disposal
- The removal of platform jackets and shipment to shore for recycling
- The decommissioning of pipelines and other subsea infrastructure and deposits (e.g. mattresses)
- The removal of two wind turbine generators and associated jackets and recovery to shore for recycling or disposal
- The decommissioning of subsea power cables

The following sections provide some more detail on the potential options considered for the removal of the Beatrice facilities.

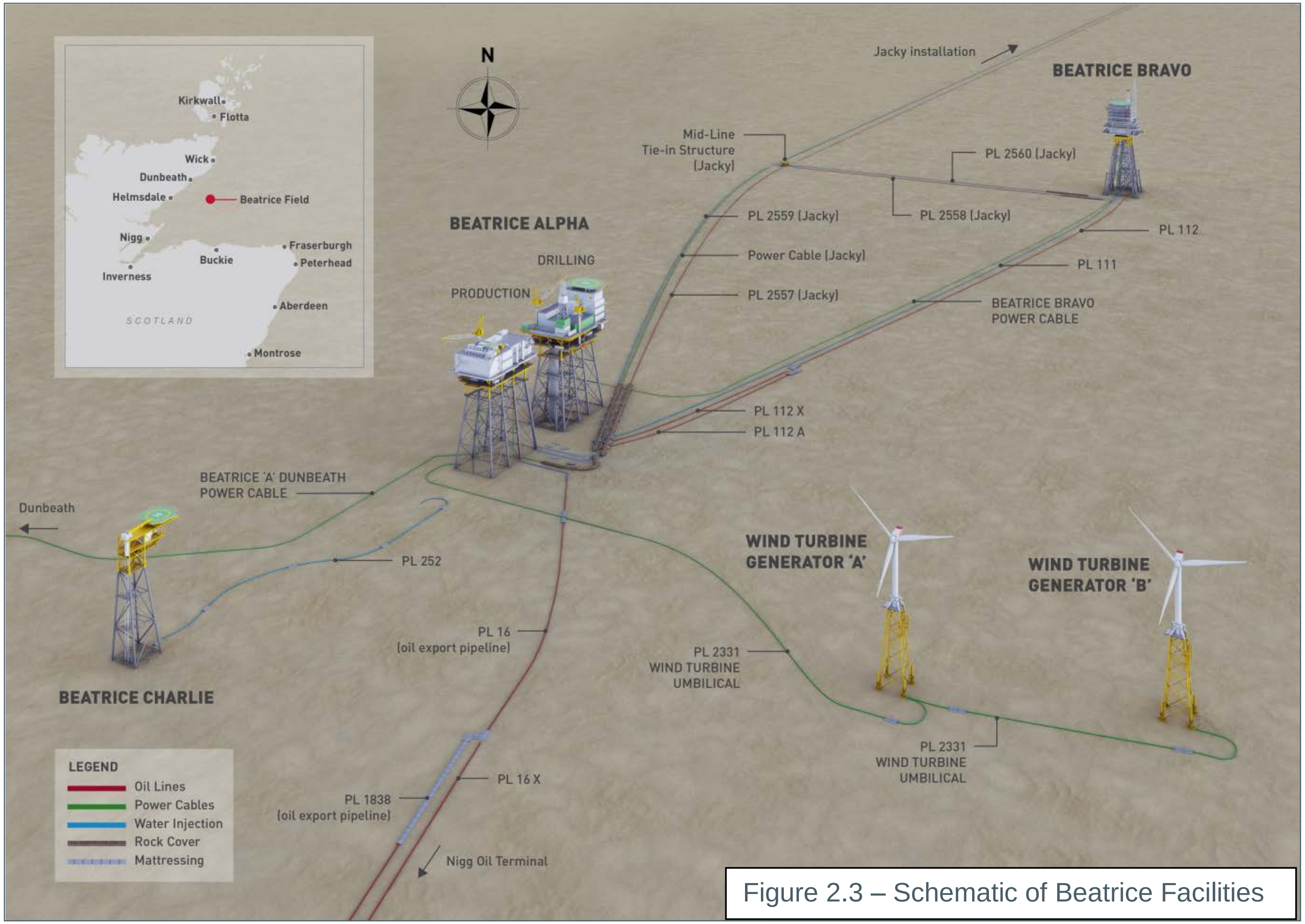


Figure 2.3 – Schematic of Beatrice Facilities

2.5 Consideration of Potential for Alternative Uses

A Decommissioning Programme for Beatrice for the reuse of the platforms was originally approved in 2004 by the DTI (relevant regulatory functions now within BEIS and OGA). This Programme was based on an agreement with the Ministry of Defence (MoD) to use the platforms for military training after Cessation of Production (CoP). The MoD has subsequently exercised their right to terminate the agreement, and therefore the Decommissioning Programme is required to be updated.

Cessation of Production was granted for the Beatrice Field in 2014 as continued production was not found to be a viable economic option for the Beatrice Field. In addition, the field life extension options that were investigated were all found to be sub-economic, and consequently the facilities will require decommissioning. Repsol Sinopec Resources UK are considering other reuse options for the facilities, and this will be a key consideration leading to a final decision on the nature and timing of field decommissioning.

2.6 Beatrice Platforms Topsides Removal Options

Exploded views of the Beatrice facility topsides are shown in Figures 2.4 to 2.7. Two broad approaches for the removal of the Beatrice topsides have been considered to date, these are:

- Piece small removal (i.e. demolition *in situ* using small plant)
- Reversal of the installation process using heavy lift vessels and transport to shore for demolition

The feasibility of a third approach, a single lift removal has been considered and discounted due to the shallow water depth at Beatrice and the structural strengthening required before the lift would be possible.

The piece small and reverse installation options are considered separately below; however, there is the possibility that a combination of these methods may be most appropriate, for instance due to their age, the condition of certain modules may not be fit for reverse installation, or single lifts.

2.6.1 Piece Small Removal

The piece small removal approach would initially utilise the existing accommodation on Beatrice AD, and keep existing platform cranes in operation for as long as possible to assist in dismantling the topsides. Additional plant (e.g. a self-erecting crane and possibly a temporary platform crane) would be required following removal of the platform cranes or where the condition of these cranes is poor. The removal methods involve the use of small to medium sized plant (e.g. excavators equipped with appropriate cutting tools) and manual hot and cold cutting techniques to dismantle modules prior to loading into containers for shipment to shore via supply vessel.

An accommodation vessel with a heavy duty crane would be required for later, piece small, phases of work so that the accommodation module could be dismantled on Beatrice AD, and for the full dismantling of Beatrice B and C. Beatrice B is now a Normally Unmanned

Installation (NUI), its accommodation facilities having been retired since 1992. Beatrice C is a NUI and has no accommodation facilities.

The piece small approach would not require the use of a large heavy lift vessel (HLV), but it would involve a significant amount of manual work offshore. The possible sequence of events would be:

- Preparatory removal and segregation of all regulated wastes from topsides for each platform (e.g. waste electrical and electronic equipment (WEEE), asbestos)
- Piece small removal: dismantling of Beatrice AP and most AD modules whilst using accommodation on Beatrice AD
- Piece small removal: dismantling of remaining Beatrice AD modules, and those on Beatrice B and C using an accommodation vessel with a heavy duty crane

An initial estimate is that it would take approximately 616 days to prepare for and dismantle all of the Beatrice Field topsides and jackets (excluding wind turbines), with the majority of the work involving the removal of the Beatrice Alpha complex (approximately 463 days).

Figure 2.4 – Beatrice AD Schematic Showing Exploded View of Topsides Modules

Figure 2.5 – Beatrice AP Schematic showing Exploded View of Topsides Modules

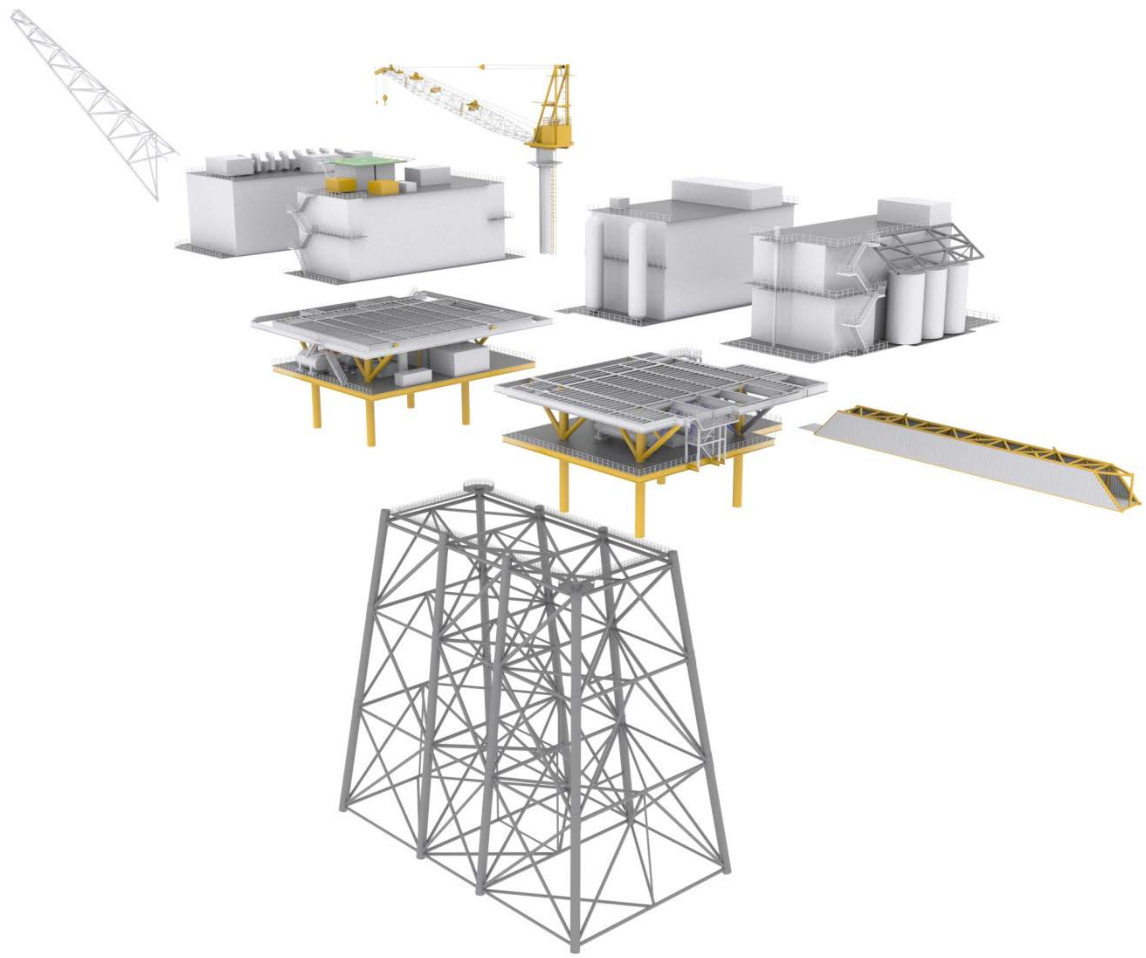


Figure 2.6 – Beatrice B Schematic Showing Exploded View of Topsides Modules

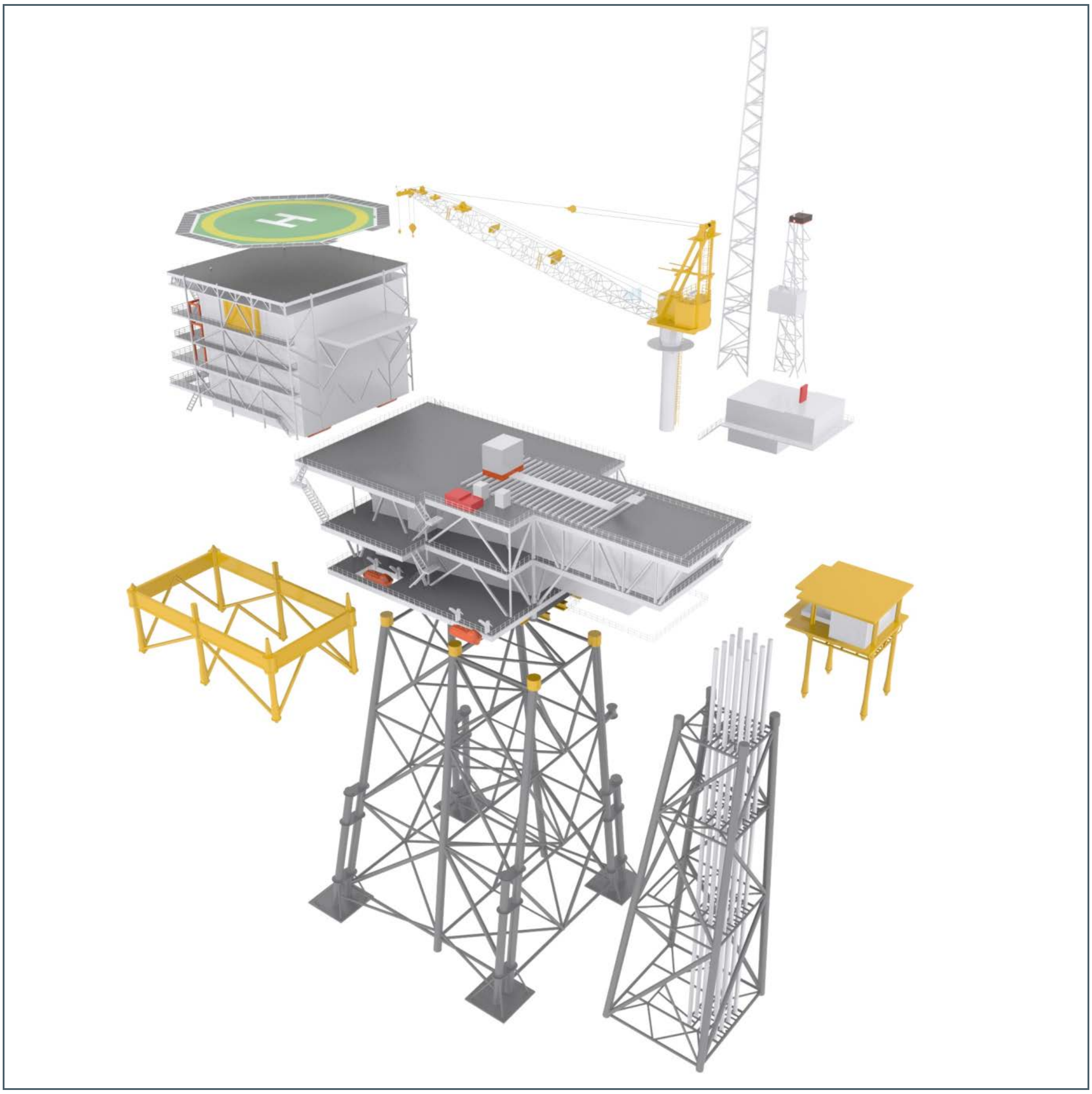


Figure 2.7 – Beatrice C Schematic Showing Exploded View of Topsides Modules

2.6.2 Reverse Installation

There is the option to reverse install the topside modules and decks. This would involve the use of a heavy lift vessel (HLV) and barge vessels to perform the removal and subsequent transport of all or most of the platform sections to an onshore disposal location (yet to be selected). Reverse installation will require the separation of all modules (e.g. cutting of connecting cables and pipes) and possible reinforcement and design of suitable lifting points where none exist or where the original lifting points have deteriorated, or were removed during installation. Module separation and preparation would be carried out before the HLV arrived on site.

This method significantly reduces time spent offshore, with complete removal, including jackets (see Section 2.4 below) and weather contingency taking approximately 88-107 days.

There are a number of modules (e.g. Beatrice B integrated deck) which are of a sufficient weight that lift operations for these may not be feasible for some vessels. Either a suitable Semi-Submersible Crane Vessel (SSCV) could be utilised to ensure that such lifts were possible, or weight would have to be removed and the module would be taken off in more than one lift. Accommodation during the removal work would be on the heavy lift vessel, with gangway access provided for personnel.

2.7 Removal Options for Beatrice Jackets

The two approaches being considered for jacket removal are:

- Removal in sections using multiple lifts of smaller jacket sections
- A single heavy lift of the entire jacket onto a barge for shipment to shore

It should be noted that marine growth will have added weight to each of the jackets, and this will either be removed offshore or onshore.

2.7.1 Removal in Sections

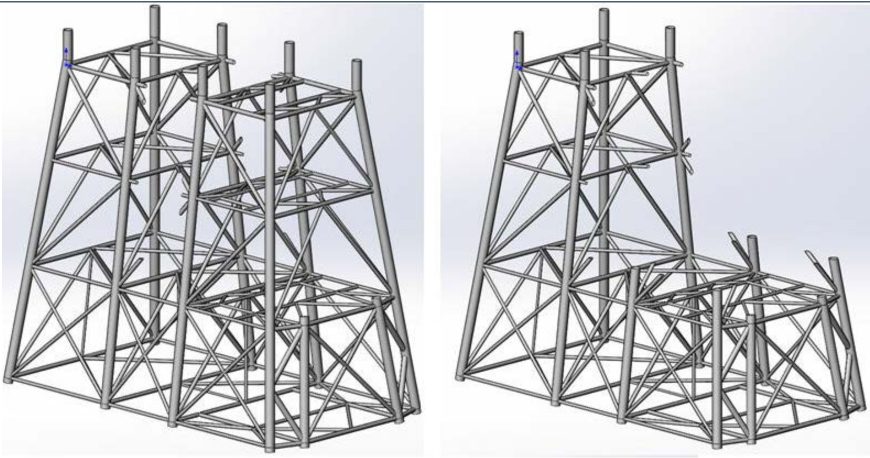
The removal of the Beatrice jackets using this method requires their division into smaller component parts prior to being lifted in sections onto a jack-up lift barge for transportation to shore. One possible removal sequence for the Beatrice AD jacket would involve cutting the structure into two by removal of the central braces and cutting each section in half again such that the jacket can be lifted in four parts (Figure 2.8). The removal of the Beatrice AP jacket would be analogous to that for Beatrice AD, requiring four primary lifts in addition to the removal of the braces.

The smaller braces would be separated using a combination of hydraulic shears or diamond wire cutting tools, and (where required) the legs and caissons would be cut using a diamond wire saw or abrasive external cutting tool. The piles would be cut below the seabed surface either internally by lowering an internal abrasive cutting tool into the legs of the jacket, or by dredging a 3m deep area around each jacket leg so that an external diamond wire cutting tool and remotely operated vehicle (ROV) may reach the desired depth below seabed for cutting.

The Beatrice AD and AP jackets and the Beatrice B platform and CSS jackets have internal leg piles with a fully grouted annulus between the leg and the internal pile. Beatrice C has leg piles which are welded to the leg at the top of the jacket and un-grouted. Once cut, some piles may need to be secured to the jacket prior to the final lift. There is also the option to use an internal cutting tool which can be passed down the jacket legs and into the pile. Additionally, the Beatrice AD and Beatrice B jackets are connected to the seabed by a series of skirt piles which were driven through sleeves at the base of the jacket, and then grouted in place. These piles would similarly be cut at least 3m below the seabed. The above tools would require the use of a hydraulic power unit which would be located on the vessel deck. Risers would be secured prior to cutting so that these may be cut and lifted with each jacket section. Each jacket section would be lifted by a combination of manufacturing new lifting points and use of an internal lifting tool lowered into each jacket leg.

Figure 2.8 – Removal in Sections of the Beatrice AD and AP Jackets

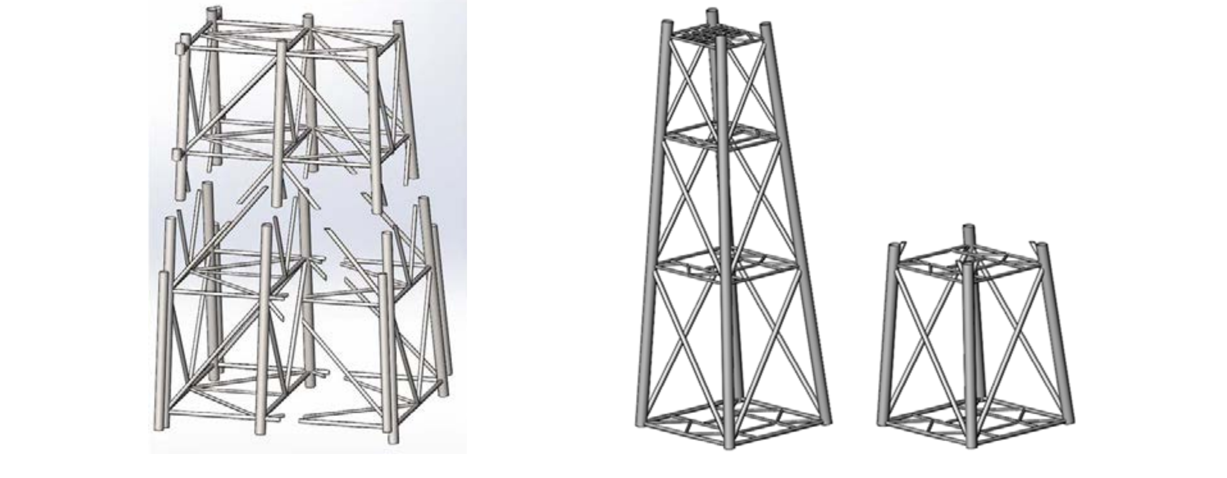
a) central braces are removed **b) legs are cut and jacket removed in four sections**



The Beatrice B jackets comprise those of the production platform and of the CSS. The removal tools and methods outlined above would also be used for Beatrice B, with the possible removal sequence involving five main lifts (Figure 2.9). The removal of the Beatrice C jacket could be made in two lifts as per the Beatrice CSS removal.

Figure 2.9 – Removal in Sections of the Beatrice B and CSS Jackets

a) main B platform jacket **b) B CSS jacket**



2.7.2 Heavy Lift Removal

The removal of the jackets using heavy lift methods involves the cutting of the jacket legs/piles approximately 3m below the seabed, prior to the jacket being removed in a single lift. The cuts required to release the jacket from the seabed could be made using those methods already outlined for the jacket medium piece removal.

Lifting points on the jacket can be made by creating “shackle holes” in the legs using high pressure water and grit or mechanical drilling methods, which would remove the need to fabricate and weld new lifting points. The jacket structures have an estimated weight in air, including removed pile sections, of between 817 tonnes (Beatrice B CSS) and 3,225 tonnes (Beatrice AD). Consideration will be made to account for the potential additional weight of the heaviest structures due to marine growth and where water has flooded members such that they would exceed the capacity of some available heavy lift vessels. In this instance, suitable vessel selection would ensure that these jackets could be lifted, alternatively a combination of heavy lift and above removal in sections options could be applied.

2.7.3 Beatrice AD Drilling Template and Conductor Framing

The drilling template at Beatrice AD was secured to the seabed by four conductor piles, and allowed for five wells to be drilled using a jack-up rig prior to the installation of the Beatrice AD platform. The template is tubular steel and measures 8.7m x 5.6m x 4.1m, with an approximate dry weight of 43 tonnes. It is envisaged that the template will be removed in a single lift following removal of the Beatrice AD jacket.

Due to the weight of drill cuttings impinging on the lower sections of the conductor support frame at Beatrice AD, the lowest level of frame was cut free from the jacket and now rests on the seabed. Options are presently being considered on how to best remove this structure.

2.8 Well Decommissioning Options

The decommissioning of the Beatrice platforms will require the plugging and abandoning of 43 wells, 30 of which relate to the Beatrice Alpha complex. There are no subsea well tie-backs related to Beatrice. Wells will be plugged and abandoned in accordance with Oil and Gas Guidelines for the abandonment of wells (Issue 5, July 2015) and with Repsol Sinopec UK Standards.

Beatrice B & C wells are being abandoned using a jack-up rig placed within the existing 500m safety zones of the platforms. The options for Beatrice Alpha well plug and abandonment are presently being considered and include platform rig reactivation, the use of a modular unit or the use of a jack-up rig.

2.9 Cuttings Piles Management Options

Low Toxicity Oil Based Mud (LTOBM) was used to drill a number of the well sections (in combination with Water Based Muds (WBMs)) at Beatrice AD, Beatrice B and Beatrice C between 1982 and 1996, with the cuttings generated being discharged to sea. Typically such discharges led to accumulations under/immediately adjacent to the platforms (cuttings piles); these piles are subject to management under OSPAR Recommendation 2006/5. The Recommendation requires the application of a two stage appraisal of contaminated cuttings piles: the first is a screening stage to determine whether the cuttings piles may be left to naturally degrade or that further management is required, and the second stage determines best available techniques (BAT) and best available practice (BAP) to managing any given pile through a comparative assessment.

The first stage identifies two thresholds below which contaminated piles may be left *in situ* to degrade, and these are:

- a rate of oil loss to the water column of less than 10 tonnes/yr
- a persistence over the area of seabed contaminated of less than $500km^2/yr$[6]

Pre-decommissioning surveys and drill cuttings pile screening have been undertaken and will inform final cuttings management and decommissioning options selection. Additionally this survey data will inform a consideration of where infrastructure to be decommissioned (e.g. pipelines, risers, drilling templates, and jacket piles) interacts with any cuttings material. Where interaction with a contaminated cuttings pile is regarded to be part of the decommissioning work scope, a comparative assessment of options to minimise contaminant loss will be made, unless this is already being undertaken due to a requirement for second stage assessment under OSPAR Recommendation 2006/5.

Depending on the outcome of the cuttings pile screening and whether disturbance of the piles is necessary, the following high level management options for the Beatrice cuttings piles will be considered in accordance with OSPAR Recommendation 2006/5:

- Leave the piles *in situ* to naturally degrade

[6] (A persistence of $500km^2/yr$ could mean an area of $1km^2$ is contaminated for 500 years, or an area of $500km^2$ is contaminated for one year)

- Leave the piles *in situ*, but with a covering
- Recovery of contaminated cuttings for offshore treatment and discharge of treated cleaning water. Solids would be returned to shore
- Recovery of contaminated cuttings for onshore treatment and disposal

The current understanding of the potential nature and size of the cuttings piles at the Beatrice facilities is outlined below.

2.9.1 Beatrice AD

LTOBM has been used at Beatrice AD since 1982 for the drilling of the 12¼″ and deeper well sections. A combination of water based mud (WBW) and LTOBM was used to drill most wells at Beatrice AD. Prior to the ban on the discharge of oil based muds in 1996, approximately 9,200m^3 of cuttings had been discharged. Subsequent wells have used a combination of WBM and LTOBM systems but with no discharge of LTOBM cuttings to the seabed, consistent with legal requirements.

A survey of the cuttings pile was undertaken by Britoil in 1989 which indicated a mound some 9m in height beneath the platform. A more recent ROV survey of the Beatrice AD drilling template in 2012 did not show an appreciable depth of cuttings, and it may be reasonably assumed that at least some of the pile has been subject to redistribution and degradation by natural hydrographic processes.

A UKCS-wide cuttings piles screening included estimates of the oil loss and persistence of cuttings piles[7] (ERT 2009). ERT (2009) estimated that the Beatrice AD pile had a leaching rate of 1.98-2.78 tonnes/yr and a persistence of <141km^2/yr, both of which are significantly below the above OSPAR thresholds. However, it should be noted that these were estimates which were often extrapolated and not necessarily based on actual field measurements.

Studies undertaken by AURIS (1993) and ERT (2009), and a recent ROV survey, provide an initial indication of the expected size and condition of the Beatrice AD cuttings pile; this will be augmented by more detailed field measurements (see Section 4.1) prior to a decision being made on the management options for the pile. In addition to the above consideration, at least part of the drilling template is covered by cuttings at Beatrice AD, which will be considered in relation to decommissioning options for subsea infrastructure and cuttings pile management.

2.9.2 Beatrice B

Ten wells were pre-drilled prior to the installation of the Beatrice B jacket. Only cuttings drilled with WBM were discharged during the drilling programme. Up to 1996, 2,700m^3 of WBM cuttings had been discharged, with three further wells having been drilled since. A 2008 ROV survey sampled depths below and immediately adjacent to the Beatrice B platform and conductor support structure at a total of 36 locations, revealing no substantial variation in sediment topography, with depths varying between 45.3m and 46.3m, suggesting a cuttings pile was not evident. New survey data (Fugro 2016) confirmed that there is no appreciable cuttings accumulation at Beatrice B.

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[7] Those installations where Organic Phase Fluid (OPF) was used and discharged or other discharges have contaminated their cuttings piles.

2.9.3 Beatrice C

Two wells were pre-drilled prior to the installation of the Beatrice C platform in 1984. These wells were drilled using LTOBM with an associated discharge of approximately 520m^3 of cuttings. ERT (2009) estimated a leaching rate of between 0.85 and 1.20 tonnes/yr and a persistence of <141km^2/yr, however an ROV survey undertaken in 1997 did not record an appreciable accumulation of drill cuttings at the base of the platform. As with Beatrice B, new survey data confirmed there are no appreciable cuttings accumulations at Beatrice C.

2.10 Pipeline Decommissioning Options

In keeping with regulator guidance[8], a comparative assessment will be undertaken to inform decisions relating to the decommissioning of those pipelines described in Section 2.1 and shown in Figure 2.10 and Table 2.1. Those options being considered by Repsol Sinopec Resources UK include:

- **Full removal** – with the pipelines being removed in their entirety. Depending on the type and condition of pipeline, reverse s-lay or reel lay methods may be used. Alternatively the pipes would be cut into sections subsea and lifted onto vessels for transport to a suitable disposal location. Pipelines would be un-buried to allow removal
- **Leave *in situ*** – any exposed ends to the pipelines would be buried and where necessary, any exposed sections trenched and buried or rock cover applied to reduce the possibility of free-spans and snagging hazards
- **Removal of selected sections** – the majority of the pipeline would be left *in situ*, but exposed sections would be selectively removed to avoid the need for additional subsea deposits and/or where they may pose a future safety risk

Where all or any part of the pipeline were to be left *in situ*, consideration would be given to the effects of continued degradation of the pipeline materials, and whether this could result in possible future environmental effects, including in relation to other users of the sea. The possibility of future pipeline exposure informed by past inspection survey data would also be considered.

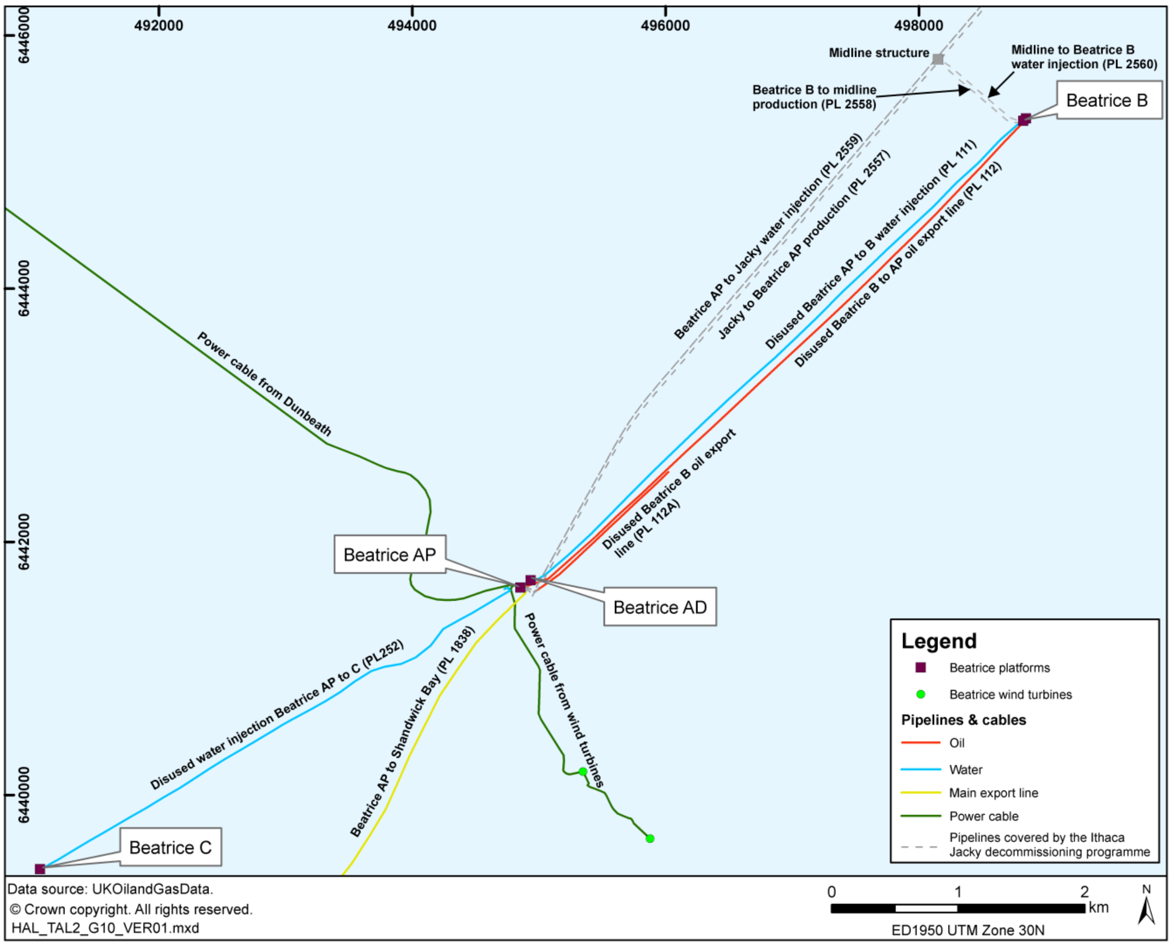
There are a number of deposits associated with the pipelines (e.g. concrete mattresses), and the base case for these items is that they will be removed unless there are significant safety and technical reasons why they cannot be. For those concrete mattresses where survey data / ROV footage suggest that they are partially or wholly buried, their fate will be determined through the comparative assessment process.

[8] Note that pipelines are not covered by OSPAR Decision 98/3, however the framework for their decommissioning is contained in *The Petroleum Act 1998*. See Section 10 of decommissioning guidance notes (DECC 2011a).

Table 2.1 – Relevant Beatrice Field Pipelines (all currently disused)

Pipeline route	Reference No.	Diameter (inches)	Length (km)	Installation type
AP to Shandwick	PL16/ PL1838	16	67	Trenched and buried
Shandwick to Nigg	PL16	16	9	Buried (onshore)
A to C	PL252	8	4.3	Trenched and buried
AP to B	PL111	8	5.4	Trenched and buried
B to AP	PL112	6	5.4	Trenched and buried
B to AP	PL112A	6	1.5	Trenched and buried

Figure 2.10 – Beatrice Field Subsea Infrastructure



2.11 Cable Decommissioning Options

The wind turbines and their related cables were installed as “supplementary units” to the Beatrice Field facilities under the *Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995*. They are therefore subject to decommissioning as part of the Beatrice Field facilities under the *Petroleum Act 1998*, and BEIS has advised

Repsol Sinopec Resources UK that these and other cables (Table 2.2) must be subject to decommissioning considerations analogous to those for pipelines (i.e. in this case comparative assessment).

Table 2.2 – Relevant Beatrice Field Cables

Cable route	Reference No.	Diameter (mm)	Length (km)	Installation type	Description	Status	
						Active	Disused
AP to Dunbeath	N/A	No data available	26	Trenched and buried	Grid connector cable from Dunbeath to AP (14MW, 33kV, 50Hz)	✓	
AP to B	N/A	No data available	6.3	Trenched and buried	Connector Cable between Beatrice AP and Beatrice B (6.6kV, 60Hz)	✓	
WTGA to WTGB	PL2331	119	0.9	Trenched and buried	Connecter between Wind Turbine A and Wind Turbine B	✓	
WTGA to AP		119	1.9	Trenched and buried	Connector between Wind Turbine A and Beatrice AP	✓	

2.12 Wind Turbine, Tower and Jacket Removal Options

Each wind turbine was assembled at the Nigg fabrication yard and installed in 2007 as a complete unit onto a four-legged jacket foundation using a crane barge (Figure 2.11). The lifespan of the demonstrator project was designed such that it would coincide with the expected lifespan of the Beatrice Field. However, prior to installation consideration was given to the re-use of the turbines in their current position as part of a wider commercial wind development in the area (details are given in the Environmental Statement, Talisman 2005). Construction of the nearby Scottish Territorial Waters joint venture between SSE, Repsol Nuevas Energias UK and Copenhagen Infrastructure Partners (Beatrice Offshore Wind Limited, BOWL) is due to commence in 2017, and consent has been granted for the wind farms within the eastern development area of the Round 3 Moray Firth zone, to be developed by EDP Renewables (EDPR) as Moray Offshore Renewables Limited (MORL). Reuse of the demonstrator turbines as part of the larger wind farms has been explored via discussions between Repsol Sinopec Resources UK and SSE/EDPR who both advised that this would not be commercially viable in the context of their proposals.

Decommissioning will be undertaken as part of the Beatrice Field programme, most likely using a reverse installation method. The turbine blades, nacelle[9] and tower will be returned as a single unit to shore for re-use or recycling. The jacket piles will be cut at 3m below the

[9] The turbine housing which principally contains the drive train and generators.

seabed in a manner analogous to the Beatrice platform jacket piles. It is presently proposed that the jackets would be removed in a single lift due to their comparatively small size and weight (805 tonnes, excluding piles), however, a piece small approach to removal cannot be ruled out at this stage.

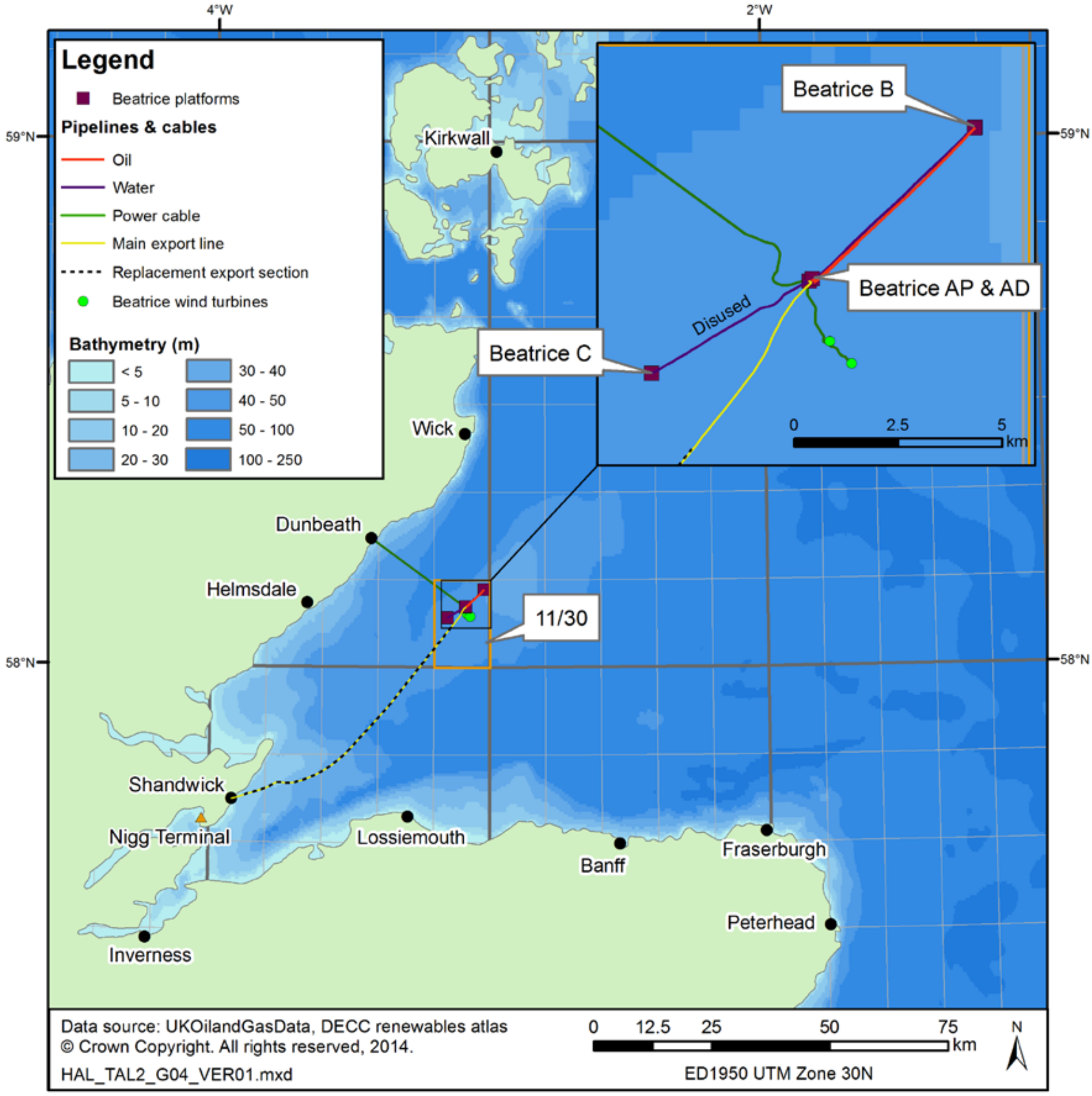
Figure 2.11 – Crane Barge Installing the Second Beatrice Wind Farm Demonstrator Turbine

3 ENVIRONMENTAL SETTING

3.1 Location

The Beatrice Field facilities are located in the outer Moray Firth in Block 11/30a, at a minimum distance of 22km (12nm) southeast of the nearest coast (Figure 3.1). The facilities are connected to the coast by the oil export pipeline which runs southwest from Beatrice AP to a landfall at Shandwick, and then overland to the Nigg terminal, and by an electrical power cable that runs from Dunbeath to Beatrice AP. Significant information on the environment of the area has been provided by the various baseline and other surveys undertaken for the Beatrice field and these are referenced in the sections below.

Figure 3.1 – Location of the Beatrice Offshore Facilities



3.2 Seabed Topography

The primary topographic seabed feature in the area is Smith Bank. The Bank rises to a depth of 30-40m, notably elevated from the surrounding waters of up to 70m depth. The Beatrice facilities and wind turbines are located off the northwest edge of Smith Bank in approximately 40-50m of water. To the south and east of the Smith Bank and along the export pipeline and power cable routes, the seabed deepens slightly to between 50-60m depth, before becoming shallower towards the coast.

Sand waves occur in the inner Moray Firth (Reid 1988, cited by Andrews *et al.* 1990) and are present at the seabed surface in the Beatrice area (Gardline 2007a, b). Linear sand patches in the Moray Firth are aligned parallel to the Buchan coast – the southerly section of coast along the outer Moray Firth covering an area east from approximately between Lossiemouth and Banff, to Peterhead on the east coast. The sand patches indicate both east and west sediment transport directions (Andrews *et al*. 1990).

3.3 Climate and Meteorology

The Moray Firth experiences a mild maritime climate (UKHO 2012). Wind in the open sea areas may come from any direction, with those from the southwest or north-northeast marginally more common (UKHO 2012). The 30-year average wind speed at 110m above sea level ranges from 9.6-9.8m/s in summer, varying between <8m/s to 10.2-10.4 and 11.3-11.6m/s in autumn and winter respectively (The Crown Estate 2015). Frequency of precipitation in the northwest Moray Firth is higher in winter (~30%) than in summer (~18%) summer (UKHO 2012), and sea fog is most frequent in the Moray Firth in summer during periods of southeast winds (UKHO 2012).

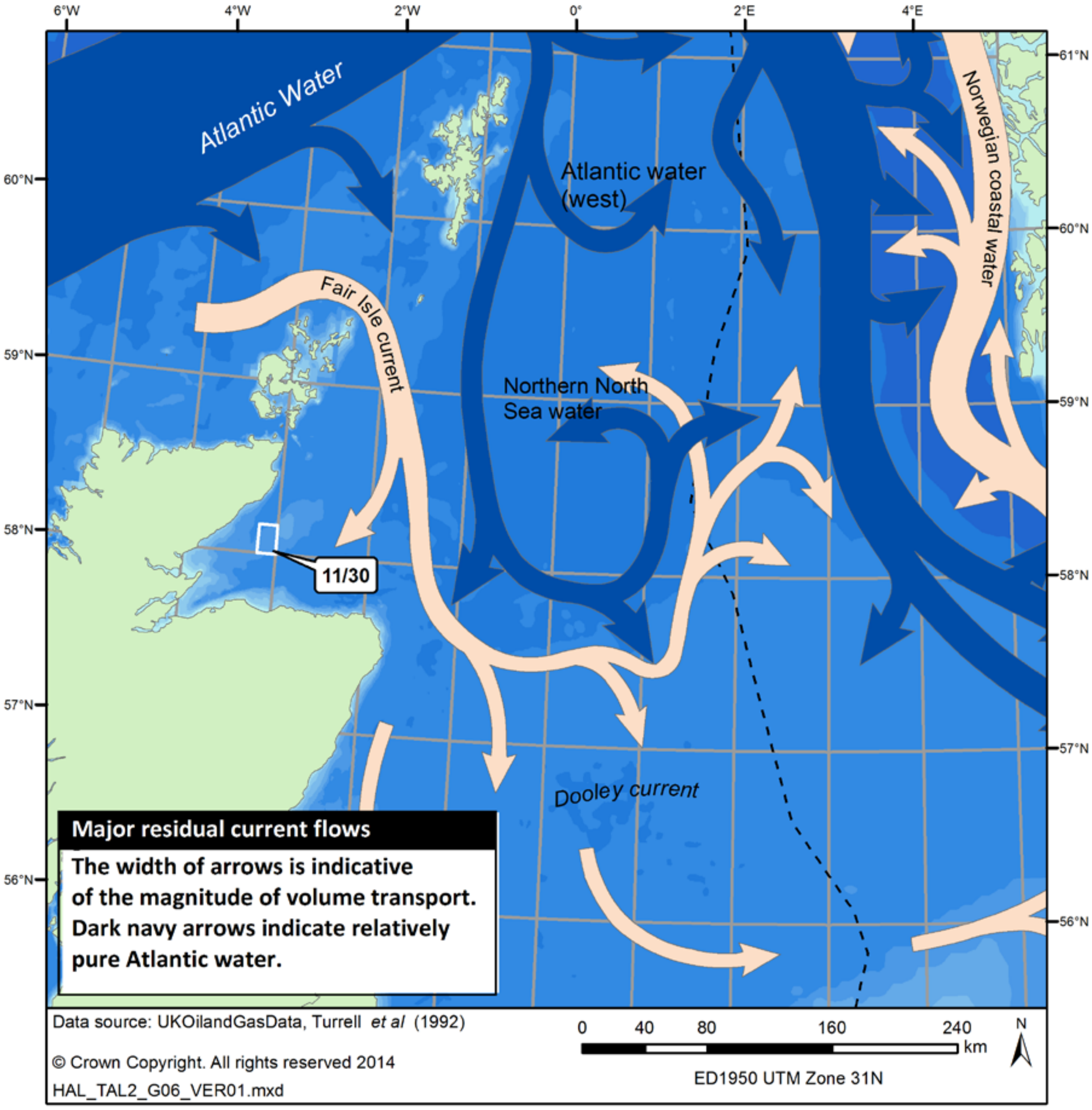
3.4 Oceanography and Hydrography

The waters over the inner and outer Moray Firth are described as ‘coastal or a region of freshwater influence’ and ‘shelf water’, with typical salinities of 30-34ppt and 34-35ppt respectively (Connor *et al.* 2006). This is due to the area being influenced by both oceanic water and coastal/mixed waters of the inner Moray Firth. Oceanic waters enter the North Sea primarily from the north by Atlantic inflow along the east of the Shetland Isles, and from the northwest through the Fair Isle current (Figure 3.2). Water column characteristics of the shelf water in the Beatrice area vary from stratified in summer to well-mixed in autumn and winter, before becoming weakly stratified in spring. The nearshore and shallow areas are influenced by freshwater inputs, resulting in some weak stratification throughout the year (Connor *et al.* 2006).

A very weak clockwise current exists around the shores of the Moray Firth due to a south-southwest flowing current passing the east of Shetland being deflected west at Rattray Head in the south of the Moray Firth (UKHO 2012).

Over Smith Bank, tidal streams show maximum speeds of 0.5 and 0.3 knots during spring and neap tides, respectively. Tidal streams are slightly stronger closer to the coast and the strongest tidal streams (up to 1.3 knots) are found at the entrances to the inner firths (UKHO 2012). Mean annual significant wave height is approximately 1.3-1.4m across the Beatrice area, with heights lowest in summer (0.86-0.93m) and highest in winter (1.68-1.8m) (BERR 2008).

Figure 3.2 – General Water Circulation in the North Sea



3.5 Plankton

The plankton community in the waters around Beatrice is similar to that found over a wide area of the central North Sea. The phytoplankton community is dominated by the dinoflagellate genus *Ceratium* (*C. fusus, C. furca, C. lineatum*), with diatoms such as *Thalassiosira* spp. and *Chaetoceros* spp. also abundant (Johns & Reid 2001). The zooplankton community in the area is dominated by the Calanoid copepods *Calanus finmarchicus* and *Calanus helgolandicus*, with other calanoid genera such as *Paracalanus* spp. and *Pseudocalanus* spp. and *Acartia* also abundant. There is also a high biomass of *Calanus* larval stages present in the region. Euphausiids and decapod larvae are all important components of the zooplankton assemblage (Johns & Reid 2001). Abundant jellyfish in the region include *Aurelia aurita*, *Cyanea capillata* and *Cynaea lamarckii* (Pikesley *et al*. 2014).

In the North Sea, a phytoplankton bloom occurs in spring followed by a smaller peak in the autumn. Diatoms are the first to bloom, then as nutrients essential for diatoms become depleted, other groups bloom such as flagellates, followed later by dinoflagellates. The progress of the spring bloom is dependent predominantly upon episodic turbulence following short periods of stratification, which allows the mixing of nutrients into the photic zone. Diatoms comprise a greater proportion of the phytoplankton community from November to May, when mixing in the water column is greatest (McQuatters-Gollop *et al*. 2007). The spring bloom in the region is stronger, relative to the autumn bloom, than elsewhere in the North Sea (Longhurst 1998).

3.6 Seabed Substrates

The seafloor of the Moray Firth mainly consists of Holocene[10] sediments. Offshore sediments in the area generally consist of sand and fine sand to a depth of approximately 50m, with gravelly sand and sandy gravel dominating the substrate closer to the coast (Reid & McManus 1987, Andrews *et al*. 1990).

A map of predicted broadscale habitats of the Moray Firth as produced by EMODnet Seabed Habitats in support of the Marine Strategy Framework Directive is shown in Figure 3.3 (EUSeaMap2 2016). The wider area consists predominantly of shelf sublittoral sand and coarse sediments but areas of mud are also present, whilst around the Beatrice facilities and wind turbines the seabed sediment is either sand or coarse sediments, characteristic of shallow or shelf sublittoral areas (see inset in Figure 3.3).

Survey data for this area (see Figure 3.4) indicate sediments comprise moderately sorted medium to fine sand with shell fragments (Hartley & Bishop 1986, DTI 2004, Holmes *et al.* 2004, ERT 2005, Gardline 2007b). Similar medium to fine sands are predicted to occur along most of the export pipeline and subsea power cable routes. Video and grab sampling survey results from Scottish Natural Heritage's (SNH) biotope mapping (Foster-Smith *et al*. 2009) of the seabed, which covers ~7km of the export pipeline's route as it approaches landfall, shows the presence of fine sediments with occasional shells. An area of very coarse sediment occurs within 3km of the power cable landfall, which led to this section of cable being surface laid.

Seabed contaminant concentrations (total hydrocarbons, polycyclic aromatic hydrocarbons and metals) around the Beatrice Field and wind turbine generators (AURIS 1993, ERT 2005, Gardline 2007a) generally reflect background concentrations (OSPAR 2005) and the results of nearby surveys (CMACS 2010, EMU 2011). Contaminant concentrations along the export pipeline and power cable routes are expected to be at background levels.

Contaminant concentrations may be elevated under, and immediately adjacent to, the Beatrice platforms as a result of historical drilling and discharge of cuttings drilled with low toxicity oil based muds prior to the cessation of such discharges. Elevated hydrocarbon and metal concentrations were observed within 750m of the Beatrice AD platform in 1992 (AURIS 1993). It is considered highly likely that present day concentrations will be substantially less as a consequence of natural degradation over time. Drill cuttings pile

[10] Those deposited and reworked since the end of the last glacial period, ~12,000 years ago.

footprint mapping and sampling will provide additional, up-to-date site specific detail when available (see Section 4).

Figure 3.3 – Predicted Seabed Habitats

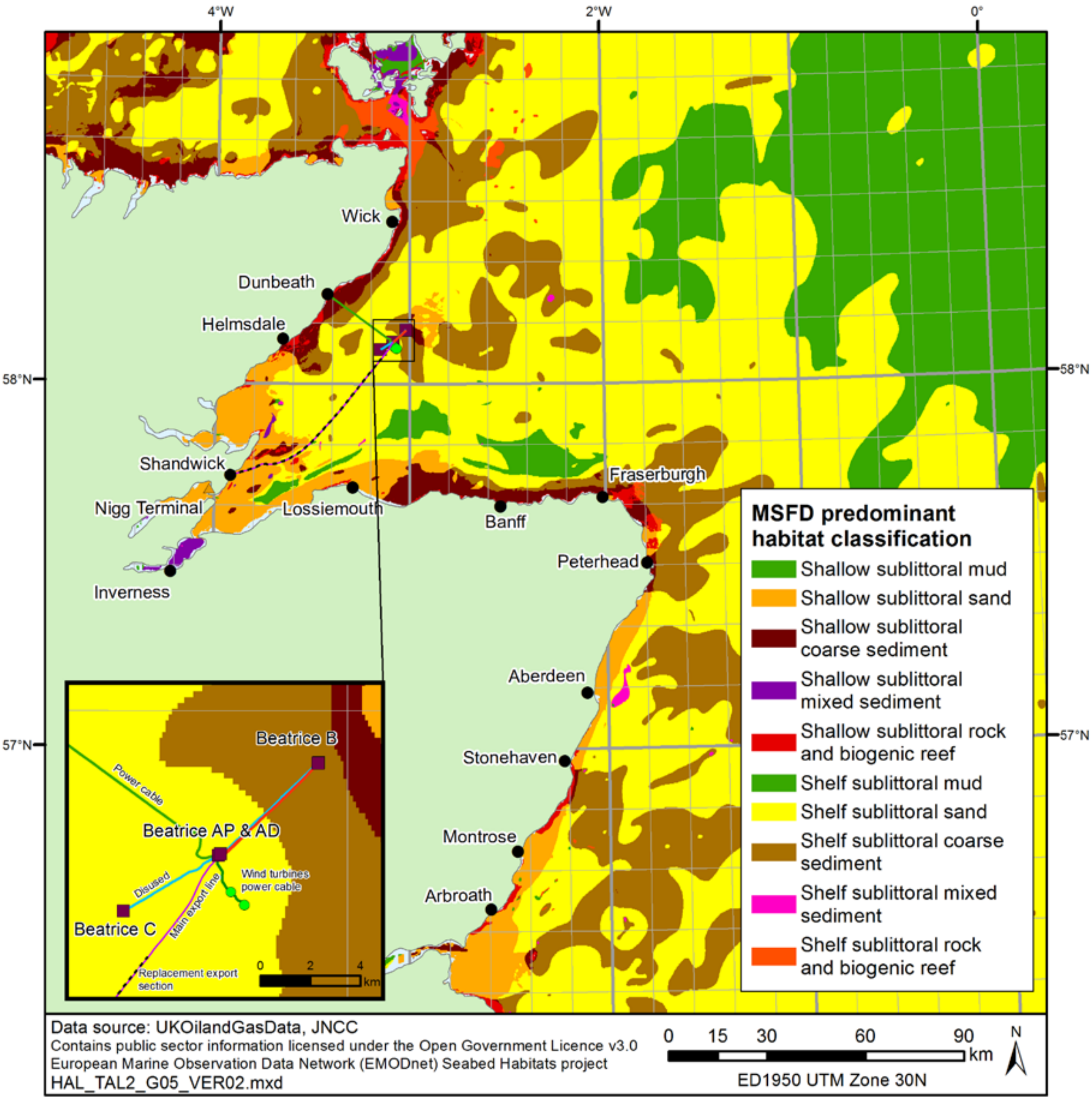
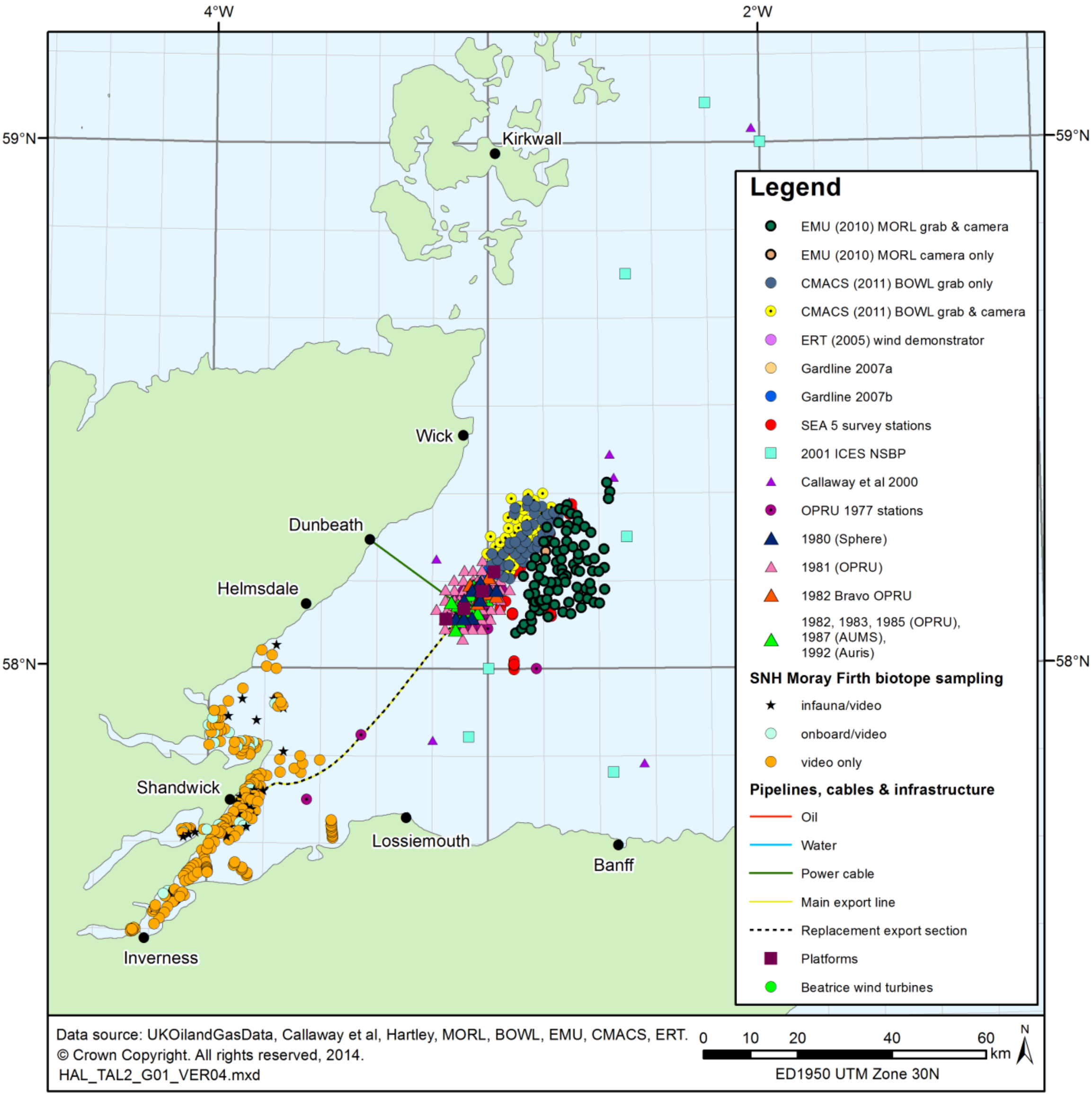


Figure 3.4 – Seabed Sampling Stations in the Beatrice Area, Including the Export Pipeline and Power Cable Routes



Note: Sampling dates in the legend may differ from report dates in references

3.7 Benthos

The most detailed studies of benthic communities in the northern outer Moray Firth were carried out over the Smith Bank (McIntyre 1958) and the Beatrice oilfield (Hartley & Bishop 1986). McIntyre (1958) described the sediments of Smith Bank as relatively coarse sand-shelly gravel with occasional outcrops of rock, noting that polychaetes, molluscs and the small sea urchin *Echinocyamus pusillus* were numerically dominant, while the bivalve *Cochlodesma praetenue* dominated the biomass.

Hartley & Bishop (1986) presented the results of a series of benthic surveys around the Beatrice platform area from 1977-1981, both before and after development (see Figure 3.4

for the locations of sampling undertaken in the Beatrice Field). The surveys indicated high species richness, both for individual sites and the area as a whole, suggesting a high natural diversity. Species abundance was also fairly high, and more comparable with inshore areas such as Sullom Voe than areas further offshore. As a result of the variable sediments in the area (and therefore the variety of habitats present), several community types were identified. These ranged from an assemblage in very fine sand sediment in slightly deeper waters in the south and west of the field, dominated by the bivalve *Thyasira flexuosa*, sea-pen *Virgularia mirabilis* and polychaete worm *Aricidea catherinae*, through a fine sand fauna characterised by *Tellina fabula*, to the coarser sand (>5% gravel) sediments of the Smith Bank in the northeast, dominated by the bivalve *Tellina (Moerella) pygmaea* and polychaetes such as *Scoloplos armiger*, *Lumbrineris gracilis* and *Polycirrus* spp. A seabed survey conducted at the Beatrice Field in 1992 found undisturbed communities were dominated numerically by the polychaete worms *Spiophanes bombyx* and *S. armiger* (AURIS 1993). More recently, infaunal analysis of samples taken at the Jacky Field (Gardline 2007a), to the north of Beatrice, indicated that in areas of medium to coarse sediment, *S. bombyx*, *T*. (*M.*) *pygmaea*, *Cochlodesma praetenue* and the small sea urchin *Echinocyamus pusillus* were dominant.

Ecological changes around the Beatrice AD and AP platforms were investigated by Addy *et al.* (1984) following the discharge of cuttings drilled with OBM. Results of surveys undertaken soon after OBM cuttings discharges indicated the presence of various zones of ecological effects, with the most marked effects localised (<115m) and characterised by a reduction in the number of dominant taxa and the abundance of the opportunistic polychaete *Capitella capitata*. Beyond 115m, progressively few *C. capitata* individuals were observed and faunal richness generally increased to undisturbed sediment levels.

A baseline survey from the Beatrice Wind Farm Demonstrator turbine sites revealed diversity was uniformly high across the survey area (ERT 2005). Samples were taken from water depths of 43-46m and sediments were generally fine sands. The infauna was characterised by the polychaetes *Chaetozone setosa*, *Lumbrineris gracilis* and *Exogone hebes*, the amphipods *Urothoe elegans*, *Ampelisca tenuicornis* and *Bathyporeia* spp., the bivalve mollusc *Tellina fabula* and *Echinocyamus pusillus*. Very little epifauna was observed from video footage and grab samples taken around the wind turbines and at stations to the north of the Beatrice Alpha complex (ERT 2005, Gardline 2007b). Visible epifauna included occasional hydroids and single specimens of the whelk *Buccinum undatum*, the scallop *Pecten maximus*, sea star *Asterias rubens* and a species of brittlestar.

Very limited benthic ecology data exists for the seabed along the export pipeline and power cable routes, with the exception of a recent broadscale biotope mapping survey by SNH (Foster-Smith *et al*. 2009) for the inner Moray Firth (up to the 30m bathymetric contour). This survey covers the export pipeline route from landfall at Shandwick, seaward out to approximately 7km. Video and grab samples showed sandy mud and muddy sand sediments along the route which were characterised by the presence of the brittlestars, *Amphiura filiformis* and *Ophiura ophiura*, and the gastropod *Turritella communis*. At depths >20m there were seabed burrows including those of the prawn *Nephrops norvegicus*.

Conservation species of interest found in the Moray Firth include the horse mussel (*Modiolus modiolus*) and the fan mussel (*Atrina fragilis*) (see Section 3.13). Surveys around the Beatrice facilities and wind turbines have not recorded any *A. fragilis* specimens and only solitary individuals of *Modiolus*, with no evidence of *Modiolus* reefs (ERT 2005, Gardline 2007a, CMACS 2010, EMU 2011).

3.8 Cephalopods

Cephalopods are mainly short-lived, fast growing molluscs such as squid, octopus and cuttlefish. Cephalopods play a key role in marine foodwebs; they feed opportunistically on a wide variety of prey (polychaetes, molluscs, crustaceans and fish) and constitute a major prey source for a number of marine top predators including commercially important fish species, cetaceans, seals and seabirds. In the Moray Firth, cephalopods form an important part of the diet for several top predators; the grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) have a preference for octopus (*Eledone cirrhosa*), while squid are regularly found in the stomach contents of bottlenose dolphin (*Tursiops truncatus*), harbour porpoise (*Phocoena phocoena*) as well as cod (*Gadus morhua*) (Boyle & Pierce 1994, Tollit & Thompson 1996, Daly *et al.* 2001, Santos *et al.* 1994, 1995).

The main commercial cephalopod species in Scottish waters is the veined squid (*Loligo forbesii*) (Boyle & Pierce 1994, ICES 2016). This species is thought to be present in all seasons; but the spatial pattern of abundance varies with season, with Scottish coastal waters yielding a clear peak in catches during October and November (Pierce *et al.* 1994, 1998). A fishery for *Loligo forbesii* has developed in the Moray Firth over the last 20 years, with fishermen taking advantage of the lack of quota restrictions on this species (DECC 2016). ICES landings data for 2014 and 2015 reveal that squid comprise almost all cephalopod landings and are a key component of landings within the Moray Firth (Scottish Government website).

Spawning grounds for *L. forbesii* are not fully understood; spatial patterns in fishery data suggest that spawning occurs in inshore waters, and juveniles then move offshore. It has been suggested that there are spawning grounds for *L. forbesii* within the Moray Firth, with spawning beginning in the winter months and small squid first appearing in July/August (Young *et al.* 2006, Hastie *et al.* 2009, Viana *et al.* 2009, Oesterwind *et al*. 2010).

3.9 Fish and Shellfish

Marine Species – Spawning and Nursery Grounds

The Moray Firth area supports a number of commercially important species, several of which use the area as spawning and/or nursery grounds. The spatial and temporal distributions of spawning and nursery grounds of some commercial species in the UK were described in Coull *et al.* (1998) and more recently revised by Ellis *et al.* (2012). At the scale of the Moray Firth, some uncertainty and data gaps remain, particularly relating to spawning grounds for elasmobranchs.

The Beatrice area lies within ICES Rectangles 44E6 and 45E6. These rectangles overlap or with known spawning and nursery grounds of eight commercially important fish and shellfish species of particular commercial importance as well as nursery grounds of eighteen species (Table 3.1 and Figure 3.5 and Figure 3.6).

Table 3.1 – Species with Spawning and/or Nursery Grounds in the Beatrice Area

Species	Spawning grounds	Peak spawning	Nursery
Herring (*Clupea harengus*)[1,2]	✓	August – September	✓ (High intensity)
Sprat (*Sprattus sprattus*)[1,2]	✓	May – August	✓
Cod (*Gadus morhua*)[1,2]	✓	January – April	✓ (High intensity)
Whiting (*Merlangius merlangus*)[1,2]	✓	February – June	✓ (High intensity)
Plaice (*Pleuronectes platessa*)[1,2]	✓	December – March	✓ (Low intensity)
Lemon Sole (*Microstomus kitt*)[1,2]	✓	April – September	✓
Sandeel (*Ammodytes marinus*)[1,2]	✓	November – February	✓ (Low intensity)
Nephrops (*Nephrops norvegicus*)[1]	✓	January – December	✓
Mackerel (*Scomber scombrus*)[2]	-	-	✓ (Low intensity)
Blue whiting (*Micromesistius poutassou*)[2]	-	-	✓ (Low intensity)
Haddock (*Melanogrammus aeglefinus*)[1]	-	-	✓
Saithe (*Pollachius virens*)[1]	-	-	✓
European hake (*Merluccius merluccius*)[2]	-	-	✓ (Low intensity)
Ling (*Molva molva*)[2]	-	-	✓ (Low intensity)
Monkfish (*Lophius piscatorius*)[2]	-		✓ (High intensity)
Spurdog (*Squalus acanthias*)[2]	-	-	✓ (Low intensity)
Thornback ray (*Raja clavata*)[2]	-	-	✓ (Low intensity)
Spotted ray (*Raja montagui*)[2]	-	-	✓ (Low intensity)

Source: Coull et al. (1998), Ellis et al. (2012)

In the Moray Firth, discrete banks of clean gravel are regularly used by spawning herring (Gordon 2003). Juvenile herring from both the Moray Firth population and those from the west coast of Scotland use the inner firths as nursery grounds (Marine Scotland website). The herring stay within the inner firths for 1-2 years, after which they move to the outer Moray Firth and offshore where they join adult populations. Sprat use deeper waters of the outer Moray Firth to spawn and adults overwinter in nearshore areas of the Firth.

The Moray Firth, and in particularly Smith Bank, is one of the most important spawning grounds in the central North Sea for plaice (Coull *et al.* 1998, Goldsmith *et al*. 2015). Smith Bank is also important for sandeel (Sparholt 2015) and cod, the latter migrating into the area from offshore to spawn (Hislop *et al*. 2015). The outer Moray Firth is of particular importance to adult spawning and juvenile lemon sole. Juvenile haddock remain and feed in the shallow waters of the Firth until they mature; adult haddock also feed in the Moray Firth and migrate in winter to spawn in the North Sea in spring.

Among sharks, skates and rays, the Moray Firth area is important for several commercial species including spurdog (*Squalus acanthias*), lesser spotted dogfish (*Scyliorhinus canicula*), starry ray (*Amblyraja radiata*) and cuckoo ray (*Leucoraja naevus*) as well as thornback ray (*Raja clavata*) and spotted ray (*Raja montagui*) (Ellis *et al.* 2004). In addition, sightings of basking shark (*Cetorhinus maximus*) occur regularly albeit infrequently during the summer (Solandt & Ricks 2009, Solandt & Chassin 2014).

Figure 3.5 – Selected Fish and Shellfish Nursery Areas

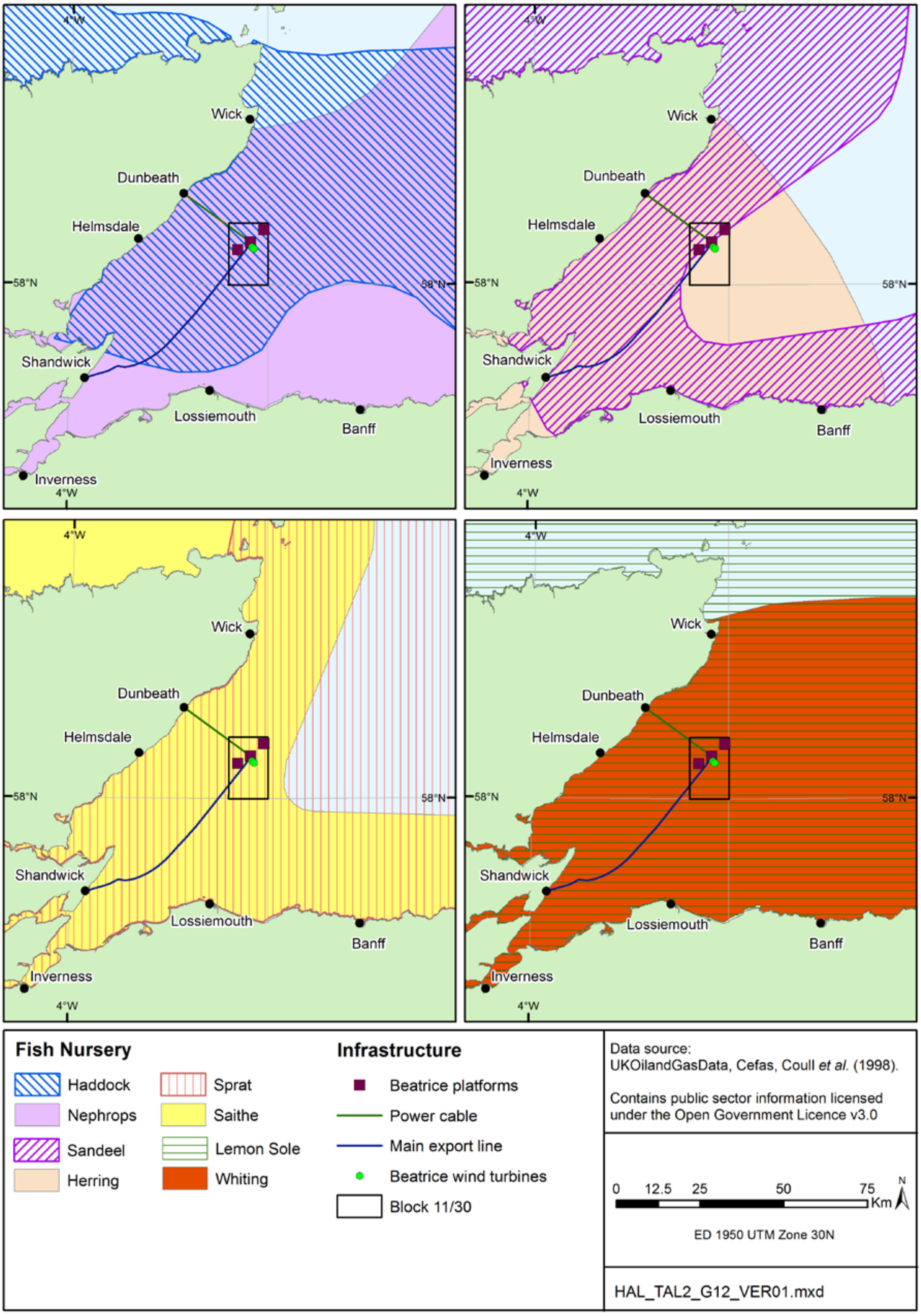
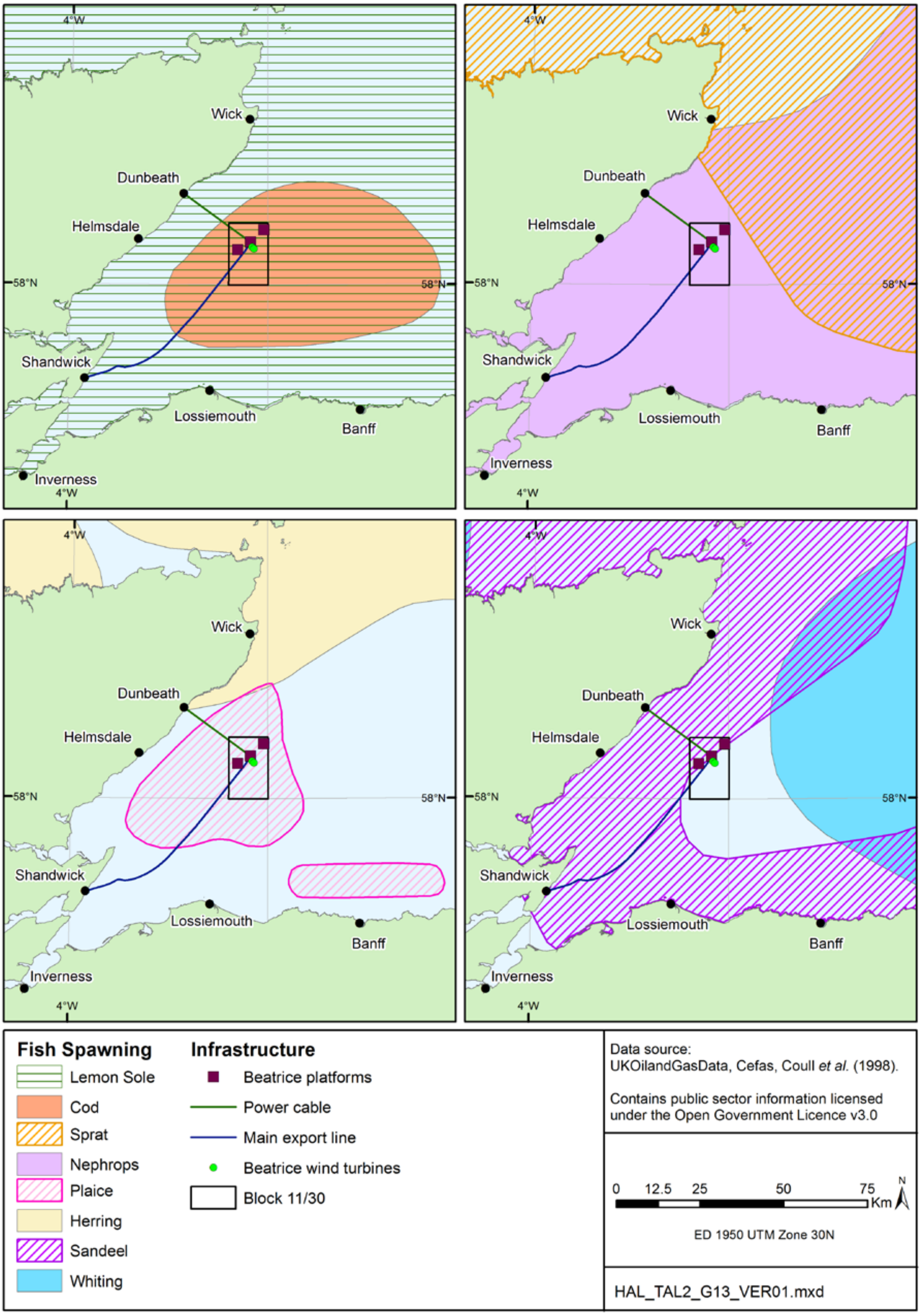


Figure 3.6 – Fish and Shellfish Spawning Areas



Several shellfish species including *Nephrops*, edible crabs, lobsters, scallops and queen scallops, edible winkles, edible mussels, whelks and razorfish are found in the Moray Firth area (Chapman 2004). The *Nephrops* population is found along a strip of suitable sediment which broadens out eastwards from the inner Moray Firth to Macduff (Coull *et al.* 1998). Important scallop fishing grounds exist on Smith Bank, and off the northwest coast between Wick and Golspie. Edible mussels form mussel beds in muddy and sandy areas, particularly in the Dornoch, Cromarty and Inverness/Beauly Firths, and also colonise rocky shores in the area. Cockles, although widespread, are generally concentrated in the intertidal habitats of the inner firths and along the southern coast of the Moray Firth.

Diadromous and Freshwater Species

Atlantic salmon (*Salmo salar*) and sea lamprey (*Petromyzon marinus*) occur in the Moray Firth area, and are listed as Annex II protected species under the EU Habitats Directive, as well as being on the OSPAR List of Threatened and/or Declining Species and Habitats[11]. Several sites in the region have been designated as Special Areas of Conservation (SACs) for the presence of one or more of these species (see Section 3.13).

The waters of the Moray Firth are important for Atlantic salmon, with more than one third of Scotland's main salmon rivers flowing into the catchment area (Moray Firth Partnership website). The main salmon rivers in the area are on the southern shore, especially the River Spey (a designated SAC with Atlantic salmon a primary feature) and its tributaries, and also the rivers Deveron, Findhorn and Nairn; these rivers are also important for sea trout (*Salmo trutta*). The Berriedale and Langwell Waters and the river Oykel on the northwest coast contain important populations of salmon and are designated SACs. The river Helmsdale, and to a lesser extent the rivers Fleet and Brora, are important for recreational fishing of salmon and sea trout. Further inland, the river Moriston, which drains into Loch Ness, is designated a SAC with Atlantic salmon a qualifying feature.

Atlantic salmon migrate from Scottish rivers towards distant feeding grounds and have been found West of Greenland and around the Faroe Islands but the exact migration route is not known; on their return, tagging studies have shown evidence of movement into the Moray Firth along the mainland coast from both the northwest and south (Malcolm *et al.* 2010). A large migration of these anadromous fish through the Moray Firth has been inferred from the feeding habits of bottlenose dolphins which have been observed to move to inshore areas of the Firth and take large salmonids during summer (Wilson *et al.* 1997).

Sea lamprey are jawless fish which spawn in freshwater but complete their life cycle at sea. They require clean gravel for spawning, along with silt or sand habitat to accommodate the burrowing larval phase. Sea lamprey have been recorded from several rivers in the Moray Firth area, most notably in the Spey, where they are a primary reason for the river's designation as a SAC. Surveys of the lower river Spey in 2002 identified many areas of suitable lamprey habitat, although sea lamprey larvae were rare (Laughton & Burns 2005).

The freshwater pearl mussel (*Margaritifera margaritifera*) is a threatened species on the IUCN Red List. It inhabits cool, clean, fast-flowing rivers and streams with healthy native salmonid populations and it is found in several water courses draining into to Moray Firth, and is a primary reason for the designation of several SACs in the region: the rivers Oykel,

[11] OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-6).

Evelix, Spey and Moriston. While it remains in freshwater for the duration of its life cycle, it spends its larval stage attached to the gills of diadromous salmonids such as Atlantic salmon and so is reliant upon them for survival. The larvae attach themselves to the gills of salmonids around mid-late summer, before dropping off the following spring to settle in riverbed gravels where they grow to adulthood (JNCC website a).

3.10 Birds

The Moray Firth and surrounding coastline is of year round importance for marine birds, a summary of which is presented in Table 3.2, and discussed in subsequent sections.

Table 3.2 – Summary of Bird Distribution in the Moray Firth Area throughout the Year

Month	Abundance in the Moray Firth blocks
January	Large numbers of waders in coastal areas. Abundance of guillemots and razorbills in coastal areas. Concentrations of gannets in Smith Bank area. Herring gulls, fulmars and great black-backed gulls abundant at sea.
February	Large numbers of eider ducks found along coast. Guillemots distributed at sea with main North Sea concentrations in the Moray Firth.
March	Concentrations of gannets, razorbills, kittiwakes and guillemots recorded at sea, particularly in Smith Bank area. Abundance of herring gulls in inner Moray Firth area.
April	Cormorant sightings in coastal waters. Small numbers of lesser black-backed gull sighted throughout the Moray Firth and offshore. Large offshore concentrations of guillemots over Smith Bank. Congregation of sea ducks in coastal waters.
May	Start of breeding season for most seabirds – very few present in areas away from breeding sites. Low numbers of great skua widely distributed at sea. Small numbers of lesser black-backed gull sighted throughout the Moray Firth and offshore.
June	Peak of breeding season. Majority of seabird sightings in coastal areas.
July	Moulting season for inshore and coastal birds. During this time some auks and ducks are flightless. Flightless moulting adults and juveniles congregate in the Moray Firth.
August	Offshore congregations of flightless moulting adult and juvenile auks. Peak in number of Arctic and great skua widely distributed in Moray Firth. Concentrations of herring gulls present over Smith Bank. Large concentrations of post-breeding puffins occur off northern Caithness coast. Density of guillemots are highest.
September	Large numbers of fulmars, sooty shearwaters, Arctic skua and great skua dispersed at sea. Peak abundance of Manx shearwater in coastal area of inner Moray Firth. High abundance of gannets over northeastern part of Smith Bank. Influx of common scoter into Moray Firth.
October	Continued influx of common scoter. Concentrations of gannets in Smith Bank area. Arctic skua widely dispersed over offshore area. Small numbers of lesser black-backed gull sighted throughout the Moray Firth and offshore.
November	Moray Firth remains important for razorbills, guillemots and herring gulls. Area is also important for long-tailed ducks arriving from offshore.
December	Peak in herring gull abundance, especially off the Moray coast. Guillemots and razorbills still present in high numbers. The area also sustains internationally important flocks of long-tailed duck, common and velvet scoter, goosander and red-breasted merganser.

Source: Tasker & Pienkowski (1987), Tasker (1996), Talisman (2006)

Seabirds

Breeding seabirds including kittiwake, guillemot and razorbill at colonies along the coastline commute offshore to feed, particularly over Smith Bank. Cormorants, shags, gulls and terns tend to feed closer to shore. The waters of the outer Moray Firth and the nearshore waters off the Moray coast are of particular importance as feeding areas (Tasker 1996). Following the breeding period adult and juvenile auks move offshore where the adults moult. The waters around Smith Bank also support important concentrations of shags, while coasts along the southern Moray Firth are of particular year round importance for herring gulls. The importance of the area is reflected in the designation of a number of international and national conservation sites on land and at sea (see Section 3.13).

The east Caithness cliffs, within 20km of the Beatrice Field facilities support vast numbers of breeding seabirds, and the area is designated as an SPA, SAC and MPA. Qualifying features for these designations include sea-cliff habitat supporting breeding populations of European importance of peregrine (*Falco peregrinus*), guillemot (*Uria aalge*), herring gull (*Larus argentatus*), kittiwake (*Rissa tridactyla*), razorbill (*Alca torda*), shag (*Phalacrocorax aristotelis*) and black guillemot (*Cepphus grylle*). These species, along with several others, contribute towards the area regularly supporting 300,000 individual seabirds during the breeding season (JNCC website b). The seabirds feed in both the inshore waters adjacent to the cliffs, as well as throughout other areas of the Moray Firth and beyond.

The main source of data on population size is the decadal census of British and Irish seabird colonies; the most recent, 'Seabird 2000', took place from 1998-2002 with results published by Mitchell *et al.* (2004). On an annual basis, key colonies along the Moray Firth are visited as part of the Seabird Monitoring Programme (SMP) and results on population trends and conservation status are reported regularly. The SMP aims to provide information on changes in seabird numbers at selected sites to monitor aspects of the health of the wider marine environment and inform conservation and research needs (Mavor *et al.* 2006, JNCC 2014). Additionally, strategic programmes including the Future of the Atlantic Marine Environment (FAME), and more recently Seabird Tracking and Research (STAR) which has sought to continue the work undertaken for FAME, have provided results on the movement of a number of seabird species since 2010 such as fulmar, guillemot, kittiwake, razorbill and shag, including in relation to a number of colonies in Scotland. Though involving relatively few birds and short tagging periods, the FAME study output did show use of the Moray Firth by fulmar, kittiwake and razorbill from Orkney colonies for foraging during the breeding season.

For the Beatrice Wind Farm Demonstrator project, baseline bird surveys were conducted from the Beatrice AP platform in 2005. Total survey effort was 171 hours and surveys were conducted in all months of the year, although with variable effort between months (Talisman 2006). The ten most frequently observed birds (and abundances) are listed in Table 3.3.

Auks showed clear peaks in abundance in April and June. Kittiwake abundance peaked in July, but was fairly high throughout spring-summer. Fulmar were abundant throughout the majority of the year, although notably less abundant from September-December. Gannet abundance was elevated from May-November, with peak numbers during October. Great black-backed gull were most abundant during autumn and winter months (Talisman 2006).

Boat-based surveys were conducted for the Beatrice Offshore Wind Farm (BOWL) project in the Moray Firth between October 2009 and September 2011 (RPS 2012). The boat based surveys took place over two days each month covering an area of approximately 383km^2 which included a 4km buffer of the wind farm site boundary. A single aerial survey was undertaken in March 2011 where weather prevented the use of boat based methods. For the 22 boat-based surveys, 21,419 individuals were recorded across 22 species. Those most frequently observed species are summarised in Table 3.3. Six pre-construction digital aerial surveys were undertaken between May and August 2015 covering the BOWL site and an area extending westwards to the East Caithness cliffs covering an area of 1,142km^2 (BOWL 2016). Densities of seabirds on the water and in flight were estimated for gannet, guillemot, kittiwake, puffin, razorbill, great black-backed gull and herring gull, which were found to be similar to those for the boat-based surveys undertaken in 2009 and 2011.

Table 3.3 − Most Frequently Observed Birds from Surveys Relating to the Beatrice Demonstrator and BOWL Projects

Species	Beatrice AP 2005		BOWL area 2008-2011
	Observations	Individuals	Observations
Kittiwake	1384	2943	2519
Auk[1]	1113	5757	12249
Fulmar	887	1078	2459
Gannet	528	707	528
Great black-backed gull	246	424	502
Herring gull	137	193	415
Great skua	49	51	91
Shag	30	63	41
Meadow pipit	25	33	-
Sooty shearwater	17	34	118
Arctic tern	-	-	29
Arctic skua	-	-	19

Notes: All data are totals for the year. [1]All auk species aggregated (includes guillemot, black guillemot, little auk, puffin and razorbill).
Source: Talisman (2006), RPS (2012)

Waterbirds

The firths, bays and other coastal areas of the Moray Firth basin are of great importance to wintering and passage wildfowl, as well as for breeding waders and other waterbirds; several Ramsar and SPA sites are designated for such features in the region (see Section 3.13).

Numbers of non-breeding waterbirds throughout the UK are regularly estimated from land-based surveys as part of the Wetland Bird Survey (WeBS). Several sites in the Moray Firth area have such high numbers of birds (5yr average of >20,000 birds) to be consistently included in the UK list of principal sites for non-breeding waterbirds; these are the Inner Moray and Inverness Firth, the Dornoch Firth, the Cromarty Firth as well as the Loch of Strathbeg (Austin *et al.* 2014). The area is of considerable importance for seaduck, most of which occur within 5km of the shore. Large flocks are also regularly recorded in the outer Dornoch Firth, off Culbin Sands, off Burghead Bay and in Spey Bay (Banks *et al.* 2006). Wintering waders are widely distributed throughout the inner Moray Firth. Major concentrations can be found on the large intertidal areas of the inner Moray Firth (Craddock & Stroud 1996, Stroud & Craddock 1996). Large aggregations of several species of geese are present at a number of sites throughout the region during winter months.

In addition, aerial surveys of wintering seaducks, divers and grebes have been conducted annually since 2000/2001 by JNCC with a particular focus on the Moray Firth area to support work progressing the identification of SPAs; long-tailed duck, common scoter and common eider were the most abundant species in all years (Wilson *et al.* 2006, Söhle *et al.* 2006, Lewis *et al.* 2009).

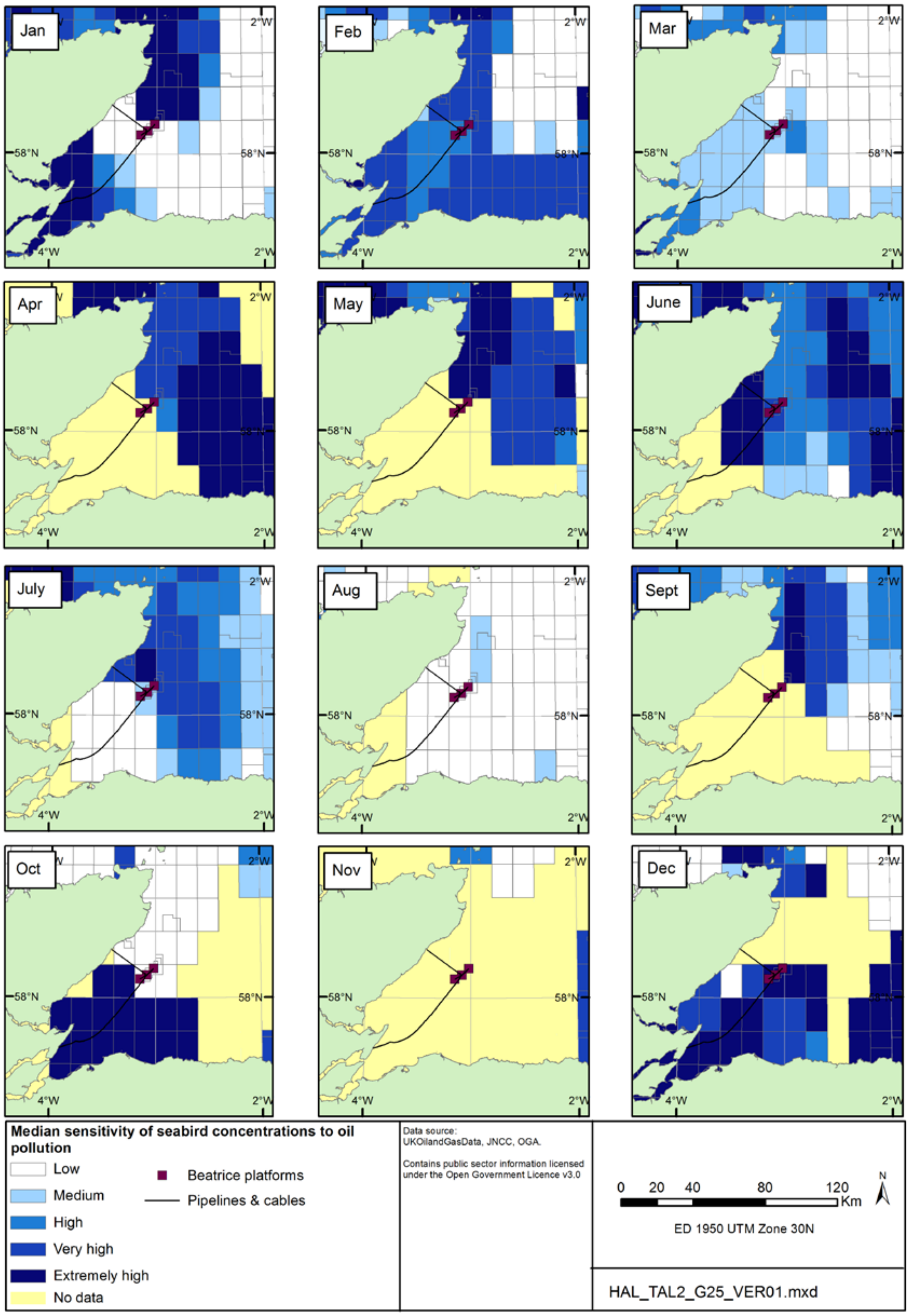
Vulnerability to Oil Pollution

The vulnerability of seabird species to oil pollution at sea is dependent on a number of factors (for example, species type in the area, number of species, number of individuals) and varies considerably throughout the year. The Seabird Oil Sensitivity Index (SOSI) was developed (see Webb *et al.* 2016) as an update and replacement to the Offshore Vulnerability Index (OVI) developed by JNCC (JNCC 1999, also see Williams *et al.* 1994). The SOSI is based on the methods of Tasker and Pienkowski (1987) and Williams *et al.* (1994), updated using Certain *et al.* (2015) and is presented as a series of monthly UKCS block gridded maps, with each block containing a score on a scale of low to extremely high. These scores indicate where the highest seabird sensitivities might lie (based on the combination of abundance and susceptibility to oil spill effects) if there were to be a pollution incident (see Figure 2.3).

Seabird sensitivity to surface pollution in the Beatrice area and adjacent blocks is classified as high, very high or extremely high for 10 months of the year (Webb *et al.* 2016)[12] (see Figure 3.7 which shows the median values used to summarise the central point of the data owing to the skewed nature of the SOSI scores). It should be noted that low availability of recent data is indicated for a number of months, highlighted by Webb *et al.* (2016) as a wider issue for the index which requires extended data coverage to be improved. As context, the OVI indicates seabird vulnerability to surface pollution is very high (the highest category) across the entire Moray Firth throughout all months of the year.

[12] Also see OGA (2016). 29th Round Other Regulatory Issues – version at 23rd August 2016. https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/

Figure 3.7 – Monthly Seabird Oil Sensitivity Index Scores



3.11 Marine Mammals

The Moray Firth is an important area for several cetaceans, with a population of resident bottlenose dolphin and high numbers of harbour porpoises, white beaked dolphins and minke whales sighted regularly. The Moray Firth area also supports important breeding colonies for harbour and grey seals.

Reid *et al.* (2003) provide a summary of the distribution of cetacean sightings in northwest European waters. The distribution and ecology of marine mammals in the central and northern North Sea is summarised by Hammond *et al.* (2004), while an overview of the marine mammals of the Moray Firth specifically is given in Thompson *et al*. (2013). Widespread ship-based and aerial surveys of cetaceans in the North Sea and adjacent waters took place in the summers of 1994 and 2005 for the SCANS and SCANS-II programmes (Small Cetacean Abundance in the North Sea); results of these are presented in Hammond *et al.* (2002) and Hammond *et al.* (2013). The latest survey, SCANS-III took place in summer 2016 and results are currently being analysed. The EIA Report will incorporate this data if available at the time of submission.

Extensive information on the distribution and abundance of grey and harbour seals around Britain is regularly obtained from annual aerial surveys of breeding colonies and haul-out sites and from satellite-relayed data loggers studies; results are reported yearly by the Special Committee on Seals (SCOS) which is tasked with providing advice on matters related to the management of seal populations.

Bottlenose Dolphin

Bottlenose dolphins (*Tursiops truncatus*) occur across a large part of UK waters, in coastal inshore areas, on the continental shelf and further offshore but for this species there is evidence for sub-population structuring. Offshore dolphins are likely part of a wide-ranging large oceanic population but inshore dolphins are mainly part of four semi-resident and much smaller populations for which separate Management Units have been recently agreed (IAMMWG 2015); the relevant unit to the Moray Firth is the Coastal East Scotland Management Unit covering inshore waters from Orkney to the Firth of Forth.

In the Moray Firth, bottlenose dolphins are regularly observed throughout the year, with a clear preference for areas within 15 km of the coast and with highest densities in the inner Moray Firth and along the southern coast (Thompson *et al*. 2013). This species is listed in Annex II of the Habitats Directive[13], and the importance of this population, and the Moray Firth, is reflected in the designation of part of this area as a Special Area of Conservation (SAC).

In the 1980s, the core of the population's range was observed in the inner Moray Firth, typically within three main areas: the Kessock Channel, Chanonry Narrows, and around the mouth of the Cromarty Firth (Wilson *et al.* 1997, 2004; Hastie *et al.* 2003). While dolphins are seen in these areas throughout the year, an apparent influx of animals is observed from May-September (Thompson *et al*. 2011). Surveys along the southern coast of the Moray Firth from 2001-2005 encountered bottlenose dolphins along the majority of the coastline, primarily in waters <25m depth (Robinson *et al.* 2007). Since the early 1990s, data have

[13] *Council Directive 92/43/EEC on the conservation of natural habitats of wild flora and fauna*

shown the population's range to include waters off Aberdeenshire, Tayside and Fife, including the Firth of Forth with high individual variability in patterns of movement between Moray Firth SAC and Tayside and Fife areas (Wilson *et al.* 2004, Thompson *et al.* 2011, Quick *et al.* 2014).

The latest number of bottlenose dolphins using the SAC has been estimated at 94 individuals (95%CI 81-110) in the summer 2013; annual estimates over the period 1990-2013; show considerable inter-annual variability (range 43-134), but no significant linear trend over time has been detected (Cheney *et al.* 2014).

Harbour Porpoise

The harbour porpoise is the most common cetacean in the North Sea. It is widely distributed throughout the Moray Firth, with frequent sightings in nearshore and offshore waters. Although seen throughout the year, sightings are most frequent and widespread in this region between April and September.

Boat-based visual and acoustic surveys of the Moray Firth SAC (see Section 3.13) and adjacent waters from January-October 2001 encountered small schools of harbour porpoise throughout most of survey area (Hastie *et al.* 2003). However, porpoises were rarely encountered in inshore waters of the inner Moray Firth, where bottlenose dolphin were most frequently encountered. Passive acoustic monitoring during late summer/autumn at the Beatrice Field showed harbour porpoise to be frequently present, with short visits recorded several times per day (Talisman 2006). Widespread distribution and regular presence across the Moray Firth was confirmed in more recent studies (Thompson *et al.* 2013). The Smith Bank and Outer Moray Firth have been identified as persistent summer high density areas following distribution modelling of survey data across the UKCS (Heinänen & Skov 2015).

Analyses of the stomach contents of harbour porpoise stranded in Scotland from 1992-2003 (primarily the east coast) revealed sandeels and whiting to be the main prey items (Santos *et al.* 2004). Other small gadoids and cephalopods were also important, along with herring in some years.

White-Beaked Dolphin

White-beaked dolphins (*Lagenorhynchus albirostris*) are frequently sighted in the Moray Firth, primarily in offshore waters of the outer firth. Along with harbour porpoise, they are the most commonly occurring cetaceans in the central and northern North Sea. Although sightings are made throughout the year, the species is most frequently observed between June and October.

Minke Whale

Minke whales (*Balaenoptera acutorostrata*) are found throughout much of the Moray Firth during summer months, with sightings recorded across the outer Moray Firth, the southern coast and occasionally the inner Moray Firth. They have been recorded during both SCANS I and II (Hammond *et al.* 2002, Hammond *et al.* 2013), and the inshore waters of the southern Moray Firth (primarily between Spey Bay and Fraserburgh (Robinson *et al.* 2009)) are thought to provide a rich feeding ground, especially between June and October (Robinson & Tetley 2007, Paxton *et al.* 2014). Minke whales in this area appear to have a strong preference for water depths between 20 and 50m, steep shelf slopes and sandy-gravel sediment type, and as a consequence, are a feature of the proposed Southern Trench MPA (see Section 3.13).

Other Cetaceans

While mainly seen along the shelf break and over deeper waters such as the Faroe-Shetland Channel, long-finned pilot whale (*Globicephala melas*) are occasionally sighted in the Moray Firth; most sightings have occurred in June-August. Atlantic white-sided dolphin (*Lagenorhynchus acutus*) is common along the continental slope and deeper waters to the north and west of Scotland; they are occasionally seen in the northern North Sea, particularly from July-August, and may be occasionally present in the outer Moray Firth. Risso's dolphin (*Grampus griseus*) has been recorded in the outer Moray Firth area with sightings most common between May and September. Robinson *et al.* (2017) reviewed killer whale (*Orcinus orca*) sightings in the Moray Firth between 2001 and 2015; the majority of sightings were in the outer Moray Firth, particularly along the northern coastline. Killer whales were seen throughout the year, with peak observations between May and July.

Harbour Seal

Harbour (or common) seals (*Phoca vitulina*) haul out on tidally exposed areas of rock, sandbank or mud throughout the Moray Firth area, with the greatest concentration found in the inner Moray Firth particularly during June, July and August (breeding season and moult) (Thompson *et al.* 1996). Important haul-out sites are found at Ardersier (at the mouth of Inverness Firth), the Beauly, Cromarty and Dornoch Firths, with smaller haul out groups near Brora, at Spey Bay and Findhorn. The harbour seal is listed in Annex II of the Habitats Directive and the importance of its presence in the region is reflected in the designation of Dornoch Firth and Morrich More as a SAC.

In the area surveyed annually (Helmsdale to Findhorn) 705 harbour seals were counted in 2015, compared with 693 counted in 2014 (Duck & Morris 2016). These are the two lowest counts, but in contrast with the extreme declines experienced elsewhere on the East Coast of Scotland (in particular Shetland, Orkney and Forth of Firth) these represent a decline of just over 20% than the mean count between 2002 and 2013 (909 seals). Considerable variability between years across different sites within the Moray Firth have been recorded; for example, in 2015 Cromarty Firth had the lowest count (n=22), but Culbin and Findhorn had the highest (330) (Duck & Morris 2016).

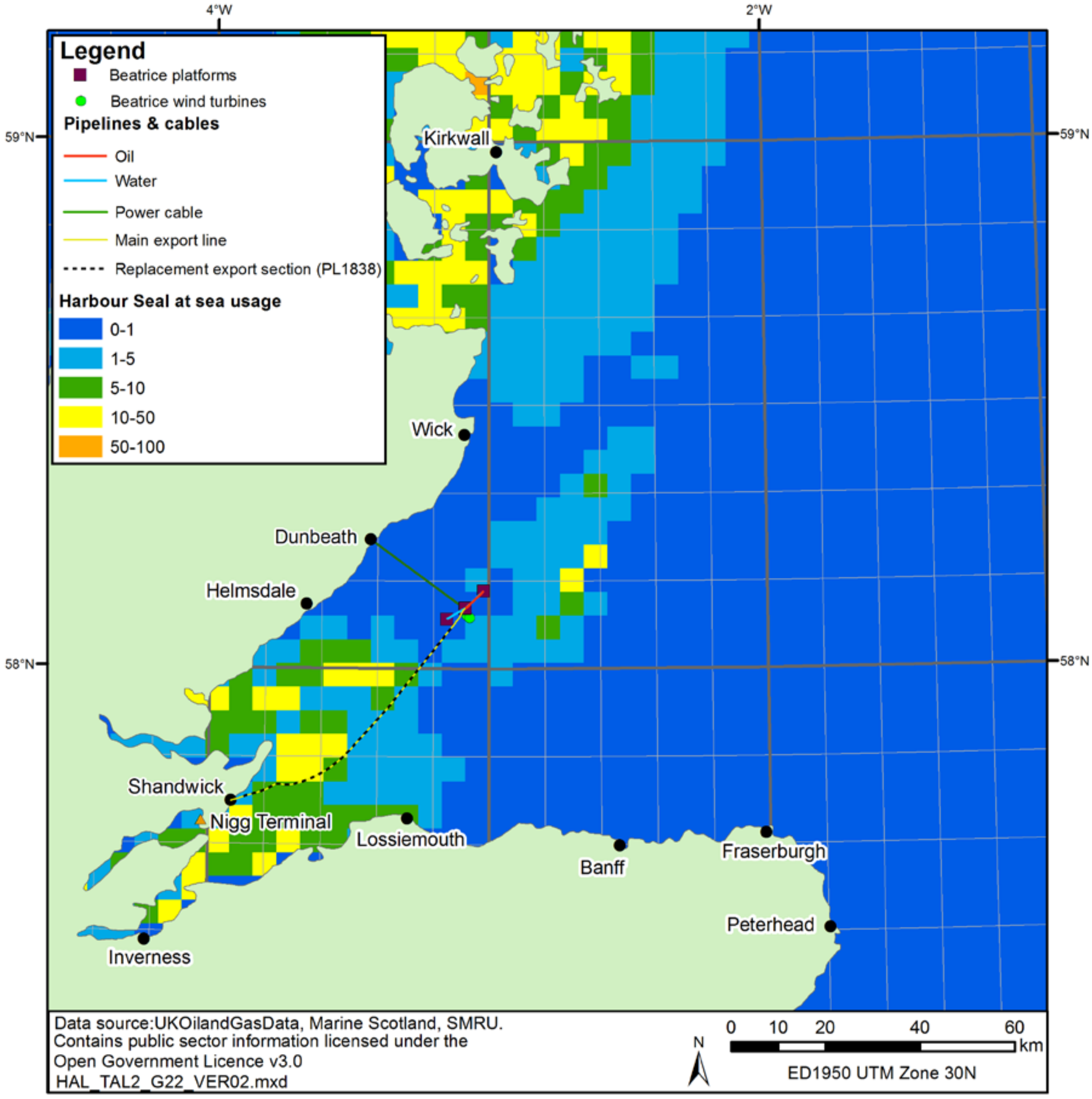
Following a period of decline, harbour seal counts in the Moray Firth have stabilised, while general declines have continued across several areas, in particular Shetland, Orkney and the Firth of Tay; research into the causes of the decline is ongoing[14] (SCOS 2015).

Harbour seals tend to forage within 60km of their haul out sites, and foraging areas can change depending on fish abundance (Thompson *et al.* 1996). In the Moray Firth, important foraging areas, include east of Tarbat Ness, north of Burghead, as well as the deep water of the inner Moray Firth. Larger seals appear to travel further out into the Moray Firth to forage than smaller seals. They also feed in rivers flowing into the Moray Firth. More recently, studies of harbour seal foraging distribution using satellite telemetry have revealed this species to forage much further offshore that previously thought and to display a large degree

[14] http://synergy.st-andrews.ac.uk/harbourseals/

of individual variation in foraging patterns and behaviour (Hammond *et al.* 2004, Sharples *et al* 2008, Sharples *et al.* 2012). In addition to seals from local haul-out sites, tagging studies have shown the Moray Firth to be part of the foraging range of seals from Orkney (Sharples *et al.* 2012). Maps displaying modelled estimates of at sea usage by harbour seals (Jones *et al.* 2013, also see Jones *et al.* 2015), show low to moderate seal density in the Moray Firth, including around the Beatrice facilities (Figure 3.8)

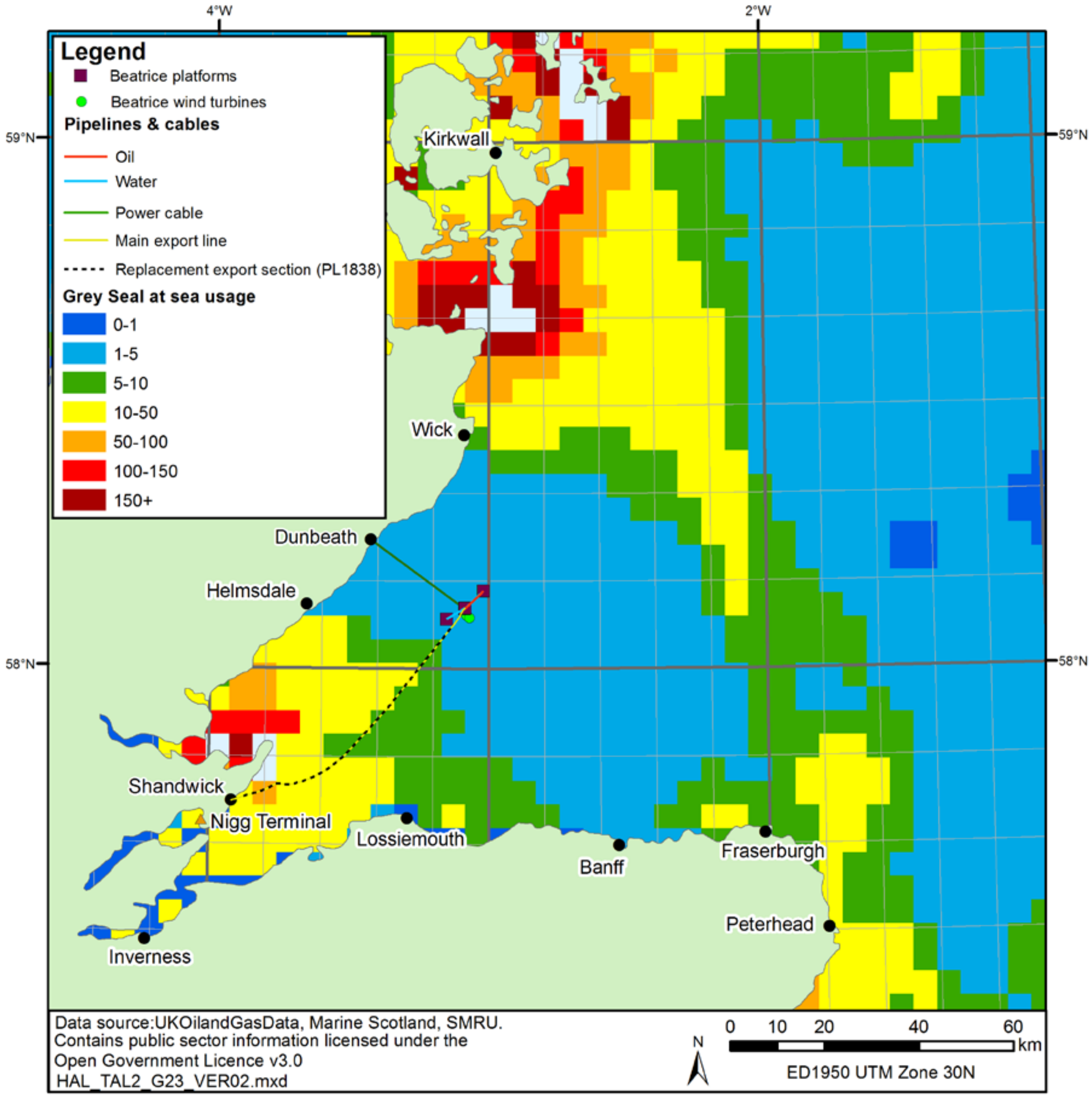
Figure 3.8 – Harbour Seal Estimated at Sea Usage



Grey Seal

Grey seals (*Halichoerus grypus*) breed on rocky beaches and in caves on the Moray Firth coast north of Helmsdale and also use haul out sites in the Dornoch Firth and on the South coast, particularly Culbin and Findhorn. Grey seals forage over a wider area than harbour seals, travelling up to 145km from haul out sites (Thompson *et al.* 1996). Numbers of seals at haul out sites are generally greatest from June-September. Grey seals are an Annex II listed species but there are no SACs designated specifically for grey seals within the Moray Firth area. Extensive telemetry information from British grey seals at sea shows that they are widely distributed throughout the Moray Firth (Russell & McConnell 2014), particularly outside the pupping season in October-November and the moulting season in February-April (Matthiopoulos *et al.* 2004). Maps displaying estimates of at sea usage by grey seals have been produced by Jones *et al.* (2013) (also see Jones *et al.* 2015 and Jones & Russell 2016), which show moderate to high seal density in the Moray Firth (Figure 3.9). Grey seals foraging in the Moray Firth are likely to include many individuals breeding across North Scotland (especially on Orkney) and the Hebrides (Russell *et al*. 2013).

Figure 3.9 – Grey Seal Estimated at Sea Usage



There has been a continual increase in pup production since regular surveys began in the 1960s; consequently population estimates are also increasing with a total estimate for the UK population in 2014 of 116,800 individuals (95% Confidence Interval 96,600-143,000) (SCOS 2015). The 2015 August count at haul-out sites across the Moray Firth was the highest ever recorded (n=1917) but variability is very high, with only 532 seals recorded in 2014 and ranging between 392 and 1917 between 1997 and 2015 (Duck & Morris 2016).

3.12 Otters

The otter (*Lutra lutra*) is a semi-aquatic mammal occurring throughout a range of ecological conditions, including inland freshwater and coastal habitats. The northern and eastern Highlands surrounding the Moray Firth are important areas for otters, with a number of SACs designated for their presence. Of these, the River Spey SAC and Dornoch Firth and Morrich More SAC include coastal and/or estuarine habitats.

The Dornoch Firth and Morrich More SAC is the most northerly large, complex estuary in the UK and is virtually unaffected by industrial development. The estuarine system, comprising sand dunes, woodlands and lochans provide an excellent habitat for otters, as do the Rivers Evelix and Oykel, which both feed into the site. It is the only specifically estuarine site designated as a SAC for otter on the east coast of Scotland. The estuary supports a good population of otters and observations of cub tracks provide evidence of breeding (Strachan 2007).

The River Spey maintains a persistently large population of otters. Reedbeds and islands, important riverine features for otters, are abundant and populations of prey species are healthy. Evidence of breeding, including breeding holts, cub tracks and sightings of family groups were noted (Strachan 2007). The lochs, lochans and ditches of the nearby Insch Marshes, provide ideal sites for feeding, resting and shelter for otters.

3.13 Conservation Sites

International Conservation Sites

To give appropriate protection to the many habitats and species of international conservation importance in the Moray Firth area, a number of marine, coastal and inland sites have been designated or are currently proposed for designation.

European designations comprise Special Protection Areas (SPAs) established under Birds Directive[15], and Special Areas of Conservation (SACs) under the Habitats Directive[16]. SPAs and SACs collectively form part of the European ecological network of Natura 2000 sites. Ramsar sites are wetlands of international importance designated under the Ramsar Convention[17]. Globally, the value of the Moray Firth in bird conservation has been recognised with five sites listed as Important Bird Areas by BirdLife International; protection for these areas has been provided for through SPA and Ramsar site designations. The suite of SPAs on land in Scotland is well established, but further work is needed to complete a network at sea. Results to date have identified important seabird aggregations in the Moray Firth (Kober *et al.* 2012). Some of these have been taken forward for potential designation (pSPAs) and were subject to public consultation in 2016 and 2017, with a decision on designation to be made by Ministers thereafter.

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[15] *Council Directive 2009/147/EC on the conservation of wild birds*
[16] *Council Directive 92/43/EEC on the conservation of natural habitats of wild flora and fauna*
[17] *The Convention on Wetlands of International Importance, especially as Waterfowl Habitat*

The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 were introduced to facilitate the designation of SACs and SPAs in offshore waters beyond 12nm. Twenty offshore SACs have now been submitted to the European Commission but none is within the Moray Firth, the closest being the Scanner pockmark Site of Community Importance (SCI) approximately 200km to the east. Work to identify offshore SPAs continues (e.g. Kober *et al.* 2010, 2012).

In Scotland, nature conservation Marine Protected Areas are designated under the *Marine (Scotland) Act 2010* in Scottish territorial waters and by the *Marine and Coastal Access Act 2009* for offshore waters; recommendations are being made by SNH and JNCC respectively. The first tranche of MPAs was designated in July 2014, and at the same time formal advice was submitted recommending four additional MPA proposals for designation, one of which, the Southern Trench, is located in the Moray Firth (Figure 3.10, Table 3.4). These MPAs will give protection to features not currently covered by SPAs and SACs and contribute further to measures aimed at achieving Good Environmental Status across Europe's seas by 2020 under the EU Marine Strategy Framework Directive.

As part of the MPA process, a set of Priority Marine Features (PMFs) were identified based on an assessment of species and habitats on existing conservation schedules against whether a significant proportion of their population occur in Scotland's seas, whether they are under threat or in decline and the functional role they play.

The location of SACs, SPAs and nature conservation MPAs currently designated or proposed are shown in Figure 3.10 and Figure 3.11 for marine and coastal sites and for riverine and inland sites respectively; only inland sites with features linked to the marine environment (e.g. breeding areas for birds which feed in coastal/marine habitats, freshwater pearl mussel, Atlantic salmon) are shown. Further details on the specific features for each site are given for those within the Moray Firth in Table 3.4.

Table 3.4 – Relevant SACs, SPAs and MPAs and their Features

Name	Status	Summary of features
Abhainn Clais An Eas and Allt a`Mhuilinn	SAC	Freshwater pearl mussel
Auskerry	SPA	Arctic tern, storm petrel
Berridale and Langwell Waters	SAC	Atlantic salmon
Caithness and Sutherland Peatlands	SPA/Ramsar	Breeding black-throated diver, golden eagle, golden plover, hen harrier, merlin, red-throated diver, short-eared owl, wood sandpiper, common scoter, dunlin, greenshank, widgeon
Calf of Eday	SPA	Seabird assemblage; cormorant, fulmar, guillemot, kittiwake, great black-backed gull
Copinsay	SPA	Seabird assemblage; fulmar; guillemot; kittiwake; great black-backed gull
Cromarty Firth	SPA/Ramsar	Breeding common tern, osprey. Wintering bar-tailed godwit, whooper swan greylag goose. Wetland of international importance.
Culbin Bar	SAC	Perennial vegetation of stony banks, embryonic shifting dunes and Atlantic salt meadow

Table 3.4 – Relevant SACs, SPAs and MPAs and their Features

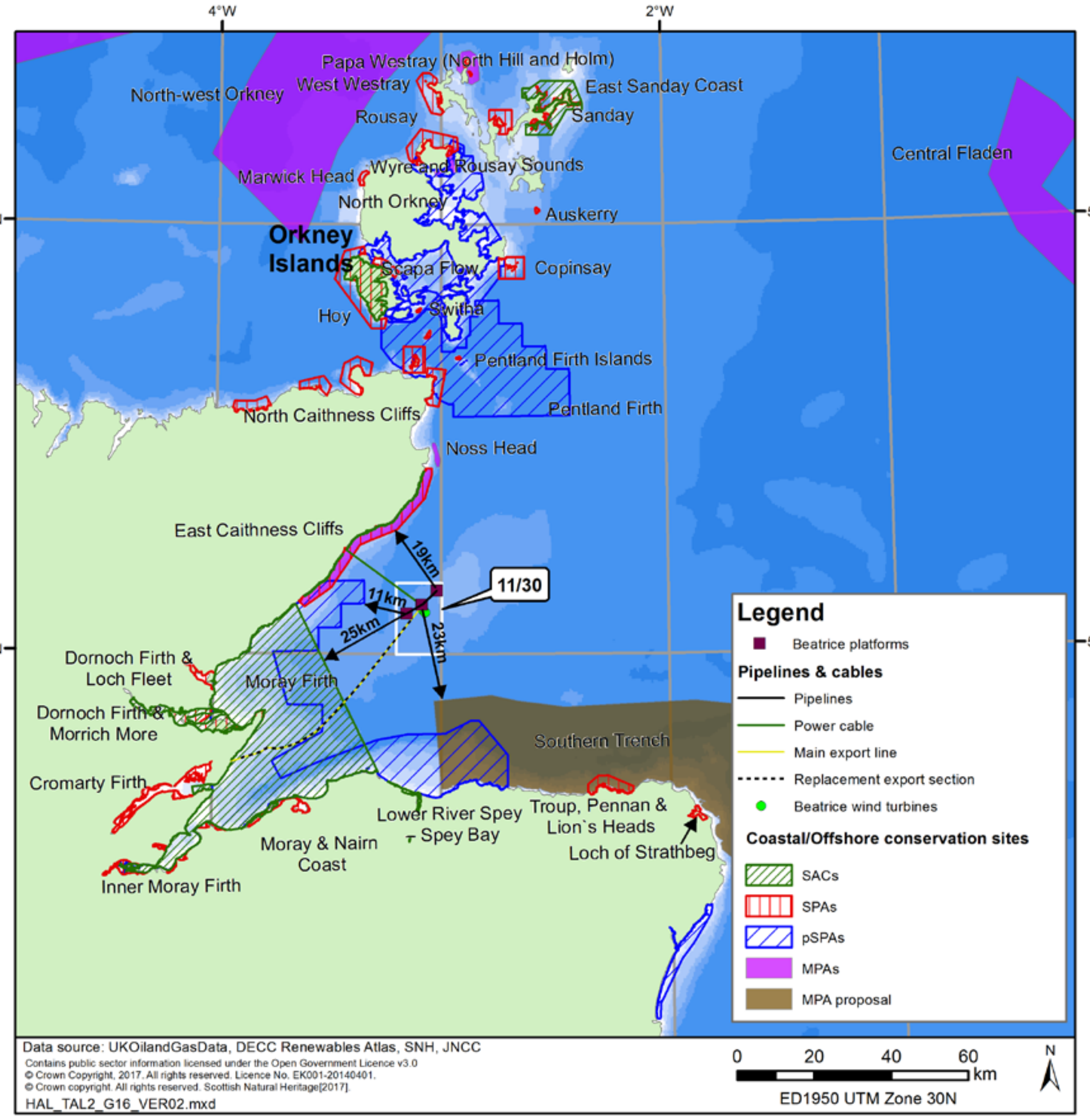
Name	Status	Summary of features
Dornoch Firth and Loch Fleet	SPA/Ramsar	Breeding osprey, wintering bar-tailed godwit, greylag goose and widgeon. Wetland of international importance
Dornoch Firth and Morrich More	SAC	Otter, harbour seal. Estuaries, mudflats and sandflats, *Salicornia* and other annuals colonising mud and sand and Atlantic salt meadow. Embryonic shifting dunes, white dunes, grey dunes, decalcified fixed dues with crowberry, Atlantic decalcified fixed dunes, coastal dunes with juniper, humid dune slacks. Sandbanks which are slightly covered by sea water all the time and reefs
East Caithness Cliffs	SAC	Vegetated sea cliffs
East Caithness Cliffs	SPA	Breeding peregrine, guillemot, herring gull, kittiwake, razorbill and shag. Seabird assemblage of international importance
East Caithness Cliffs	MPA	Black guillemot
East Sanday Coast	SPA/Ramsar	Aggregations of non-breeding birds (turnstone, purple sandpiper)
Hoy	SAC	Vegetated sea cliffs, blanket bogs, dystrophic lochs and pools, wet heaths
Hoy	SPA	Seabird assemblage (breeding), Arctic skua, great black-backed gull, guillemot, kittiwake, red-throated diver, fulmar, puffin, great skua, peregrine
Inner Moray Firth	SPA/Ramsar	Breeding common tern, osprey. Wintering bar-tailed godwit, greylag goose, red-breasted merganser, redshank. Wetland of international importance
Lairg & Strathbrora Lochs	SPA	Breeding black-throated diver
Loch Ashie	SPA	Breeding Slavonian grebe. On passage Slavonian grebe
Loch Flemington	SPA	Breeding Slavonian grebe
Loch of Strathbeg	SPA/Ramsar	Breeding sandwich terns, wintering teal, greylag goose, pink-footed goose, goldeneye, whooper swan, Wetland of international importance
Loch Ruthven	SPA/Ramsar	Breeding Slavonian grebe
Lower River Spey-Spey Bay	SAC	Perennial vegetation of stony banks. alluvial forests
Marwick Head	SPA	Guillemot, kittiwake, seabird assemblage (breeding)
Moray & Nairn Coast	SPA/Ramsar	Breeding osprey, wintering greylag goose, pink-footed goose and redshank. Wetland of international importance
Moray Firth	SAC	Bottlenose dolphins; sandbanks which are slightly covered by sea water all the time
Moray Firth	pSPA	Great northern diver, red-throated diver, Slavonian grebe, greater scaup, common eider, long-tailed duck, common scoter, velvet scoter, common goldeneye, red-breasted merganser, European shag

Table 3.4 – Relevant SACs, SPAs and MPAs and their Features

Name	Status	Summary of features
North Caithness Cliffs	SPA	Peregrine, seabird assemblage (breeding), fulmar, guillemot. Kittiwake, razorbill, puffin
North Inverness Lochs	SPA	Breeding Slavonian grebe
North Orkney	pSPA	Great northern diver, Slavonian grebe, red-throated diver, Arctic tern, common eider, long-tailed duck, velvet scoter, red-breasted merganser, European shag
North-west Orkney	MPA	Sandeels
Noss Head	MPA	Horse mussel beds (largest known horse mussel bed in Scottish waters)
Papa Westray	MPA	Black guillemot
Papa Westray (North Hill and Holm)	SPA	Breeding Arctic tern
Pentland Firth	pSPA	Arctic tern, common guillemot, Arctic skua, breeding seabird assemblage.
Scapa Flow	pSPA	Great northern diver, red-throated diver, black-throated diver, Slavonian grebe, European shag, common eider, long-tailed duck, common goldeneye, red-breasted merganser.
Pentland Firth Islands	SPA	Breeding Arctic tern
River Evelix	SAC	Freshwater pearl mussel
River Oykel	SAC	Freshwater pearl mussel, Atlantic salmon
River Spey	SAC	Freshwater pearl mussel, sea lamprey, Atlantic salmon, otter
River Thurso	SAC	Atlantic salmon
Rousay	SPA	Arctic tern and seabird assemblage (breeding)
Sanday	SAC	Reefs; harbour seal
Southern Trench	Proposed MPA	Burrowed muds, fronts, minke whale; shelf deeps
Switha	SPA	Non-breeding Greenland barnacle goose
Troup, Pennan and Lion's Head	SPA	Breeding guillemot. Seabird assemblage (breeding)
West Westray	SPA	Arctic tern, guillemot, seabird assemblage (breeding)
Wyre and Rousay Sounds	MPA	Kelp and seaweed communities on sublittoral sediment; maerl beds

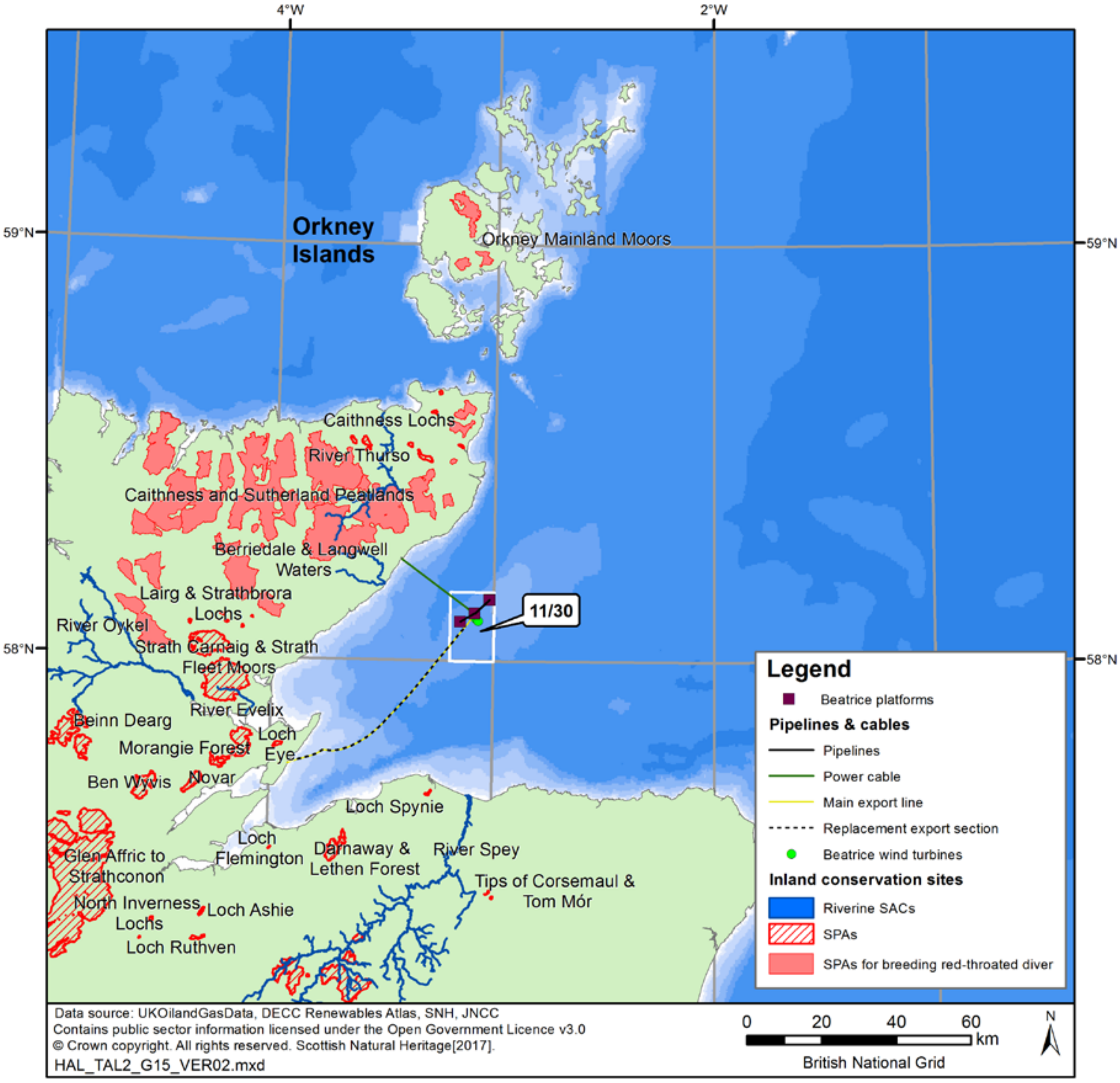
Source: JNCC website (http://jncc.defra.gov.uk/page-162, accessed 17/01/2017), SNH website (http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/proposed-marine-spas/, accessed 17/01/2017)

Figure 3.10 – Inshore and Offshore SACs, SPAs and MPAs



There are several Sites of Special Scientific Interest (SSSIs) in the Moray Firth (e.g. Culbin Sands, Culbin Forest and Findhorn Bay, Cromarty Firth). SSSIs are designated for both biodiversity and geodiversity. In the case of biodiversity, several SSSIs have also acquired European protection by being included within SPAs and SACs. The designation of geological and geomorphological features is underpinned by the identification along the Moray Firth coastline of approximately 35 Geological Conservation Review (GCR) sites. Most of the sites are some distance from the Beatrice facilities, the closest site being Culgower Bay, 30km from the Beatrice Field on the east Caithness coastline, with Cadh`-an-Righ approximately 3km from the pipeline landfall at Shandwick.

Figure 3.11 – Relevant Onshore SACs and SPAs



Species Conservation

In addition to the designation of specific conservation sites within the area, a number of individual marine species are afforded protection throughout their range. At a European level, strict protection is afforded to species on Annex IV (Animal and Plant Species of Community Interest in Need of Strict Protection) of the Habitats Directive, including all cetacean species, otters, marine turtles and a number of fish and invertebrate species. Under this Annex, the 'deliberate capture, killing or disturbance[18] is an offence, as is their keeping, sale or exchange'. Nationally, several marine species are protected under Schedule 5 of the Wildlife and Countryside Act, 1981. These include all cetacean species, otters, all turtle species, a range of fish including sturgeon, allis shad, twaite shad and

[18] See JNCC (2008) for information regarding the definition of disturbance.

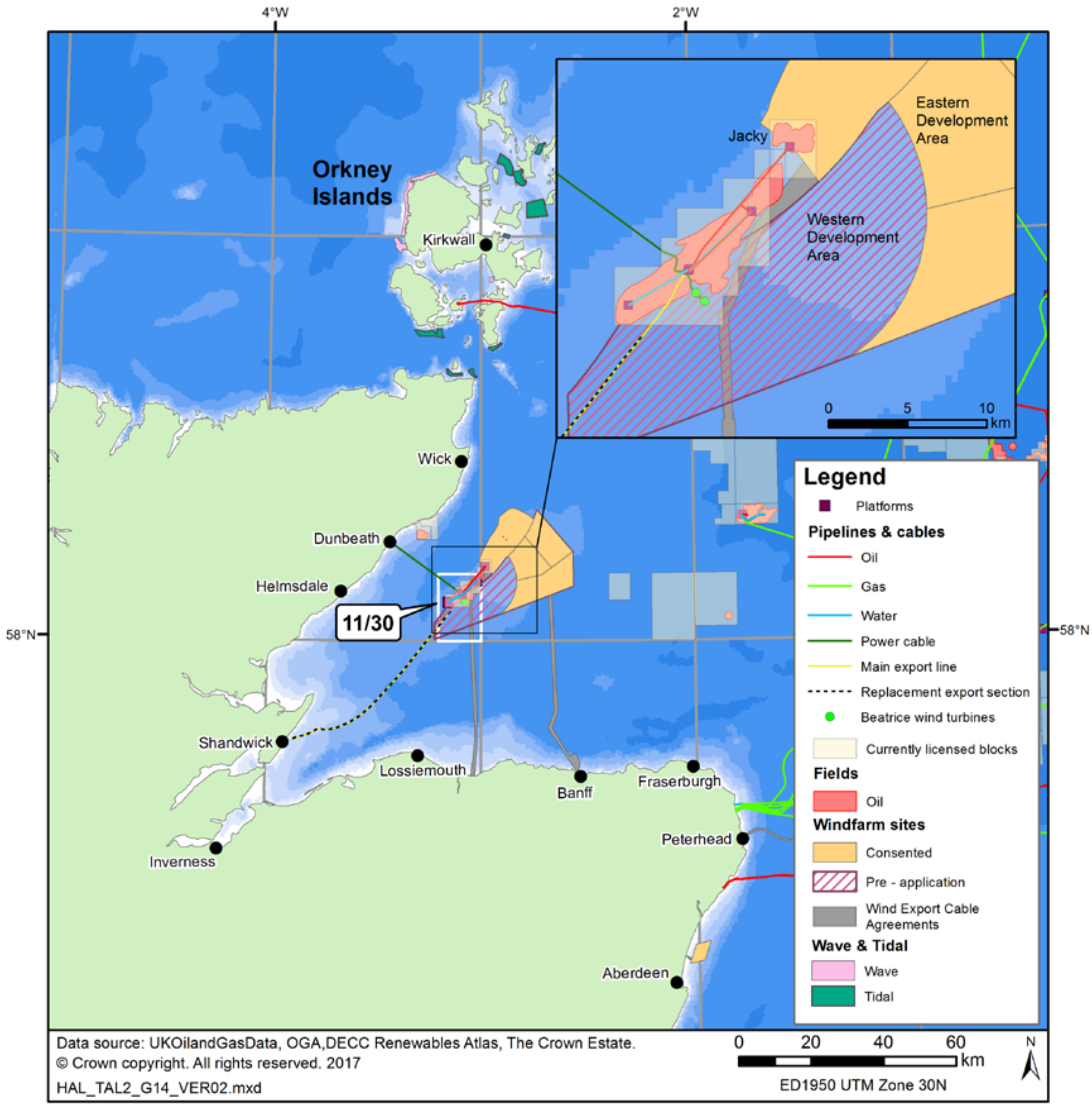
basking shark, and a number of marine invertebrates. The cold water coral *Lophelia pertusa* is a species of conservation concern and also listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). *Lophelia* has been found growing on some North Sea oil and gas platforms, but none was seen in video footage of all the Beatrice jackets.

3.14 Users of the Sea and Offshore Environment

3.14.1 Offshore Energy Infrastructure

Beatrice is one of two developed fields within the Moray Firth; the other is the Jacky oil field (Block 12/21) operated by Ithaca, comprising a normally unmanned wellhead platform (WHP) tied back to Beatrice Alpha (Figure 3.12).

Figure 3.12 – Offshore Energy Activity around Beatrice



The Beatrice facilities are partly located within the Moray Firth Round 3 wind farm zone, and are immediately adjacent to the Beatrice Scottish territorial waters wind farm leasing zone. The Beatrice Offshore Wind farm was granted consent in March 2014 and a final investment decision was made in 2016, with construction due to commence in 2017. The Round 3 area contains two sections; the Eastern Development Area 11km to the east of Beatrice B comprises the consented Telford, Stevenson and MacColl offshore wind farms; and the Western Development Area which to date has been subject to scoping for a development of up to 90 turbines with a capacity of 750MW.

Cable export agreement areas are in place for the Beatrice and Moray Firth wind farm zones which both have their landfall on the southern Moray Firth coast at Portgordon and near Banff respectively.

3.14.2 Fisheries

Commercial Fisheries in the Region

ICES rectangles are subareas of larger ICES sub-divisions, and are used for fisheries data recording and management. The northwest outer Moray Firth area lies in ICES sub-division IVa, and the Beatrice platforms, turbines and pipelines are within ICES rectangles 44E6 and 45E6.

Over the period 2013-2015, fisheries in these ICES rectangles were exploited using a variety of fishing gears, with trawls and dredges being most common. The liveweight and value at first sale of fish and shellfish taken by all gears from 44E6 and 45E6 are shown in Table 3.5. Reported landings were dominated by shellfish in both weight and value. Demersal fish was the second most important group in terms of weight and value, while pelagic fish were landed in very small numbers with a generally low value. The catch mainly comprised scallops, *Nephrops,* lobster, squid, crab and haddock.

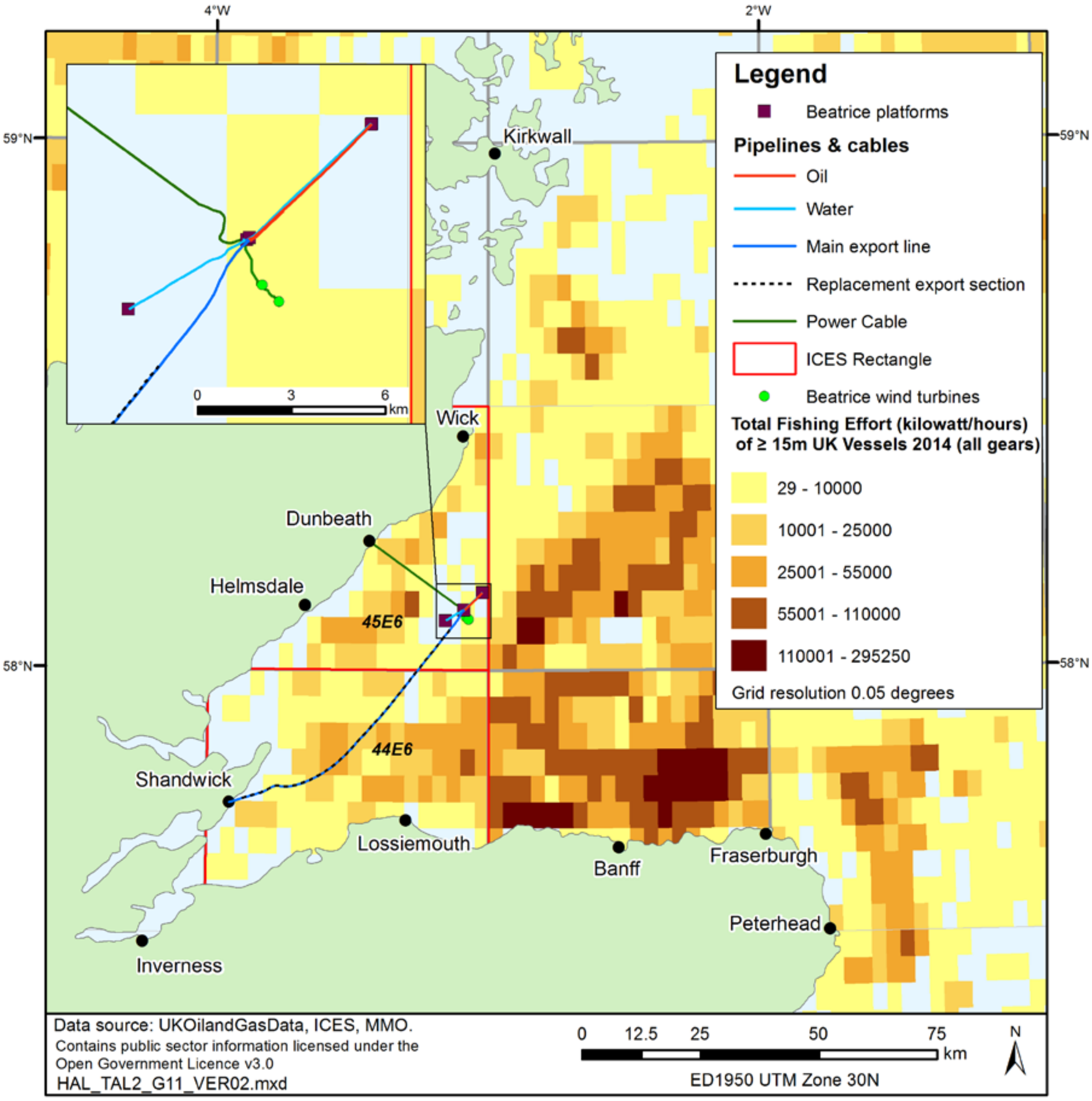
Table 3.5 – Live Weight and Value of Fish Taken from ICES Rectangles 45E7 and 45E6, 2013-2015

Species type	2013		2014		2015	
	Liveweight (tonnes)	Value (£)	Liveweight (tonnes)	Value (£)	Liveweight (tonnes)	Value (£)
ICES rectangle 44E6						
Demersal	56.0	45,712	65.1	80,646	22.0	35,304
Pelagic	1.4	1,256	5.0	5,173	10.3	10,063
Shellfish	558.0	1,584,822	900.7	2,289,443	599.8	2,037,583
Total	615.4	1,631,790	970.8	2,375,261	632.1	2,082,950
ICES rectangle 45E6						
Demersal	79.8	67,394	18.3	20,397	27.8	39,661
Pelagic	5.3	2,008	55.4	14,216	1.7	1,187
Shellfish	606.0	1,332,589	542.6	1,222,466	418.9	893,889
Total	691.1	1,401,991	616.3	1,257,079	448.4	934,737
Total 44E6 +45E6	**1,306.5**	**3,033,781**	**1,587.1**	**3,632,340**	**1,080.5**	**3,017,687**
Percentage of UK total	**0.20%**	**0.40%**	**0.26%**	**0.55%**	**0.20%**	**0.53%**

Source: Scottish Government website (accessed 19/01/17).

Vessel Monitoring System (VMS) data gathered in 2014 shows fishing activity in the Moray Firth. Effort in the Beatrice area is low to moderate and is to the north of an area of high effort located along the southern Moray Firth coast (Figure 3.13).

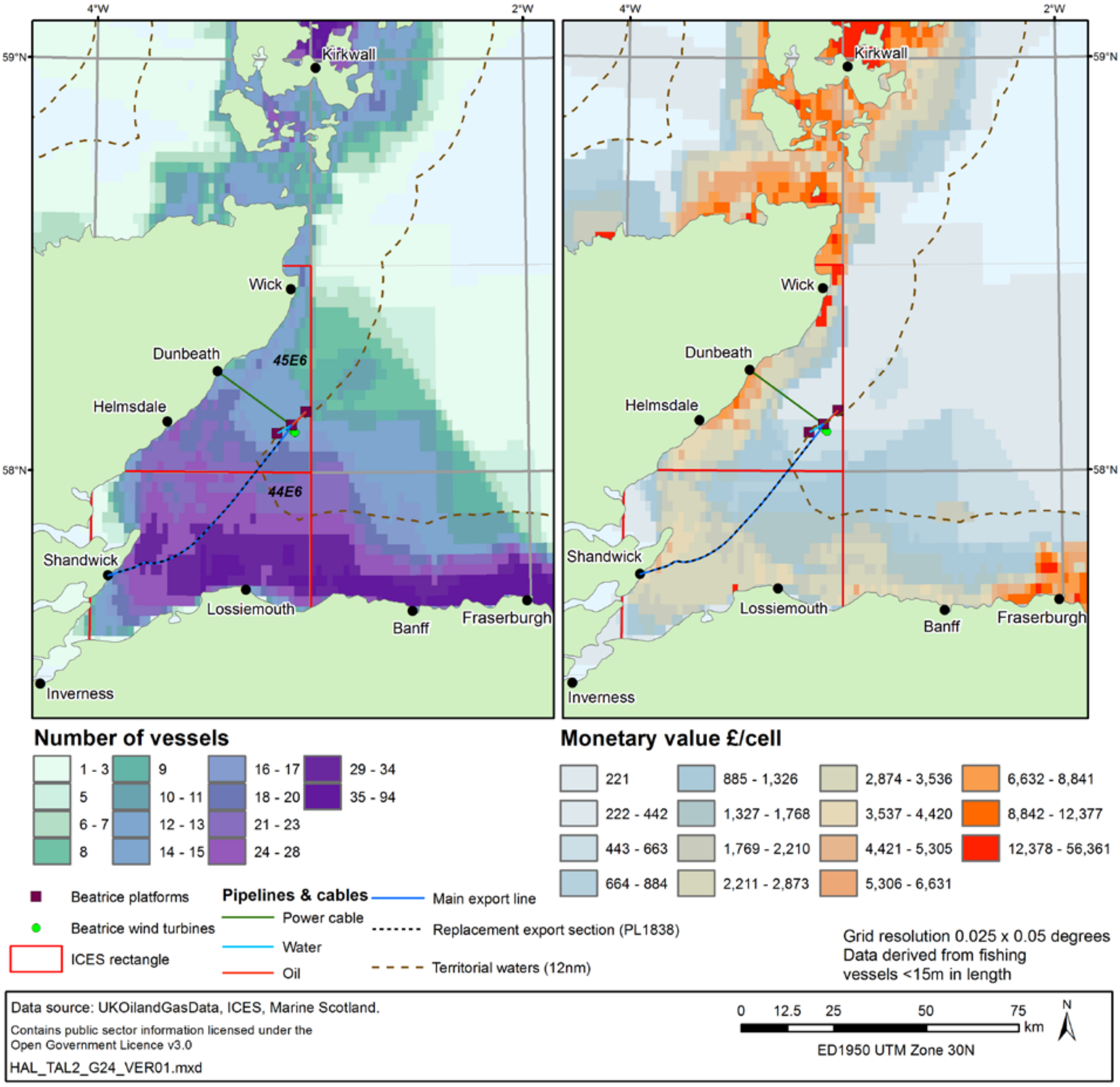
Figure 3.13 – Total Fishing Effort by UK Vessels (all gears), 2014



Inshore and Salmon Fisheries

An important inshore (0-6nm from coast) mixed fishery exists in the Moray Firth operating a variety of gears, with landings almost exclusively comprising shellfish including crab, scallops, lobsters, squid and whelks. The main inshore landing ports around the Moray Firth for these inshore fisheries are Buckie, Burghead, Wick, Lybster and Fraserburgh, but landings are also recorded for other smaller ports. The number of active vessels is greatest along the southern coast of the Moray Firth, which is indicated in Figure 3.14. The data displayed in Figure 3.14 was collected as part of the ScotMap project (see Kafas *et al.* 2014) through interviews with fishermen for activities covering the period 2007-2011.

Figure 3.14 – Inshore Fisheries by Vessel Number and Value, 2007-2011



Additionally, the Moray Firth area supports an important salmon and trout fishery; in 2013, the region contributed 15% of the total wild salmon and 8% of the total wild sea trout caught and retained in Scotland (data from Marine Scotland 2014). Fixed engine boats and rod and line anglers are responsible for the majority of catches, however net and cob techniques are also used but to a lesser extent. Various initiatives have been set up in recent years to collect data to monitor and support inshore fisheries in the region. The Scottish Inshore Fisheries Integrated Data System (SIFIDS) project[19] (led by the Marine Alliance for Science and Technology for Scotland (MASTS)) aims to collate and analyse inshore fisheries data in

[19] http://www.masts.ac.uk/research/emff-sifids-project

order to support fisheries management and marine planning. Projects to further monitoring of inshore fisheries using AIS are also being developed by MASTS[20], while the Fisheries Local Action Group (FLAG) for Highland and Moray[21] aims to initiate a community-led approach to the sustainable development of local fisheries. Repsol Sinopec Resources UK plans to carry out a detailed study of fishing activity in the area of the Beatrice facilities to inform the CA and EIA processes.

3.14.3 Ports and Shipping

There are several important ports in the Moray Firth for fish landings, the transport of oil industry supplies and products, as well as general cargo. Fraserburgh and Buckie are important fishing ports and were the base for 284 vessels in 2015 (Marine Scotland 2016). The port of Inverness, located in the Beauly Firth, is of strategic importance to the north of Scotland supporting cargo, cruise ship and renewable energy industry related activities. Slightly further north in the Cromarty Firth, the port of Invergordon receives approximately 100,000 cruise ship passengers between March/April and October each year.

Shipping density in and around the Beatrice Field area and along the pipeline and cable routes is very low, with the exception of moderate levels near the entrance to the Beauly and Cromarty Firths (OGA website[22]). There are no IMO routeing measures close to the Beatrice Field area or in the wider Moray Firth. A number of primary navigation routes are identified in ship Automatic Identification System (AIS) data along the southern and outer Moray Firth. Lower levels in the area are associated with ‘non-route-based’ traffic such as fishing vessels, naval vessels, tugs, dredgers, yachts, supply vessels to mobile drilling installations and non-routine traffic. Relevant vessel traffic surveys will be undertaken to inform the decommissioning work.

3.1.1 Military Activity

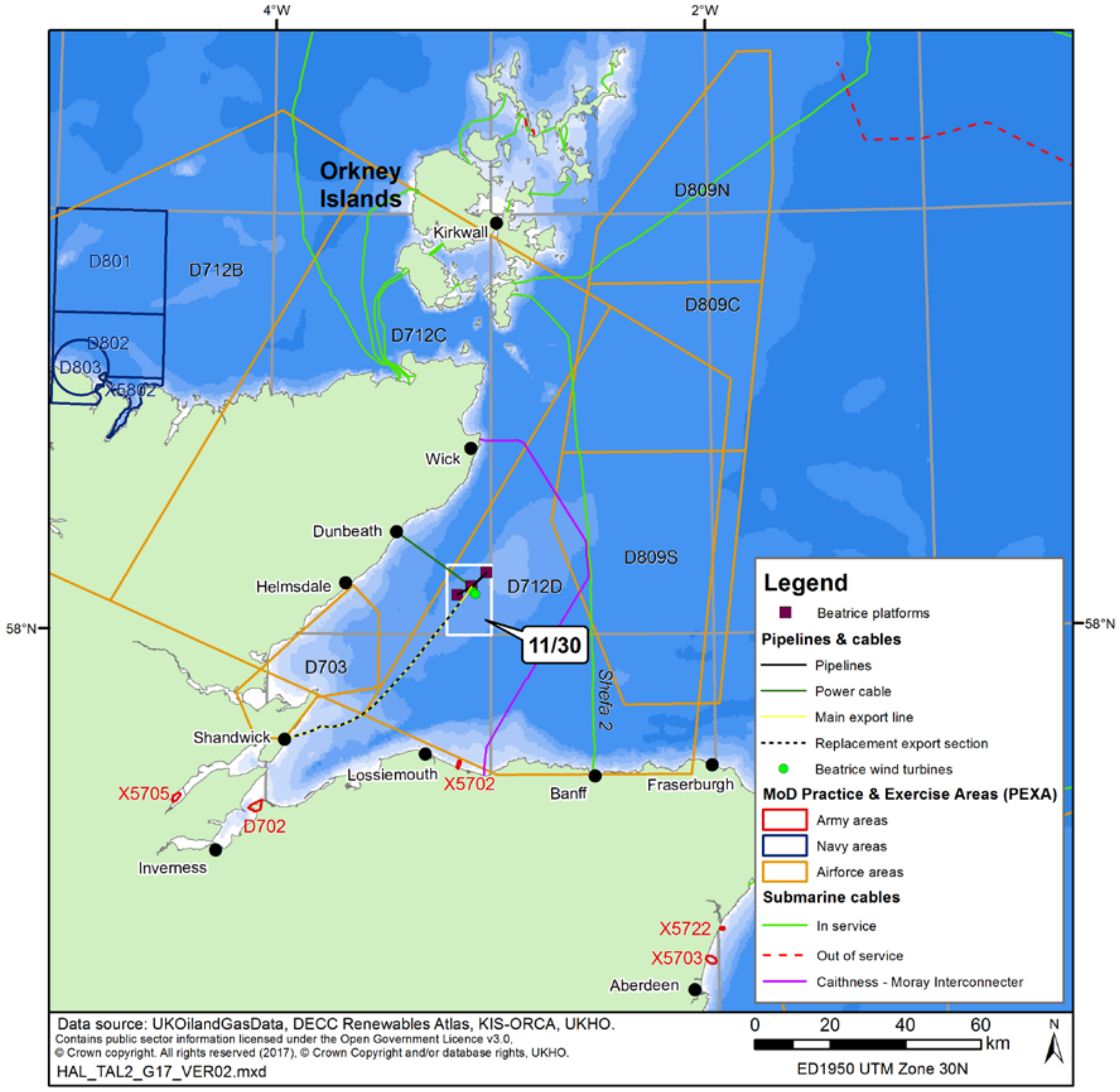
Several areas of the inner and outer Moray Firth are used by the Royal Air Force for radar training, high and low-angle gunnery and air to sea or ground firing (Figure 3.15). The Beatrice Field area, along with the majority of the Moray Firth, lies within the large Air Force Area D712D, used for air combat training and high energy manoeuvres.

3.14.4 Cables

There are no telecommunications or subsea power cables in the Beatrice area, though the Shefa-2 telecommunications cable and the proposed Caithness-Moray HVDC transmission project cable are located 27km and 26km to the east of Beatrice respectively (Figure 3.15). The latter is due to be completed by 2018.

[20] http://www.masts.ac.uk/research/sustainable-scottish-inshore-fisheries
[21] http://www.highlandmorayflag.co.uk/
[22] OGA website – https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/ accessed 17/01/2017

Figure 3.15 – Military Areas and Subsea Cables Relevant to the Moray Firth



3.14.5 Archaeology and Wrecks

Summary of Coastal and Marine Discoveries in Moray Firth

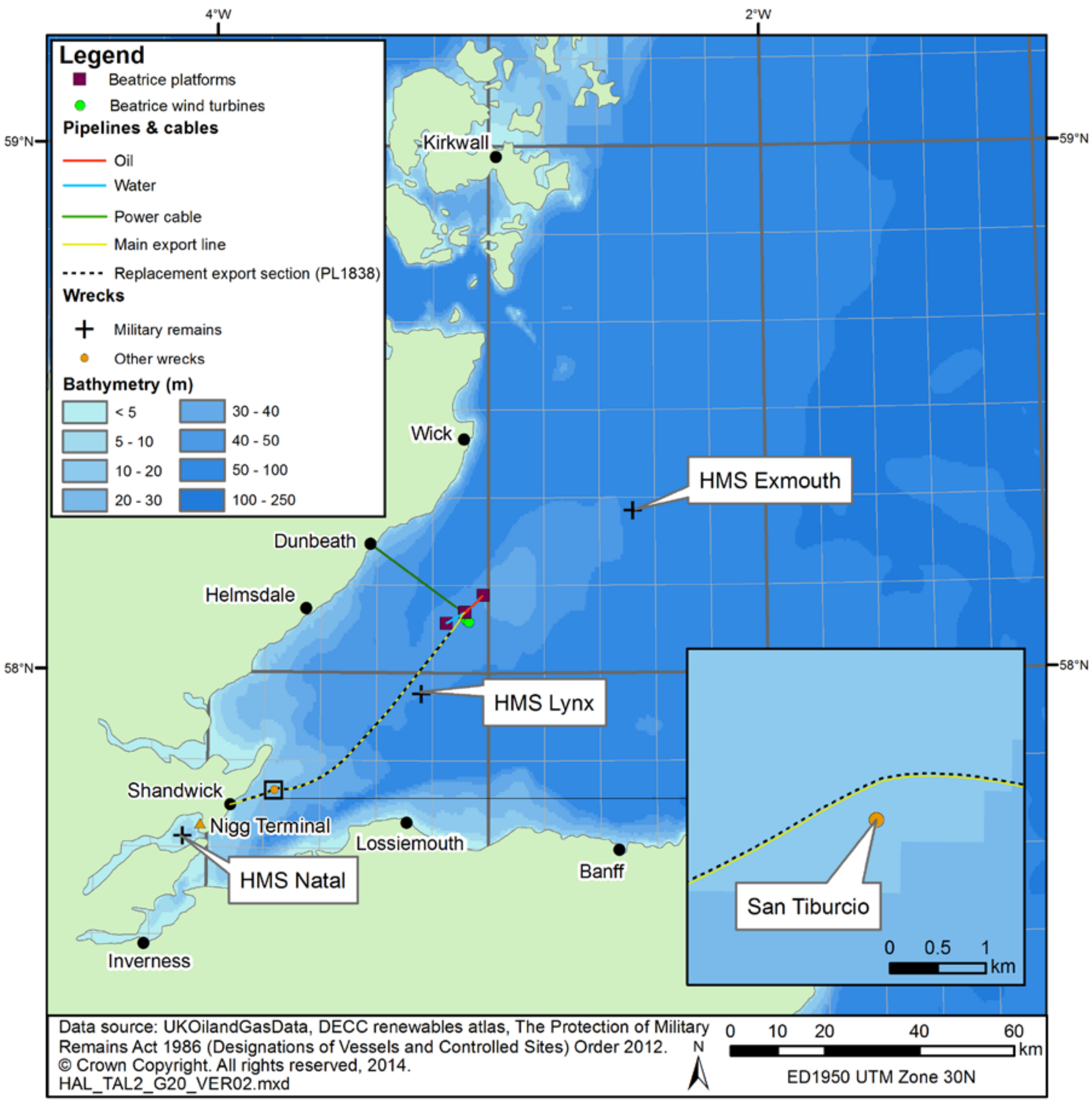
The Moray Firth has a number of coastal sites of archaeological interest, particularly within the more sheltered inner firths (Beauly and Cromarty) and Inverness area. Features include Mesolithic shell middens, marine crannogs dating from the late Bronze and Iron Age, cist cemetery sites from the Bronze Age and a number of fishtraps dating from the 17th-19th century (Hale & Cressey 2003). Additionally, the Canmore[23] database records a large number of monuments around the coast of the Moray Firth, and occasional marine wreck sites.

[23] https://canmore.org.uk/ (accessed: 02/02/17)

Wrecks

No Historic Marine Protected Areas[24] are located in the Moray Firth. Three protected wrecks are located in the Moray Firth (Table 3.6), designated under *The Protection of Military Remains Act 1986*[25]. Additionally, the wreck of *San Tiburcio* was recorded in close proximity to the main oil export pipeline in an as-laid survey of the pipe, and is also shown on Figure 3.16.

Figure 3.16 – Wrecks Relevant to the Beatrice Area



[24] Note that HMPAs replaced those designations under the Protection of Wrecks Act 1993, which was repealed in Scotland in November 2013.
[25] *The Protection of Military Remains Act 1986 (Designation of Vessels and Controlled Sites) Order 2012*

Table 3.6 – Wrecks in the Moray Firth Protected under *The Protection of Military Remains Act 1986*

Wreck	Location	Closest Distance to Beatrice Surface or Subsurface Facilities
HMS Natal (WWI)	Cromarty Firth, an area 100m radius around 57°41'244"N 4°05'310"W	15km
HMS Exmouth (WWII)	Northeast outer Moray Firth, an area 750m radius around 58°18'467"N 2°28'938"W	36km
HMS Lynx	Moray Firth, approximately 57°57'35.8"N 3°14'39.5"W	3km

Information obtained from the UK Hydrographic Office (see below) and previous site surveys indicate that no wreck features occur within several kilometres of the Beatrice Platforms. Similar wreck information was obtained within a 10nm radius of the Jacky Field to inform the EIA for that development. This provided coverage of the seabed throughout the pipeline route to the Beatrice Alpha complex, within which six live and two dead wrecks[26] were identified (the closest being 11.5km to the northwest of the Jacky platform, and one 5km to the southeast of Beatrice AP which is recorded as an anchor). Further information will be obtained to inform decommissioning, however work will be largely undertaken within areas which have already been developed.

The strategic importance of the North Sea area during WWI and WWII; the concentration of much of the North Sea fishing fleet in coastal ports; the importance of maritime trade routes in the region and the treacherous nature of nearshore waters, have led to a large number of ship and aircraft wrecks. While many of the locations of these wrecks have been identified and listed by the UK Hydrographic Office, the locations of many more remain uncharted.

Potential Coastal and Marine Pre-historic Sites

There is a low probability of prehistoric submarine archaeological remains occurring in the Beatrice area given the strong prevailing current conditions, exposure to North Atlantic storms, thin sediment cover in many places and the large areas of exposed bedrock. There is no evidence of such from historic surveys.

3.14.6 Tourism and Recreation

The Moray Firth coastline and adjacent land and waters provides for a variety of recreational activities which make tourism and leisure an important contribution to the local economy (see LUC 2016), with approximately 700,000 visitors bringing around £106 million to the Moray area in 2015[27]. There are a large number of easily accessible beaches in the area, several of which are designated by the Scottish Environment Protection Agency (SEPA) as

[26] Live wrecks are charted and considered to exist; dead wrecks are not considered to exist (e.g. may be fragmented and dispersed) and not shown on charts.

[27] http://www.parliament.scot/parliamentarybusiness/28877.aspx?SearchType=Advance&ReferenceNumbers=S5M-02563 (accessed 18/01/17)

bathing water sites under the Bathing Water Directive (Directive 2006/07/EC) (SEPA 2016). Sailing is popular in the area with Moray Firth harbours being home to several hundred recreational vessels. In addition to this, boat-based dolphin watching attracts many tourists to the Moray Firth, with numerous boats operating cruises during summer months (Moray Firth Partnership 2011). Angling is important in the area with several rivers (e.g. River Spey) supporting internationally important populations of Atlantic salmon. Other popular activities include land-based wildlife watching, cycling, walking/hiking, sea kayaking/canoeing, scuba-diving and surfing (Moray Firth Partnership 2011, LUC 2016).

3.14.7 Land and Seascape

A number of relevant coastal areas have been subject to landscape character assessment for SNH, including the inner Moray Firth, Moray and Nairn, and Caithness and Sutherland. The reports associated with these assessments provide an overview of landscape features and character, including a consideration of key issues relating to these landscapes, and their sensitivity to particular activities, some of which are predicted to expand in these areas (e.g. onshore wind farms). Most recently the landscapes of the area have been characterised through The Landscapes of Scotland[28] project, which provides a high level overview of Scotland's landscapes which complement the more specialist analysis in landscape character assessments. Additionally, a seascape assessment was undertaken by Scott *et al.* (2005) to evaluate the sensitivity of seascape units in Scottish waters to the installation of offshore wind turbines, however some of the information provided in the characterisation is more generally applicable.

There are relatively few landscape designations within the Moray Firth. The Dornoch Firth National Scenic Area (NSA) is the closest designated site with policy protection (52km to the west of the Beatrice surface facilities). Additionally, there are a number of non-statutory local landscape designations, including on the south coast of the Black Isle and inner Moray Firth, and along the east Caithness coastline. Such sites are designated at a local level, are shown on local development plans, and have associated policies to safeguard their valued features[29].

[28] www.snh.gov.uk/about-scotlands-nature/scotlands-landscapes/landscapes-varieties/ (accessed 18/01/17).
[29] Scottish Planning Policy, published June 2014.

4 STUDIES COMMISSIONED IN SUPPORT OF BEATRICE DECOMMISSIONING

4.1 Studies Undertaken to Date

A list of studies of relevance to the appraisal of decommissioning options for the Beatrice Field is provided in Table 4.1. These include reports detailing the facilities to inform the initial “appraise” phases of work and related environmental screening and survey, and the engineering options for removal of the facilities. In addition to these, a range of previous environmental and maintenance survey work, including as-laid surveys of pipelines, cables and associated deposits, have been used to inform the initial stage of work.

Table 4.1 – Studies Undertaken to date in Support of Beatrice Decommissioning

Title	Year	Summary
Beatrice Platform ROV Structural Inspection Report – AD, AP, B, B CSS, C.	2012	A visual appraisal was made of each platform structure and the status of marine growth, including species community and estimates of hard and soft growth recorded.
Beatrice Decommissioning Appraise Project – Basis of Design	2013	Defines the key information on the wells, facilities and associated pipelines and cables to inform subsequent phases of work and establish where information gaps are present.
Beatrice Decommissioning Appraise – Environmental Screening Report	2013	A high level desktop screening of environmental issues relating to the three main potential alternative uses (see Section 2.2) to inform the subsequent phases of work.
Beatrice Platform Piece Small Removal Study	2013	Outlines the methods and timescales of removal of the Beatrice facilities by small/medium piece removal.
Beatrice Platform Heavy Lift Removal Study	2013	Outlines the methods and timescales of removal of the Beatrice facilities by using heavy lift vessels.
Beatrice Decommissioning Scoping ENVID Workshop Report	2014	The output of a workshop to identify the main issues to be taken forward for consideration in decommissioning planning and the environmental impact assessment.
Beatrice Pre-Decommissioning Environmental and Subsea Survey	2016	Environmental survey in the vicinity of the Beatrice facilities (Alpha, Bravo, Charlie, WTGs) and pipelines, including habitats assessment, identification of the presence of historic drill cuttings pile, drill cuttings sampling at Alpha. Subsea survey of pipeline burial depths.

4.2 Future Studies

A number of additional studies are presently being undertaken or planned to inform the Beatrice decommissioning (e.g. comparative assessment work for pipelines). It is proposed that the following survey work is undertaken to inform the EIA and wider decommissioning planning and engineering:

- Pipeline material inventory, status and historical review

- Pipeline decommissioning option screening study
- Pipeline and subsea infrastructure removal methods and technical feasibility assessment
- Comparative assessment for pipeline decommissioning options
- Jacket removal methods
- HAZID for pipeline and jacket derogation candidate removal options
- Safety risk to fishermen assessment

5 APPROACH AND METHOD OF EIA

5.1 Introduction

To comply with company policy and regulator guidance, the Beatrice Decommissioning Programme will be supported by an EIA. The EIA will be documented in an EIA Report which will be made publicly available. The EIA will build on the description of the existing environment which is summarised in Chapter 3, augmented through the studies commissioned to inform the decommissioning programme including the CA (Section 4), and the outcome of this scoping exercise and ongoing stakeholder engagement.

5.2 Initial Issue Identification

This section describes the process used to make an initial assessment during the EIA scoping process of the relative significance of potential environmental issues associated with the options outlined in Section 2. The activities have been initially screened for their potential interactions with the environment, other users and against legislative and policy requirements. The activity and environment interactions were identified and screened using a range of data sources, including:

- Regional and site specific environmental data
- Typical vessel specifications (e.g. for pipeline removal and support)
- Typical jack-up drilling rig specifications
- Experience of analogous projects in the North Sea and elsewhere
- Reviews and assessments of the environmental effects of offshore oil and gas operations
- Peer reviewed scientific papers describing the effects of specific interactions
- Other publicly available “grey” literature
- Offshore Energy Strategic Environmental Assessment Environmental Reports and underpinning studies (DECC 2016)
- OSPAR Quality Status Report 2010 (OSPAR 2010) and Defra’s Charting Progress 2 (Defra 2010)
- Conservation site designation, potential designations and related information
- Initial consultation (see below)
- Applicable legislation, guidance and policies

To inform initial identification of environmental issues and stakeholder concerns, Repsol Sinopec Resources UK has already undertaken early engagement with a number of stakeholders and statutory bodies (see Section 7.2). Issues raised during these meetings included:

- Full environmental pre-decommissioning baseline survey and habitats assessments
- Potential for presence of horse mussel habitats
- Impacts from cuttings pile disturbance and plumes
- Impact of cuttings pile if left *in situ*
- Impacts of sediment disturbance and plumes
- Impacts of noise and disturbance from vessels
- Potential for corkscrew injuries to seals from unshielded ducted propellers[30]
- Potential new conservation sites to be designated in the area (harbour porpoise, black guillemot)
- Cumulative impacts from multiple activities e.g. on birds and marine mammals
- Cumulative impacts from multiple developments e.g. fisheries and other users
- Importance of Smith Bank for scallop and squid fishing
- Potential for effects on salmon and sea trout migration
- Presence of static gear and squid fishing along the cable route in the nearshore area towards Dunbeath
- The importance of herring, haddock, crab and lobster in the Moray Firth
- The impact of removal of trenched and buried pipelines.
- Potential for cables to present a snagging risk to fishing gear if not properly buried

Repsol Sinopec Resources UK also undertook an Environmental Impact Identification (ENVID) scoping workshop. The workshop further contributed to the initial identification of activity/environment interactions, as well as raising awareness within the Repsol Sinopec Resources UK decommissioning team of the baseline environment, and potential sources of environmental effect from decommissioning activities.

[30] While further research may be necessary before interactions from ducted propellers can be entirely discounted, it is now considered very likely that the use of such vessels may not pose any increased risk to seals over and above normal shipping activities (see Thompson *et al.* 2015 and SNCB 2015).

5.2.1 Initial Screening of Sources of Potential Environmental Effect

The topics potentially having an environmental impact identified as relevant to the EIA at this stage include:

- Climate/air quality
- Water quality
- Seabed condition
- Benthic fauna
- Plankton
- Fish and shellfish
- Marine mammals
- Water and seabirds
- Fisheries
- Other users of the sea (Defence, Offshore renewables, Oil and gas, Recreational activities)
- Shipping
- Landfill resource
- Communities
- Landscape/seascape
- Conservation sites/species
- Cultural heritage
- Cumulative effects
- Transboundary issues

Based on the current level of definition on the potential decommissioning/removal options, a screening has been undertaken for the topics to identify an initial list of issues to be considered in the EIA (see matrix in Table 5.3).

From the screening process, a number of environmental interactions have been initially identified with the potential to result in significant effects. These are summarised in Table 5.1 and considered in greater detail in Section 6, where mitigation and potential cumulative effects are identified. These issues will be taken forward for detailed assessment in the EIA.

Table 5.1 – Environmental Interactions Considered Further in Section 6 and for Inclusion in the EIA Report

Issue	Potential Source of Effect	Section in Scoping Document
Physical presence of Vessels during decommissioning and legacy of any infrastructure left *in situ*	• Rig, supply and other vessel presence/movements (e.g. jack-up vessel, heavy lift vessel, barges), including when in transit and within-field movements • Disturbance of seabirds (noise and light), marine mammals and migratory salmon • Legacy of pipelines, cables and associated protection materials	**6.2**
Seabed disturbance during decommissioning	• Disturbance of seabed from rig installation (spud cans), vessel presence (anchors, use of taut wire DP systems or jack-up vessel) • Excavation of jacket and Beatrice AD drilling template piles • Dredging of seabed under partial or full pipeline and cable removal options • Removal of mattresses and other pipeline or cable protection • Seabed condition (e.g. presence of clay mounds) following pipeline and cable removal, and excavation	**6.3**
Drill cuttings disturbance, and cuttings pile management options	• Resuspension and release of contaminants from pile disturbance • Legacy of cuttings left *in situ*	**6.4**
Energy use and atmospheric emissions	• Combustion emissions from rig power generation, vessel operations and ancillary power generation for cutting tools and cranes.	**6.5**
Underwater noise	• Underwater noise from drilling associated with well abandonment, underwater cutting of jacket legs, piles and conductors (3m below seabed), and the removal of pipeline or cable sections • Underwater noise from rig and vessels	**6.6**

Table 5.1 – Environmental Interactions Considered Further in Section 6 and for Inclusion in the EIA Report

Issue	Potential Source of Effect	Section in Scoping Document
Near-shore and onshore dismantling of structures: cleaning of marine growth from removed jacket structures and the fate of materials returned to shore: recycling, reuse and disposal	• The landfill resource for waste generated by facilities removal • Muds and cuttings contained (including of historic cuttings pile under the removal option) • Landscape/noise and disruption to communities and other users • Air quality effects (dust, fumes, decaying marine growth)	**6.7, 6.8 and 6.9**
Accidental events	• Diesel and other spills • Collision risk • Chemical spills • Dropped objects • Loss of containment of residual hydrocarbons or contaminated cuttings under the removal option	**6.10**
Natura 2000 sites	• Noise and disturbance effects	**6.11**
Cumulative effects	• Possibility of interactions between decommissioning activities and those ongoing or proposed activities/developments in the Moray Firth	**6.12**
Transboundary effects	• Possibility for the disposal of parts of the facilities outside of the UK	**6.9**

The EIA will take both qualitative and quantitative approaches to the identification of the likely magnitude of effects, as appropriate, and will use defined severity criteria to assist in describing the magnitude of environmental effect from the decommissioning options. For scoping, these are primarily based on the UKOOA Environmental Impact Assessment Guidelines (UKOOA 1998), and allow for the consideration of the likelihood, scale and frequency of potential effects (see Table 5.2).

Table 5.2 – EIA Scoping Assessment Criteria for Potential Environmental Effects from Beatrice Decommissioning

Effect	Consequences
None Foreseen	No detectable effects
Positive	Activity may contribute to recovery of habitats Positive benefits to local, regional or national economy
Negligible	Change is within scope of existing variability but potentially detectable.
Moderate	Change in ecosystem leading to short term damage with likelihood for recovery within 2 years to an offshore area less than 100 hectares or less than 2 hectares of a benthic fish spawning ground Possible but unlikely effect on human health Possible transboundary effects Possible contribution to cumulative effects Issue of limited public concern May cause nuisance Possible short term minor loss to private users or public finance
Major	Change in ecosystem leading to medium term (2+ year) damage with recovery likely within 2 - 10 years to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites Transboundary effects expected Moderate contribution to cumulative effects Issue of public concern Possible effect on human health Possible medium term loss to private users or public finance
Severe	Change in ecosystem leading to long term (10+ year) damage with poor potential for recovery to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites Major transboundary effects expected Major contribution to cumulative effects Issue of acute public concern Likely effect on human health Long term, substantial loss to private users or public finance

Frequency with which Activity or Event Might Occur	Likelihood
Unlikely to occur during the lifetime of operation	**Unlikely**
Once in the life of the rig or facility	**Low**
Once a year	**Medium**
Once a month or regular short term events	**High**
Continuous or regular planned activity	**Very High**

	Likelihood				
Consequences	Very High	High	Medium	Low	Unlikely
Severe					
Major					
Moderate					
Negligible					
Positive					
None foreseen					

Issues requiring detailed consideration in the EIA Report

Positive or minor or negligible issues

No effects expected

Table 5.3 – Scoping Screening Matrix for Potential Activity/Environment Interactions

Key	
P	Potential for significance
M	Minor issue

Activity/Source of Potential Impact	Climate/air quality	Water Quality	Seabed condition	Benthic Fauna	Plankton	Fish and Shellfish	Marine Mammals	Water & Seabirds	Fisheries	Other Offshore Users[1]	Shipping	Landfill resource	Communities	Landscape/seascape	Conservation sites/species	Cultural heritage	Transboundary issues
Topsides Removal																	
Flushing and cleaning of topsides	P	P	P		P							P					
Removal of asbestos												P					
Removal of radioactive materials												P					
Removal of other hazardous materials (PCBs, Halons, refrigerants, mercury)												P					
Removal of WEEE												P					
Internal clearance (insulation removal etc.)												P					
Cutting and rigging of structures to be lifted	M						M								M		
Utilities preparation and accommodation refurbishment		M															
Removal of items with poss. residual hydrocarbons e.g. drains caisson		M			M	M											
Jacket Removal																	
Abrasive cutting (internal and external cuts)			P			P	P								M		
Excavation of piles (also see cuttings piles management)			P	P		P	P		P								
Airlift tool (if used)			P	P		P	P										
Marine growth removal (offshore)			P	P		P	M										
Lift of jacket and template		P	P	P	P	P	P										
Well Decommissioning																	
Jack-up tow in & out	M						M	M	M	M	M			M			
Jack-up positioning (anchors)		M	P	P													
Jack-up positioning (spud cans)		M	P	P													
Potential for introduction of alien species in ballast				P	P												
Physical presence of jack-up (within existing 500m safety zone)							M	M					M	M			

Table 5.3 – Scoping Screening Matrix for Potential Activity/Environment Interactions

Potential for significance

Minor issue

Activity/Source of Potential Impact	Environment Receptors: Climate/air quality	Water Quality	Seabed condition	Benthic Fauna	Plankton	Fish and Shellfish	Marine Mammals	Water & Seabirds	Fisheries	Other Offshore Users[1]	Shipping	Landfill resource	Communities	Landscape/seascape	Conservation sites/species	Cultural heritage	Transboundary issues
Discharge of mud, cement & chemicals from operational wells		M	P	P	P	M											
Disposal of Organic-Phase Fluid mud/cuttings from suspended wells	P											P					
Discharge of chemicals from suspended wells		P			P	P											
Power generation on jack-up	P																
Fugitive emissions from fuel & chemical storage	M																
Drainage, sewage & other discharges from rig		M			M	M											
Solid & liquid wastes to shore	P											P					
Underwater noise							P								P		
Rig surface noise & light								P					P	P			
Mechanical cutting of casings			P				P								P		
Removal of conductors			P														
NORM/LSA contaminated equipment/tubulars		P				P						P					
Venting	P																
Flaring	P																
H_2S within well fluids	P																
Pipelines & Cables																	
Flushing & cleaning		P			P	P						P					
Disconnection of pipelines from jacket		P	P	P	P												
Cutting of pipeline (including at intermediate locations)	P	P	P	P	P	P	P								P		
Rock placement/burial at cut ends			P	P					P						P		
Seabed disturbance (full removal)		P	P	P	P	P	P		P						P	M	
Seabed disturbance (partial removal)		P	P	P	P	P	P		P						P	M	
Pipeline degradation/exposure (left *in situ*)			P						P	M							

Table 5.3 – Scoping Screening Matrix for Potential Activity/Environment Interactions

Potential for significance

Minor issue

Activity/Source of Potential Impact	Environment Receptors: Climate/air quality	Water Quality	Seabed condition	Benthic Fauna	Plankton	Fish and Shellfish	Marine Mammals	Water & Seabirds	Fisheries	Other Offshore Users[1]	Shipping	Landfill resource	Communities	Landscape/seascape	Conservation sites/species	Cultural heritage	Transboundary issues
Loss of access									Potential for significance	Potential for significance							
Mattress removal			Potential for significance	Potential for significance		Potential for significance						Potential for significance			Potential for significance		
Mattress burial			Potential for significance	Potential for significance		Potential for significance			Potential for significance	Minor issue					Potential for significance		
Cuttings Piles																	
Leaching of contaminants (Leave *in situ*)		Potential for significance	Potential for significance	Potential for significance	Potential for significance	Potential for significance			Potential for significance								
Loss of access (Leave *in situ*)									Potential for significance	Potential for significance							
Potential contamination of fishing gear/catch (Leave *in situ*)									Potential for significance								
Release/resettlement of contaminants (Removal)		Potential for significance	Potential for significance	Potential for significance	Potential for significance	Potential for significance	Potential for significance		Potential for significance								
Onshore transport (Removal)	Potential for significance									Potential for significance	Potential for significance		Potential for significance				
Onshore treatment and disposal (Removal)	Potential for significance	Potential for significance										Potential for significance					
Vessels (Applicable to Jacket and Topsides Removal, Drilling Support, Cuttings Removal, and Pipeline Decommissioning)																	
Presence of supply, jack-up barge/ accommodation or heavy lift vessels							Potential for significance	Potential for significance	Minor issue	Minor issue			Minor issue	Minor issue			
Vessel positioning (anchoring, jack-up feet)		Minor issue	Potential for significance	Potential for significance													
Dynamic positioning	Potential for significance						Potential for significance								Potential for significance		
Drainage, sewage & other discharges		Minor issue			Minor issue	Minor issue											
Vessel and ancillary equipment power generation	Potential for significance																
Underwater noise						Potential for significance	Potential for significance								Potential for significance		
Airborne noise								Potential for significance					Potential for significance	Potential for significance			
Lighting								Potential for significance					Potential for significance	Potential for significance			
Onshore Aspects																	
Offloading of structures		Potential for significance	Minor issue	Minor issue	Minor issue					Minor issue	Minor issue						
Dismantling of structures onshore	Potential for significance									Potential for significance			Potential for significance	Potential for significance			
Storage of structures at yard (including odour)	Potential for significance									Potential for significance			Potential for significance	Potential for significance			
Refurbishment and reuse	Potential for significance											Potential for significance					Potential for significance

Table 5.3 – Scoping Screening Matrix for Potential Activity/Environment Interactions

Potential for significance (P)

Minor issue (M)

Activity/Source of Potential Impact	Climate/air quality	Water Quality	Seabed condition	Benthic Fauna	Plankton	Fish and Shellfish	Marine Mammals	Water & Seabirds	Fisheries	Other Offshore Users[1]	Shipping	Landfill resource	Communities	Landscape/seascape	Conservation sites/species	Cultural heritage	Transboundary issues
	Environment Receptors																
Materials recycling	P																P
Energy recovery from materials	M																P
Onshore waste treatment												P	P				P
Landfill of residual waste												P	P				P
Road transport of waste/materials	P												P				P
Treatment of NORM/LSA scale	P											P					P
Hazardous materials												P	P				P
Accidental Events																	
Dropped objects			M						M								
Accidental releases to atmosphere (including refrigerants)	P																
Accidental spills of fuel/lubricants/crude to sea		P	P	P	P	P	P	P	P	P			P				
Vessel collision									M	M	M						
Hydraulic fluid loss from subsea tools and equipment		M			M	M											
Mud and other chemical spills		P			P	P											
Litter		M	M														
Cuttings pile removal option – loss of containment		P	P	P	P	P	P		P								
Accidental discharge of muds, chemicals from installations		P	P	P	P	P											
Accidental discharge of muds, chemicals from rig		P	P	P	P	P											

Notes: [1]includes offshore renewables, oil and gas, military activities, subsea cables, recreational yachting etc.

6 OVERVIEW OF POTENTIAL ENVIRONMENTAL IMPACTS

6.1 Introduction

For each broad source of effect (e.g. physical presence, disturbance and discharges), descriptions of the potential impacts are expanded upon below, providing an initial indication of how these are to be considered in the EIA Report, what mitigation would be possible, and how any information gaps are to be filled during the EIA process. In all instances, pre- and post-decommissioning survey and monitoring[31] will contribute to the prediction, recording and mitigation of any environmental effects.

In addition to the preparation and acceptance of a decommissioning programme, most activities to be undertaken to decommission the Beatrice facilities are regulated and will be subject to individual consenting mechanisms which the EIA Report will support (e.g. under the *Offshore Chemical Regulations 2002, Marine (Scotland) Act 2010, Energy Act 2008*), in addition to requirements of the Offshore Safety Directive[32], for example as implemented through *The Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015*. Repsol Sinopec Resources UK will also maintain awareness of any additional provisions which come into force during decommissioning planning and implementation. All third party contractors (including waste disposal yards) will be audited to ensure that they comply with relevant legislation (e.g. various Merchant Shipping Regulations), and operate in a way which is consistent with Repsol Sinopec Resources UK's HS&E policy, and programme specific HS&E targets.

6.2 Physical Presence of Vessels during Decommissioning and Legacy of any Infrastructure left *in situ*

6.2.1 Impacts, Approach to Assessment and Mitigation

The decommissioning programme will involve the use of a number of vessels for supply and support during well abandonment, to provide machinery and personnel for platform dismantling, and transport of waste and other materials to shore. The number of movements will partly depend on the decommissioning option chosen, with a greater number of vessel transits and time in the field required for small/medium piece removal methods. The physical presence of vessels has the potential to disrupt other users of the sea, including shipping and fishing. However, the main source of effect will relate to vessels in transit, as most vessels undertaking work would be located within close proximity to the Beatrice facilities and/or within their respective 500m safety zones.

In addition to potential socio-economic effects, ecological effects could arise for birds (e.g. from surface noise and light), marine mammals and migratory salmon (e.g. shipping noise), particularly during the peak smolt run (spring-summer), rather than when adult salmon are returning to rivers. The likelihood of such effects will be considered in detail within the EIA, including with regards to potential effects on conservation sites or species.

[31] Note that the liability for any structure left *in situ* remains with the facility owner in perpetuity.
[32] Directive 2013/30/EU on the safety of offshore oil and gas operations.

Available information indicates that vessel traffic in the Beatrice Field area is low, and a vessel traffic survey will also be undertaken to inform decommissioning, particularly where activities will be undertaken outside of existing safety zones.

The physical presence of vessels will be temporary and localised, and there is the potential to reduce the scale of any possible impact through the optimisation of schedules of work to make use of vessel synergies. Relevant consent to locate permits will be applied for, in addition to reporting of activities through Notices to Mariners and the Kingfisher bulletins. The potential for cumulative effects from vessel presence and movements should wind farm construction activity coincide with that of the decommissioning programme will also be a consideration of the EIA Report (see Section 6.12).

The physical presence of any pipelines, cables (or sections of these) and associated protection materials, could pose a longer term source of potential effect for other users (e.g. fisheries). Were all or part of the pipelines to be left *in situ*, consideration will be given to the long-term effects of their degradation and possible future exposure. Protection materials will be removed unless there are significant safety and technical reasons why they cannot be.

6.2.2 Further Studies

A vessel traffic survey will be undertaken and if required a Collision Risk Assessment. The EIA will be informed by the selection of likely vessel types, their number, number of transits and likely onshore disposal locations.

A comparative assessment will be undertaken to inform the likely scale of any removal works for the pipelines, cables and associated seabed protection.

6.3 Effects of Seabed Disturbance during Decommissioning

6.3.1 Impacts, Approach to Assessment and Mitigation

Depending on the final decommissioning options selected, seabed disturbance could occur due to the placement of a jack-up rig (and possible anchoring during positioning), the anchoring of a heavy-lift vessel or other vessels (including during reverse s-lay), or placement of a jack-up barge, seabed excavation (e.g. trenching associated with partial or full removal of pipelines, cables and seabed protection materials, excavation to cut platform piles below seabed) and deposits such as rock dump, and the excavation of piles. Overall, the extent of physical disturbance will likely be equivalent to installation activities, with any seabed deposits having a relatively small footprint.

Seabed disturbance will result in direct physical effects which may include mortality as a result of physical trauma, smothering by excavated sidecast and re-suspended sediment, and habitat modification due to changed physico-chemical characteristics, including from the introduction of hard substrates through rock cover. The excavation of the platform piles and the complete or partial removal of the pipelines and cables would involve the resuspension of some sediments and the creation of mounds on the seabed surface. Given the present understanding of the shallow sediments in the area (see Section 3.2), there is the possibility that some of the excavated sediment may be clay which has the potential to generate persistent mounds and unless remediated could hinder towed fishing gears. Additionally, there are significant fixed fisheries within the Moray Firth (particularly nearshore) which could be temporarily disturbed should complete or partial removal options be chosen for the export pipeline and power cable.

The impact of physical disturbance on benthic communities will be informed by the existing broadscale and site specific information gathered to date (e.g. see Section 3.6) and the results of new pre-decommissioning surveys which were conducted in October-November 2016. Previous surveys have not indicated the presence of any Annex I habitats in the Beatrice Field area. However, the Moray Firth SAC includes "*Sandbanks which are slightly covered by sea water all the time*" as a qualifying feature; the export pipeline traverses the SAC and dependent on the outcome of the CA work may need to be undertaken within site boundaries to either remove or make safe the pipeline if left *in situ*.

Mitigation may be possible, including careful planning of anchoring locations to avoid sensitive features, the minimisation of rig and vessel movements which require anchoring, and the use of dynamic positioning (DP) to reduce anchor deployment (however, see Sections 6.2 and 6.5).

6.3.2 Further Studies

Pre-decommissioning surveys have been undertaken and will augment existing broadscale and site specific seabed survey data. Repsol Sinopec Resources UK will maintain a dialogue with fishermen to understand the location, timing and sensitivities of fishing activities in relation to the potential decommissioning options. If appropriate, sediment dispersion modelling will be undertaken to inform the EIA.

6.4 Effects of Drill Cutting Disturbance, and Cuttings Pile Management Options

6.4.1 Impacts, Approach to Assessment and Mitigation

The final management option for the drill cuttings piles at the Beatrice Alpha platform (see Section 2.9) will depend on the outcome of a screening assessment conducted using the results of the recent environmental survey when the results become available. Should the leaching and persistence of cuttings contamination be found to be above the OSPAR Recommendation 2006/5[33] thresholds, a second stage comparative assessment of the Best Available Techniques (BAT) and Best Environmental Practice (BEP) will be carried out to inform cuttings management options. If the leaching and persistence of cuttings contamination are found to be below OSPAR 2006/5 thresholds such that the pile may be left *in situ*, the possibility of cuttings pile disturbance during decommissioning will be considered. Repsol Sinopec Resources UK propose to carry out modelling of the disturbance of the cuttings pile

The removal of the Beatrice AD drilling template, excavation associated with jacket removal and possibly also the disconnection and removal of cables and pipelines, has the potential to result in the resuspension and settlement of contaminated sediment associated with historic cuttings piles under the Alpha jacket. Disturbance of the drill cuttings has the potential to negatively affect local seabed and water quality, with associated local impacts on benthic fauna, fish and shellfish. Additionally, should appreciable cuttings be recorded during the screening assessment, leaving such cuttings piles *in situ* following decommissioning

[33] (A persistence of 500km^2/yr could mean an area of 1km^2 is contaminated for 500 years, or an area of 500km^2 is contaminated for 1 year)

presents a possible economic risk to fishing interests should they be over-trawled, leading to the possible loss of the catch and damage to fishing gear.

Should a complete removal option be regarded as appropriate, a review of recovery options will be undertaken to ensure that removal would not result in significant redistribution of material and that loss of containment risks were minimised.

The EIA will consider the proposed decommissioning methods, including engineering options to minimise cutting disturbance identified above, and pre-decommissioning survey results (see below), to inform an assessment of the likely scale and impact of cuttings piles disturbance. Dialogue will be maintained with fisheries interests, Marine Scotland, JNCC and others on the chosen cuttings pile management option.

6.4.2 Further Studies

Recent pre-decommissioning survey data (2016) has demonstrated that there are no historic, contaminated cuttings piles beneath the Beatrice B and Beatrice C platforms, and the survey of the Beatrice AD jacket and drilling template did not show an appreciable depth of cuttings. Results of the pre-decommissioning surveys will characterise the piles and inform cuttings management and decommissioning options selection, and will be available to inform the EIA. Additionally, the results of this survey will indicate where there is interaction between the infrastructure to be decommissioned (e.g. pipelines and jacket piles) and cuttings material. If appropriate, sediment dispersion modelling will be undertaken to inform the EIA.

6.5 Effects of Energy Use and Atmospheric Emissions

6.5.1 Impacts, Approach to Assessment and Mitigation

The principal source of emissions from the decommissioning programme will be those from energy generation through fuel combustion during well abandonment operations, vessel transits, any helicopter journeys used for crew changes, and ancillary power generation (e.g. for cutting tools and lifting). Gas emissions will primarily comprise carbon dioxide (CO_2), carbon monoxide (CO), oxides of nitrogen (NO_x), sulphur dioxide (SO_2), methane (CH_4) and volatile organic compounds (VOCs) which will contribute to atmospheric greenhouse gas (GHG) concentrations linked to global climate change and related effects (e.g. sea-level rise), ocean acidification (dissolved CO_2 decreasing seawater pH), regional acid loading (release of SO_2 into the atmosphere) and tropospheric ozone (resulting from reactions of NO_x, CO and VOCs).

Emissions of relevant gas species and their associated Global Warming Potential (GWP) will be calculated for combustion activities associated with each of the decommissioning options. These calculations will be informed by the latest information base (e.g. IPCC 2013), those studies already undertaken to inform decommissioning options selection (see Sections 2 and 4) and any additional engineering planning undertaken during the assessment process. The contribution of these emissions to air quality and global GHG concentrations will be assessed with reference to relevant regional and national data. The potential loss of other gases including refrigerants or other ozone depleting substances will also be considered in decommissioning planning and in the EIA Report.

Work schedules will be optimised to make use of vessel synergies and therefore minimising energy use and emissions.

6.5.2 Further Studies

The EIA will be informed by the selection of likely vessel numbers and types, fuel specification, number of transits and likely onshore disposal locations and routes.

6.6 Effects of Underwater Noise from Decommissioning Activities

6.6.1 Impacts, Approach to Assessment and Mitigation

Of all marine organisms, marine mammals are regarded as the most sensitive to acoustic disturbance. This is due to their use of acoustics for echolocation and vocal communication and their possession of lungs which are sensitive to rapid pressure changes. The Moray Firth is an important area for several cetaceans, including a resident bottlenose dolphin population, and high numbers of harbour porpoises, white beaked dolphins and minke whales are sighted regularly (see Section 3.11). The Moray Firth area also supports important breeding colonies for grey and harbour seals. The likely presence of particular marine mammals will be assessed based on existing studies relating to the Moray Firth and proposed wider management units (see Section 3.11 for references).

Underwater noise will be generated during decommissioning by a combination of rig and vessel noise, and abrasive or mechanical cutting techniques used in the removal of the jackets and pipeline sections. Whilst individual rig, vessel and cutting tool noise is not considered to be a significant source of disturbance, the cumulative effect of multiple vessel presence and movements and other activities will be considered, and potential effects assessed. The potential effects will be assessed by defining the type, frequency and source level of noise generated.

The potential for mitigation will be identified in the EIA Report and could include the optimisation of schedules of work to make use of vessel synergies, the selection, use and operation of cutting machinery to minimise noise magnitude/duration.

6.6.2 Further Studies

The noise assessment will be informed by the selection of likely vessel numbers and types, time in the field and the potential noise source levels and durations for the types of cutting tools likely to be used.

6.7 Effects Associated with Near-shore/Onshore Dismantling of Structures

6.7.1 Impacts, Approach to Assessment and Mitigation

The dismantling of the Beatrice facilities following their transport to shore has the potential to generate a range of impacts including visual intrusion, noise, dust, fumes and odour (also see Section 6.8). The level of work to be undertaken onshore will in part depend on the chosen decommissioning option, with much demolition and waste segregation taking place offshore if using piece small/medium methods.

The location for the dismantling of the Beatrice facilities is yet to be chosen, but will be an established yard to which the decommissioning programme will generate incremental activity, rather than the creation of any new site which could generate additional sources of effect. The visual, noise and other effects on communities and environmental receptors will be a consideration of the EIA. Mitigation is possible through yard selection and contractor audit, to ensure that any effects are minimised.

6.7.2 Further Studies

The location of the onshore yards and disposal site or sites is yet to be selected but will be based on site selection criteria including the potential environmental effects. All sites and waste carriers will have appropriate environmental and other operating licences in order to carry out this work and will be managed within contractor assurance processes.

6.8 Cleaning of Marine Growth from Removed Jacket Structures

6.8.1 Impacts, Approach to Assessment and Mitigation

The Beatrice jackets have a covering of marine growth below the splash zone, which when recovered constitutes a controlled waste under the *Environmental Protection Act 1990* (as amended). The marine growth consists of seaweeds, soft corals, anemones, hydroids, mussels and barnacles, as confirmed in ROV inspection surveys conducted in 2012. This marine growth, which may represent between 5 and 15% of the jacket weight, is likely to be transported on the jacket *in situ* and removed onshore. Species on the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) list, including *Lophelia pertusa*, are not present on the Beatrice installations and therefore would not require additional measures to be undertaken during jacket disposal.

Disposal options are likely to include landfill or composting. The decay of marine growth at the yard location is likely to cause short-term deterioration in air quality (primarily odour). The intensity and duration of the smell produced by decaying organisms will depend on the time of year and environmental conditions such as temperature, with dominant winds being responsible for the range and location of areas affected.

6.8.2 Further Studies

A review of existing marine growth data will be undertaken to ensure that sufficient data is available, and if required further analysis of ROV inspection video of each jacket will be undertaken to characterise the marine growth present.

6.9 Fate of Materials Returned to Shore: Recycling, Reuse and Disposal

6.9.1 Impacts, Approach to Assessment and Mitigation

A number of controlled, hazardous (e.g. insulation containing asbestos) and other (e.g. NORM) wastes will be returned to shore for treatment and disposal at licensed dismantling yards in keeping with relevant legislative provisions (e.g. the *Environmental Protection Act 1990* (as amended)*, The Waste (Scotland) Regulations 2011 and 2012* (as amended)). The eventual fate of materials will in part be controlled by the type of waste and how it is regulated, and also the potential for material reuse and recycling. All waste will be documented in a waste register, which will be used to record the types, quantities and fate of all waste.

To limit the quantity of waste requiring eventual landfill disposal, Repsol Sinopec Resources UK will ensure appropriate waste segregation and treatment is undertaken, and will consider a waste hierarchy whereby opportunities for the reuse or recycling of equipment and materials will be maximised. Should the destination of any part of the facilities be a non-UK yard, Repsol Sinopec Resources UK will ensure that waste is exported in a manner consistent with relevant waste shipment Regulations (e.g. *The Transfrontier Shipment of Waste Regulations 2007* (as amended)).

6.9.2 Further Studies

An inventory of items and materials on each platform and any subsea infrastructure will be made to identify the potential quantities of wastes and the options for reuse and recycling, as well as items or materials which will require special handling and disposal.

6.10 Accidental Events

6.10.1 Impacts, Approach to Assessment and Mitigation

Risk assessment of accidental events involves the identification of credible accident scenarios, evaluation of the probability of incidents and assessment of their ecological and socio-economic consequences. Evaluating spill risk requires consideration of the probability of an incident occurring and the consequences of the impact. Given the nature of the activities which could take place as a result of decommissioning, the following potential sources of spill risk have been identified:

- Loss of vessel through collision
- Worst case loss of fuel inventory from a vessel
- Worst case loss of diesel from the drilling rig
- Small scale spillages of diesel during bunkering
- Loss of drilling chemical containment, including of legacy chemicals from suspended wells
- Loss of residual hydrocarbons from topsides or subsea infrastructure during dismantling

Other users of the Beatrice area and transportation routes will be alerted to the decommissioning activities via publication of Notices to Mariners detailing rig and vessel positions, activities and timing and by full navigation lighting on the rig and vessels. Current information indicates that shipping density in the Beatrice area is low, however a vessel traffic survey will be undertaken to inform rig siting, decommissioning planning and the wider EIA process. All vessels and rigs to be used during well and wider facility decommissioning will be subject to audit by Repsol Sinopec Resources UK (against, for example, Marpol standards) and will have in place the relevant, current Shipboard Oil Pollution Emergency Plan (SOPEP) and/or OPEP, which would be implemented in the event of an accidental event. Further spill response resources would be available to Repsol Sinopec Resources UK via contracted spill management contractors.

In the unlikely event of a diesel spill, these would rapidly spread and disperse to form a sheen on the sea surface. Diesel is not persistent and would rapidly evaporate.

All of the platform topsides and pipelines would be flushed and cleaned prior to decommissioning work commencing. This should reduce the potential for the loss of any hydrocarbons to sea once the installations start to be engineered down, however there is the possibility that small residues will remain. It is unlikely that these residues would be of a quantity to generate pollution events.

It is understood that some of the chemicals contained in suspended wells may no longer be permitted for discharge, therefore containment for onshore treatment and disposal may be necessary.

6.10.2 Further Studies

A vessel traffic survey and, if required, a Collision Risk Assessment will be undertaken to inform the relevant consent to locate applications. Modelling of a worst case diesel loss scenario from the drilling rig would be undertaken as part of OPEP preparation for well decommissioning. An appraisal of historic well data is required to understand the nature and quantity of chemicals contained in suspended wells and the appropriate management option and permitting requirements for their discharge or containment.

6.11 Effects on Natura 2000 Sites

6.11.1 Impacts, Approach to Assessment and Mitigation

The Moray Firth has a number of Natura 2000 sites (SACs and SPAs) designated for habitats and species which may be sensitive to activities associated with decommissioning the Beatrice Field (e.g. noise, physical disturbance). Though the surface facilities are outside of Natura 2000 site boundaries (at least 11km distant), mobile species, such as grey and habour seals which are qualifying features of both SACs and SPAs may forage in the Beatrice area. Additionally, any offshore work which is undertaken along the pipeline route (e.g. removal of subsea deposits or pipeline sections) and nearshore section of the cable route would fall within SAC and SPA site boundaries, and may have the potential to generate disturbance effects to both species and supporting habitats.

The decommissioning activities which could take place as a result of the options presented in Section 2 will be considered in relation to the relevant Natura 2000 sites described in Section 3.13. Sufficient information will be presented in the EIA Report so that the Secretary of State can undertake Appropriate Assessment under the Habitats Regulations if likely significant effects are predicted.

Mitigation will be identified in the EIA process and documented in the EIA Report.

6.11.2 Further studies

The comparative assessment of pipeline and cable decommissioning options is required to inform the likely scale of any removal works within conservation site boundaries. In addition, the pre-decommissioning surveys and cuttings pile disturbance and spill modelling referred to in earlier sections are required to inform the assessment of potential effects on conservation sites features.

6.12 Cumulative Impacts

6.12.1 Impacts, Approach to Assessment and mitigation

The EIA will seek to set the potential impacts arising from decommissioning activities in the context of all other activities taking place in the area and determine the additive or cumulative effects, as required by BEIS (DECC 2011a). It is considered that given the existing uses of the sea and the potential decommissioning options available, that cumulative effects have the potential to arise with other activities, notably:

- Fishing
- Shipping and navigation
- Military activity
- The construction of offshore wind farms

The sources of effect from these activities, in-combination with those from the decommissioning options, will be considered in the EIA to identify the potential for cumulative effects assessment. Depending on the outcome of this assessment, mitigation measures may be proposed to avoid or reduce such impacts. The optimisation of schedules and making use of vessel synergies will be considered in order to minimise any interactions with other users, for instance in the generation of additional vessel traffic.

6.12.2 Further studies

A good level of information is available on the scale and intensity of activities undertaken by other users in the Moray Firth. Repsol Sinopec Resources UK will continue to monitor progress with the planning and deployment of offshore wind farms in the Moray Firth in order to understand the potential overlap of activity timing, and whether project phasing may negate potential interactions.

7 CONSULTATION ON THE DRAFT EIA SCOPING REPORT

7.1 Aims of the Consultation Programme

Repsol Sinopec Resources UK commenced early stakeholder engagement in 2014 with the purpose of informing the pre-decommissioning environmental survey scope of work that was conducted in 2016; to identify potential stakeholders with an interest in the Beatrice decommissioning project; to identify further data information sources available for the Beatrice area and to identify environmental issues associated with the Beatrice decommissioning project early in the planning process to inform this EIA scoping report.

The aim of this consultation is to ensure that Repsol Sinopec Resources UK is aware of all environmental information and stakeholder issues relevant to the potential activities which could be undertaken as part of the decommissioning options proposed, to inform the EIA and the decommissioning project planning.

7.1.1 Repsol Sinopec Resources UK Stakeholder Engagement Strategy

The major components of the stakeholder engagement strategy can be summarised as follows:

1) Establishment of good engagement with BEIS, OGA and other regulatory agencies to ensure visibility and understanding of intentions as well as opportunities to anticipate potential stumbling blocks for the decommissioning planning

2) Early contact with government advisory bodies, fishermen, environmental NGOs and marine scientists to help anticipate and design-out environmental issues so that they are properly addressed in relevant studies

3) Involvement of selected stakeholders at key stages of pre-planning to review scoping of the environmental impact assessment (this document), comparative assessment of pipeline and cable decommissioning options, and initial recommendations from the comparative assessment prior to DP submission

The strategy will be underlined by an approach which:

1) Establishes and builds on a personal approach to engagement wherever possible

2) Builds trust by being as open and transparent as possible (while respecting boundaries on the need for commercial confidentiality with respect to certain matters, including cost)

3) Seeks to engage on the basis of learning, demonstrating willingness to explore new ideas and ways of thinking in order to optimise the decommissioning plans

4) Shows how inputs have been taken forward (or not) at appropriate stages to ensure meaningful stakeholder engagement

5) Recognises that while some stakeholders will want to engage, provide input and share information, others will be more interested in merely being kept informed in the context of other interests and opportunities

Scoping is the first stage of engagement with stakeholders on the EIA process. Scoping is being undertaken early in the EIA and project planning process, but at a stage where sufficient definition is available on the likely decommissioning activities. This allows the initial consideration of potential environmental effects which may arise, the identification of information gaps to be filled and possible mitigation measures. These will be refined as the EIA and engineering planning progresses, informed by stakeholder engagement. Scoping feedback will be considered throughout the EIA process, and will be documented in a final post-consultation version of this scoping draft, and in the EIA Report. Where necessary, Repsol Sinopec Resources UK may contact individual stakeholders for further clarifications on particular issues raised.

At a later date (see Figure 7.1), certain stakeholders will also be contacted to participate in a review of the comparative assessment (CA) of pipeline decommissioning options to inform pipeline decommissioning and the final comparative assessment report. The CA report and the EIA Report will accompany the submission of the draft Decommissioning Programmes to BEIS.

Following submission of these documents, both the EIA Report and draft Decommissioning Programme will be made available to stakeholders and the public so that interested parties have the opportunity to make representations to the Secretary of State for Business, Energy and Industrial Strategy. The issue of the draft Decommissioning Programme and supporting documents (including the EIA Report) will be advertised in relevant newspapers, and be made available to view in hard copy at a number of selected venues and via download through the Beatrice decommissioning webpages.

Following completion of the above consultation, the draft Decommissioning Programme will be revised incorporating feedback/comments. When the Secretary of State considers the programme suitably developed, BEIS will invite Repsol Sinopec Resources UK to submit the final Programme which will update the approved 2004 version (which has been discussed in Section 2.5 and was originally based on reuse of the platform by the MoD, this option has subsequently been withdrawn by the MoD).

Figure 7.1 – High Level Overview of the Beatrice Decommissioning Planning Process

7.2 Stakeholder Consultations on the Beatrice EIA Scoping Report

On the basis of the type, location and environmental sensitivities (including other users) of the Beatrice decommissioning project, the following stakeholders have been consulted as part of ongoing early engagement (see Section 5.2):

- The Association of Salmon Fishery Boards
- Cetacean Rescue and Retrieval Unit
- The Crown Estate
- Department for Business, Energy and Industrial Strategy (formerly DECC)
- EDPR (for Beatrice Offshore Wind Limited)
- Highland Council
- Historic Environment Scotland (formerly Historic Scotland)
- Joint Nature Conservation Committee
- Marine Conservation Society
- Marine Scotland
- Moray Council
- Moray Firth Partnership
- Moray Firth Trout Initiative
- Royal Society for the Protection of Birds
- Scottish Fishermen's Federation
- Scottish Natural Heritage
- Scottish Wildlife Trust
- University of Aberdeen (Lighthouse Field Station)
- Whale and Dolphin Conservation
- WWF Scotland

7.3 Contacting Repsol Sinopec Resources UK

Comments on this scoping document may be directed to Repsol Sinopec Resources UK via the Beatrice decommissioning website: (http://www.talisman-sinopec.com/operations/beatrice-oil-field-decommissioning) or by letter or email addressed to:

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Comments are requested by the close of business on **Friday 30th June 2017**.

Repsol Sinopec Resources UK may wish to contact you following scoping to respond directly to any issues raised, or to request additional information where relevant. Feedback may be made public by Repsol Sinopec Resources UK in relation to the EIA process. If you do not want your name, organisation or all or part of your response made public, please state this clearly in the response.

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