Atlantic & Cromarty Decommissioning Programmes Environmental Impact Assessment

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1.0 EXECUTIVE SUMMARY

The Atlantic and Cromarty (A&C) Fields in United Kingdom Continental Shelf Blocks 14/26a and 13/30, respectively are located in the outer Moray Firth approximately 79 km northeast of the St. Fergus gas terminal and 135 km from the UK / Norway median line. Developed as gas and gas condensate fields, the A&C installations and pipelines were installed in 2005. The fields were in production from 2006 to 2009.

Hess Limited is the operator of the Cromarty Field and BG Group (BG) is the operator of the Atlantic Field and the joint facilities that serve both fields. When operational, production from the two wells at Atlantic and the single Cromarty well was routed to the Atlantic manifold and then exported by pipeline to the Scottish Area Gas Evacuation (SAGE) terminal at St. Fergus. Monoethylene glycol (MEG) injected into the gas production exported to shore was supplied from the SAGE terminal via a pipeline piggybacked to the gas export pipeline. Control of the wells was provided by means of an umbilical from the Goldeneye platform to the Atlantic manifold and to the A&C wells (see Figure 1-1).

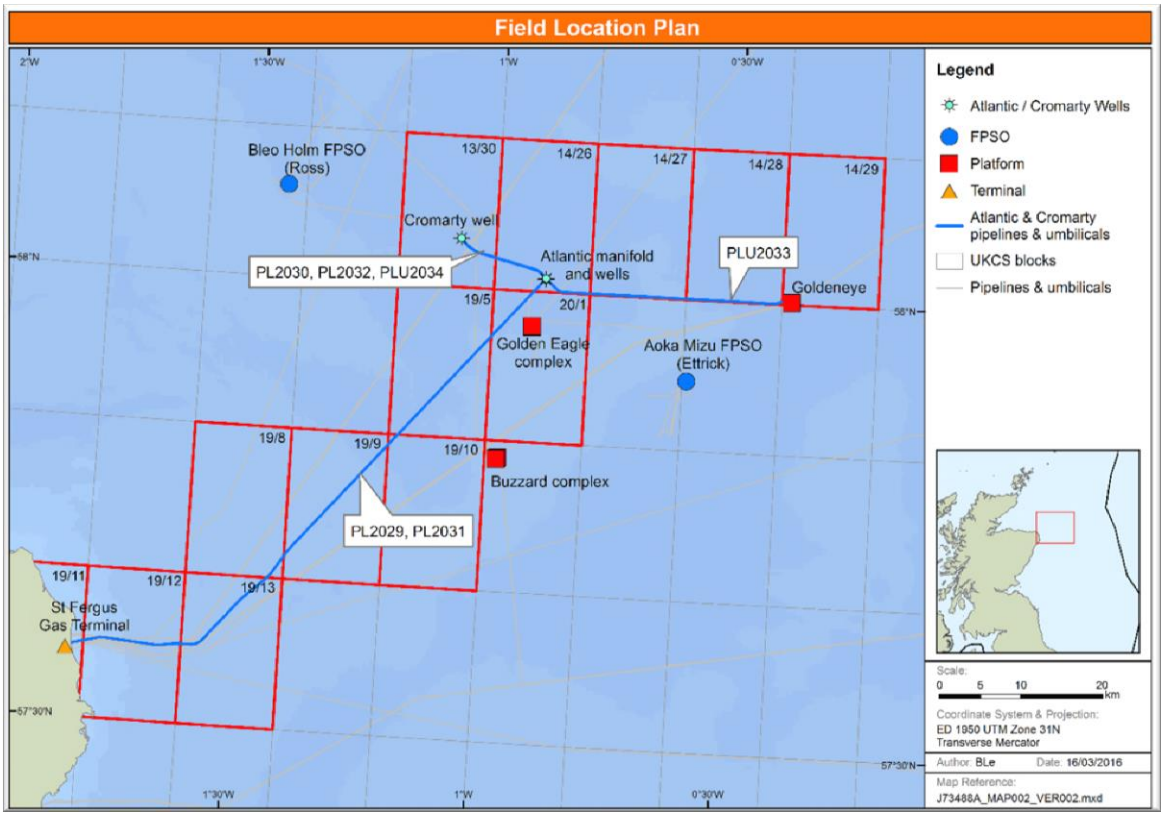

Figure 1-1: Chart showing the location of the Atlantic and Cromarty infrastructure

Cessation of Production (CoP) of the three wells was agreed in December 2011. The pipelines and umbilicals were flushed and the subsea equipment and pipelines were declared hydrocarbon free. The Atlantic pipelines (PL2029 and PL2031) and the Cromarty pipelines (PL2030 and PL2032) were placed under the Interim Pipeline

Regime (IPR) for a period of five years in order that potential opportunities for reuse by third parties could be identified and evaluated. The wells were suspended in 2014.

The pipelines are currently hydrocarbon free and filled with water, MEG and corrosion inhibitor. Some cores in the umbilicals contain hydraulic fluid.

BG has prepared this Environmental Impact Assessment (EIA) in support of the draft Decommissioning Programmes in accordance with the Petroleum Act 1998 submitted to the Department of Business, Energy and Industrial Strategy (BEIS) seeking approval for the decommissioning works associated with the:

(1) Subsea installations in the Atlantic Field

(2) Subsea pipelines associated with the Atlantic Field

(3) Subsea installations in the Cromarty Field

(4) Subsea pipelines associated with the Cromarty Field.

In July 2016, BEIS assumed responsibility for the approval of offshore Decommissioning Programmes that had previously resided with the Department of Energy and Climate Change (DECC).

The Decommissioning Programmes do not cover the onshore pipelines and SAGE terminal at St Fergus and this EIA does not cover the onshore facilities.

1.1 Decommissioning Activities

Decommissioning activities were selected following detailed technical review and comparative assessment of the feasible decommissioning options available to determine the optimal approach. The comparative assessment took into account the safety, environmental, technical, societal and cost consequences of all potential options. Cost was only the determining factor when other criteria considered were found to be equal.

The majority of the pipeline lengths and umbilicals associated with the developments offshore are trenched and buried at a depth of 0.6 m below the seabed surface. Given the length and burial status of the offshore pipelines and umbilicals, the results of the comparative assessment for the pipelines determined that these buried pipelines and umbilicals should be left in place.

The nearshore section of the pipelines are not trenched and buried in the same manner as the offshore sections as these sections were laid on the seabed surface and predominantly rock covered. The comparative assessment determined that these sections should also be left in place with further spot rock cover added where potential snagging hazards for fishing gear have been identified.

The technical studies and comparative assessment carried out resulted in the following decommissioning approach being selected:

- Plugging and abandoning two wells in the Atlantic field and one well in the Cromarty field and removing their Christmas trees and wellhead protection structures

- Buried pipelines to be left in place following the cutting and removal of the unburied ends and placement of rock cover over the pipeline end cuts to prevent snagging by fishing gear
- Placing rock cover over any areas of unburied pipeline where there is a risk of snagging by fishing gear
- Removal and lifting of the following infrastructure and materials from the seabed:
    - pipeline and infrastructure protection concrete tunnels, mattresses and grout bags
    - the Atlantic subsea manifold and protective structure
    - the cut ends of pipelines and umbilicals
    - seabed surface-laid tie-in spools and control jumpers
- Transportation of the removed infrastructure and materials to an onshore decommissioning yard, where they will be dismantled and batched for transportation to recycling facilities or disposal sites. Current estimates are that less than 400 tonnes of steel, and less than 2,000 tonnes of concrete and cut umbilical ends containing small quantities of copper and plastic will be returned to shore for recycling.
- A post removal debris survey of the seabed and removal of debris for transportation to shore
- Trawling trials after rock placement to verify the seabed is safe for commercial fishing

Post removal seabed environmental survey

1.2 Environmental Baseline

A pre-decommissioning environmental survey carried out in August 2015 found the environment at the A&C Fields to be typical of much of the Central North Sea. The water depth at Atlantic is 114 m and at Cromarty 113 m. The maximum tidal flow is 0.51 m/s, with residual currents moving to the southeast. Sea surface temperatures range from 8.5°C in the winter to 15°C in the summer. At the seabed, temperatures range between 8°C and 9°C. The seabed between the Cromarty field and the Goldeneye platform primarily comprises muddy sand with shell fragments that is typical for the ‘circalittoral muddy sand’ habitat widespread in the Central North Sea at water depths above 100 m. The benthos, fish, marine mammals and seabirds associated with the area are typical of the Central North Sea and occur over the wider North Sea region.

The seabed in the shallower part of the WAGES export pipeline route, up to approximately 45 km from shore, comprises a ‘circalittoral mixed sediment’ habitat, in which sandy areas occur that exhibit low biodiversity, and areas where shell material, gravel, pebbles, cobbles and boulders occur that exhibit relatively high biodiversity. The mixed stable sediment in the latter supports the tube worm *Sabellaria spinulosa* at the extreme of its geographic range and depth tolerance. This species is capable of forming

biogenic reefs, but a habitat assessment concluded that the *S. spinulosa* accumulations along the pipeline route do not form a contiguous reef.

The WAGES pipeline passes through an area that is being considered for designation as a possible Marine Protected Area (MPA), the Southern Trench MPA proposal. The WAGES pipeline is 30 km from the biodiversity and seabed geological features for which the site may be designated in the future, but it passes through an area where the thermal characteristics are associated with nursery grounds for fish.

Commercial users of the area are mainly associated with the oil and gas industry, shipping and fishing.

1.3 Impact Assessment

Following an evaluation of decommissioning activities that could interact with known environmental and socio-economic receptors within the footprint of the decommissioning activities and in the wider defined area of influence of the proposed activities, the significance of the potential risks and impacts was assessed based on pre-determined criteria. The risks and impacts were then categorised, based on their significance prior to the addition of controls to be implemented to avoid, or where avoidance is not possible, minimise, remediate or compensate for the impacts and risks identified. Potential pre-mitigated risks and impacts categorised as having high or moderate significance are summarised below. Particular emphasis has been placed on the control and mitigation measures for these identified risks and impacts.

The results show that through careful selection, planning and optimisation of available decommissioning options and the effective implementation of mitigation and management controls identified through the risk and impact assessment process, impacts to the existing biological, physical and socio-economic environment will be minimal with no adverse or long-lasting impacts predicted.

Overall, the activities will be of relatively short duration, irrespective of whether the decommissioning work programme is carried out in a single deployment or in stages. The plugging and abandoning of the three wells will require the presence of a rig in the field for a period of approximately three months with surface vessel deployment during subsea installation cutting and removal activities anticipated to last for approximately two months.

On the basis of the anticipated duration of the overall decommissioning programmes, estimated rig and vessel engine fuel requirements amount to approximately 4,500 tonnes of diesel, resulting in a total 14,000 tonnes of CO_2 emissions following combustion.

Routine discharges to the sea from vessels (including treated sewage, drainage and engine bilge waters) will be in line with normal shipping activities and all shipping discharge specifications will be in accordance with international MARPOL requirements. As with other shipping activity in the North Sea, the prevailing hydrodynamic conditions will rapidly assimilate these discharges to ambient conditions through natural dispersion and dilution.

Pipelines were cleaned and flushed of all hydrocarbon products in 2012 and flooded with treated seawater treated with small quantities of a corrosion inhibitor to prevent corrosion

until options for pipeline re-use had been fully considered. The umbilicals contain quantities of relatively benign hydraulic fluids. When the pipelines, spools and umbilicals are disconnected and cut at the seabed, small quantities of these contents will be released directly to sea. Dispersion modelling has shown that these releases will reach ambient conditions within 100 m of the release point over a very short time period and any localised effects to the marine environment would be negligible, short-lived and will rapidly recover. A gradual release of the pipeline and umbilical contents that remain buried in the seabed as these structures corrode over time will have an even less pronounced effect and will be within the range of natural variation.

Activities relating to the access to subsea infrastructure for cutting and removal, the placement of rock cover over exposed pipeline sections and cut ends, and the placement of rig anchors prior to well plugging and abandonment procedures will all result in temporary disturbance of localised seabed sediments. The impact on sediments will be temporary and the sedentary benthos (e.g. polychaete worms) is predicted to recover within about 100 days without affecting other trophic levels or the integrity of the wider ecosystem.

The decommissioning work will be planned to minimise its footprint on the seabed. The total footprint on the seabed from all decommissioning activities, including the deployment of rig anchors and placement of rock cover is not expected to exceed an area of 12.5 hectares. Placement of rock cover to prevent the snagging of fishing gear, particularly at sections of the WAGES pipeline between 7 and 10 km from shore where fishing vessels are known to dredge for scallops in autumn and winter may initiate an alteration to the balance of species due to the change to the character of the seabed within the small footprint of the activity. Species will recolonize the area from the adjacent habitat and due to the small footprint the change will not affect the integrity of the populations concerned.

On completion of decommissioning, debris in the A&C 500 m exclusion zones and along the pipeline routes will be cleared from the seabed. Trawling trials will be conducted to certify that the seabed is safe for commercial fishing. Post-decommissioning environmental sampling will monitor recovery of habitats and benthos.

Decommissioning poses little risk of marine spills from seabed infrastructure during well plugging and abandonment, cutting and removal procedures as barriers between the depleted hydrocarbon reservoir and the marine environment were installed in each well (mechanical bridge plugs) during well suspension and the subsea pipeline infrastructure was flushed until hydrocarbon free.

Spill dispersion modelling of a worst case spill during vessel activity (the unlikely event of the loss of a support vessels entire inventory of fuel following a collision at sea) predicted that the sheen it would form on the surface of the sea would disappear in nine hours by processes of evaporation and dispersion into the water column. It is noted, however, that seabirds have high or very high vulnerability to oil pollution throughout much of the year in the project's area of interest, but particularly from August to September.

Infrastructure and materials removed from the seabed will be transported to a shore-based decommissioning yard. The yard has not yet been selected, although only

established onshore yards will be considered and the yard will need to demonstrate its ability to meet BG HSE standards.

Onshore yard activities will inevitably result in an incremental increase in localised noise and vehicle traffic, although the scale and size of the A&C materials taken to the yard is relatively small and is expected to have limited cumulative effect on existing yard activities. It is unlikely to give rise to serious stakeholder concern. The decay of marine growth on the structures at the yard may result in unpleasant odours if not effectively managed. BG will select an onshore yard that is located at distance from local residents who may be affected by odour nuisance or, alternatively, a yard that has procedures in place to dispose of marine growth in a manner that will avoid odour nuisance.

1.4 Approach to Managing Risks and Impacts

Decommissioning activities will be carried out in accordance with BG Standards and will comply with UK legislation. Applications for all relevant permits, consents and marine licences for the proposed activities will be made to BEIS and other authorities and no activities will begin until all consents and licences are approved and marine notifications disclosed.

Activity-specific mitigation measures will be implemented through careful management and planning to avoid environmental and social impacts and, where avoidance is not possible, to ensure potential impacts are minimised to a level that is as low as reasonably practicable. This includes management of contractors commissioned to carry out the decommissioning activities, including auditing contractor activities and processes during the execution of the work and monitoring their performance. Agreed mitigation controls, regulatory requirements and BG standard requirements will be included as terms and conditions in all contract awards, including the measures to be adopted. Monitoring measures required to ensure compliance, will form part of the contractors decommissioning plans and procedures to be approved by BG prior to mobilisation. BG will carry out pre-mobilisation audits to assure that effective planning and operational procedures are in place and that all vessels comply with International Maritime Organisation requirements, including MARPOL requirements with regard to emissions, discharges, waste management and collision avoidance.

1.5 Conclusion

This EIA has identified potential environment and societal risks and impacts that may arise during the proposed A&C decommissioning activities and assessed their significance. Decommissioning the A&C infrastructure is of limited scope and activities will be carried out over a relatively short period.

No specific high risk environmental or social sensitivities were identified in the footprint of the planned decommissioning activities. While the decommissioning activities may disturb a small area of seabed within the project footprint, it will recover rapidly and be re-colonised by local species. Implementation of standard ship navigation and notification measures will ensure that risks and disturbance to other users of the sea are reduced to as low as reasonably practicable. Where additional rock cover is placed on the seabed, grades will be used that avoid hazards to fishing gear. This will be assured by over-trawl trials to check that the new rock cover does not present a hazard to fishing.

The mitigation measures to be implemented during the planned activities, including compliance with regulatory requirements and the management of contractors, will be fully integrated into the Decommissioning Programmes design, planning and contract awards. The decommissioning management programme will include close supervision and monitoring of the contractors' compliance with contract requirements. With appropriate implementation of the mitigation measures and controls, the minimal impacts within the project footprint will be localised and the seabed habitat will fully recover in a short period of time.

2.0 INTRODUCTION

On behalf of the Section 29 Notice Holders, BG-Group (hereafter referred to as BG) has prepared this Environmental Impact Assessment (EIA) under the Petroleum Act 1998 in support of the Decommissioning Programmes for the subsea facilities in the Atlantic and Cromarty (A&C) fields in the United Kingdom Continental Shelf blocks 14/26a and 13/30. These blocks are located in the outer Moray Firth some 79 km northeast of the St. Fergus Gas Terminal and 135 km from the UK / Norway median line (see Figure 2-1).

The Environmental Impact Assessment Report is one of three documents submitted for consultation in support of the Draft Decommissioning Programmes for the A&C Field, alongside the Comparative Assessment Report and the Stakeholder Engagement Report. Each of these documents is available online at the BEIS website (see 'Table of draft decommissioning programmes under consideration' at www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines), on request from BG, and, during the consultation, is available at the BG Group offices at 27 Albyn Place, Aberdeen AB10 1YL.

The Decommissioning Programmes seek approval for works to decommission and remove the A&C subsea installations along with approval for the proposal to decommission and leave in place the A&C subsea pipelines as the best preferred option in accordance with the findings of a Comparative Assessment of decommissioning options evaluated.

The scope of the A&C Decommissioning Programmes is limited to offshore installations, pipelines, including the export pipeline to shore, and umbilicals. It includes well plugging and abandonment for completeness and clarity. It excludes onshore pipelines and terminal installations, which will be decommissioned at a later date under separate arrangements.

This EIA assesses the potential environmental and social risks and impacts relating to the offshore activities proposed in the Decommissioning Programmes as well as considering potential issues relating to the onshore decommissioning yard, that has yet to be selected, but will be contracted to dismantle the recovered equipment and materials transported to shore for recycling and disposal.

2.1 Project Background

BG and Hess Limited (Hess) are partners in the A&C Fields. Table 2-1 shows the interest held by each partner. BG operates the Atlantic Field and the joint facilities that serve both fields. Hess is the operator of the Cromarty Field.

Table 2-1: Field partners

Field	BG Group	Hess Limited
Atlantic	75 % (Field Operator)	25 %
Cromarty	10 %	90 % (Field Operator)

The developments comprise three wells with associated subsea trees and protection structures: two at the Atlantic Field (14/26a-A2Z and 14/26a-A1Y); and one at the Cromarty Field (13/30a-6Z), connected to a subsea manifold (the Atlantic manifold). From the manifold, gas was exported via a 16" pipeline (the Western Area Gas Evacuation System or WAGES production export pipeline) to the Scottish Area Gas Evacuation (SAGE) terminal at the St. Fergus gas plant whilst monoethylene glycol (MEG), injected into the export pipeline to inhibit the potential formation of hydrates, was supplied to the offshore wells from St. Fergus via a 4" pipeline piggybacked to the WAGES pipeline. Electrical power, signals, hydraulics and chemical injection capability were supplied via control umbilical from the Goldeneye platform to the manifold and onwards to the wells. The A&C infrastructure, (manifold, installations, pipelines and umbilicals) was installed in 2005 (Figure 2-2). Production started in 2006 and stopped in 2009. A schematic of the A&C infrastructure is presented in Figure 2-2.

Cessation of Production (CoP) from the A&C Fields was agreed in December 2011. The wells were suspended and mechanical plugs installed in June/July 2014 in compliance with DECC requirements and in accordance with Oil and Gas UK (OGUK) Guidelines for the suspension and abandonment of wells (OGUK, 2009).

The pipelines were flushed and cleaned until hydrocarbon free and disconnected from the wells in 2012. The export pipeline and MEG lines were then placed under an Interim Pipeline Regime (IPR) for a period of five years to allow potential third party reuse applications to be identified and evaluated. No viable third party reuse application for these pipelines has been identified.

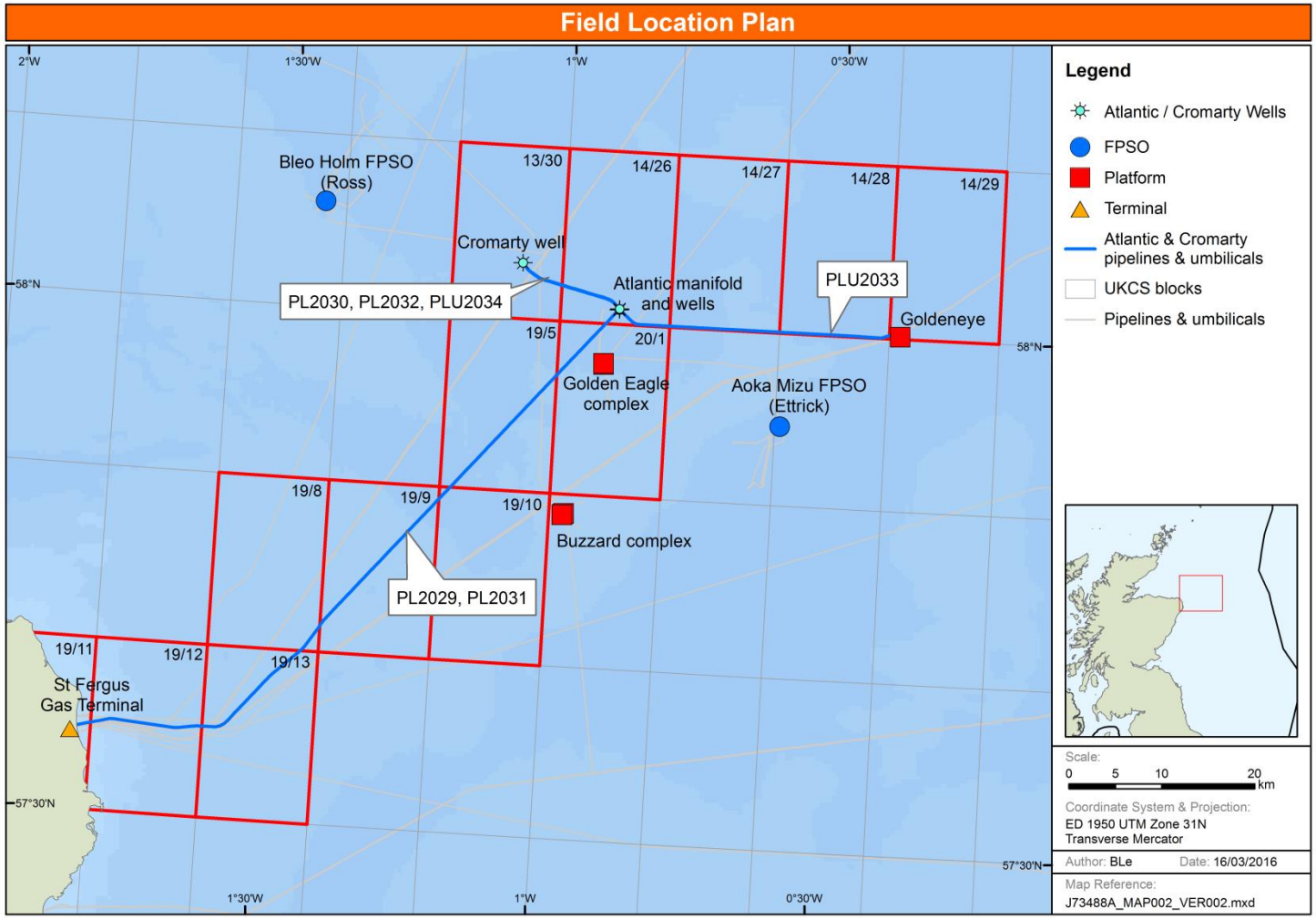

Figure 2-1: Chart showing the location of the Atlantic and Cromarty infrastructure

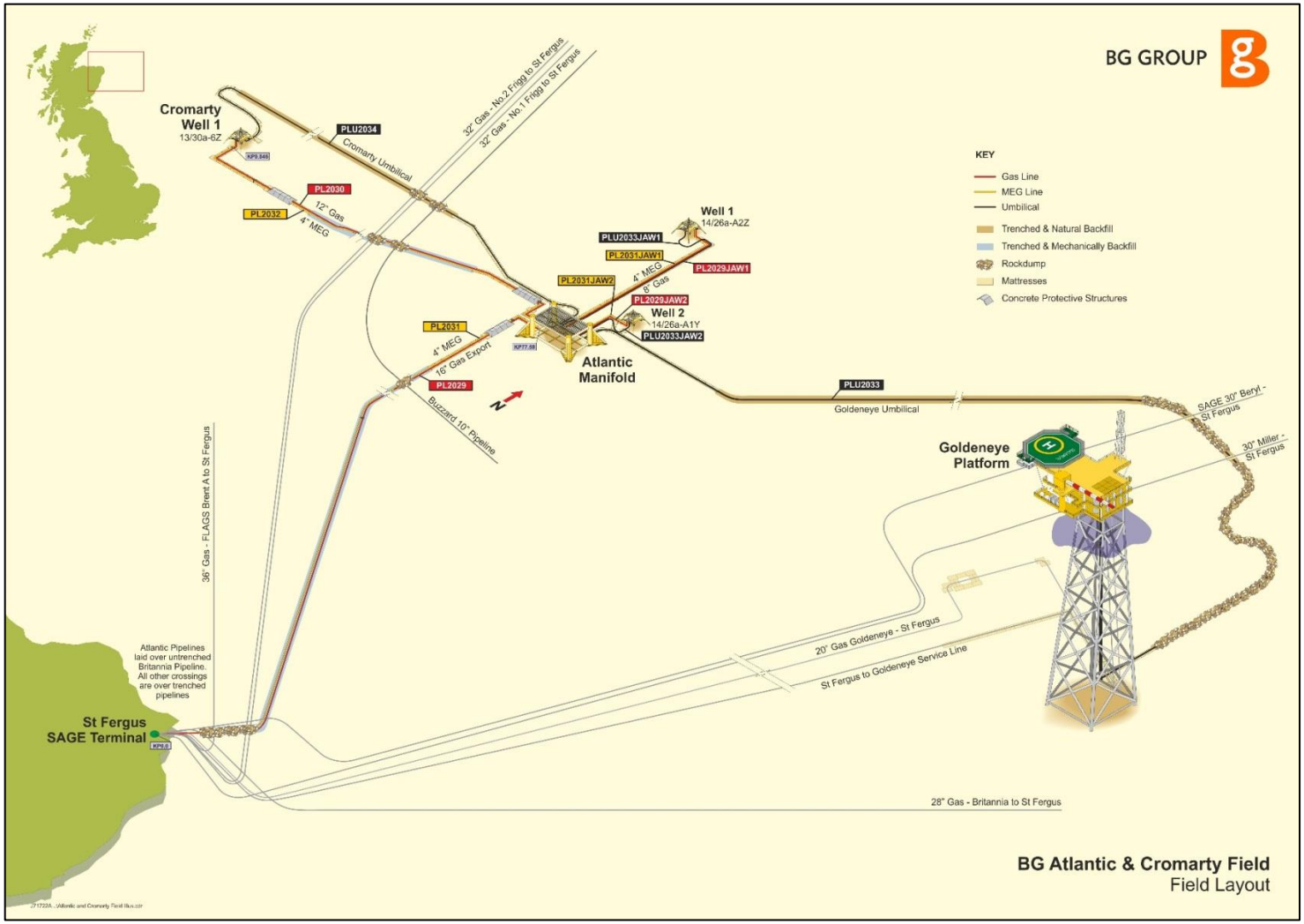

Figure 2-2: Representative schematic of the Atlantic and Cromarty infrastructure

2.2 A&C installations and pipelines to be decommissioned

The scope of the A&C Decommissioning Programmes is limited to offshore installations (including wells) and pipelines and excludes pipelines buried landward of Mean Low Water Springs and installations in the SAGE terminal. Landward pipelines and A&C terminal facilities and infrastructure will be decommissioned at a later date under separate arrangements.

To comply with UK regulations (see Section 1.3), steel installations on the seabed must be removed at the decommissioning stage. The weight of the A&C installations is below the threshold for any derogation and therefore all the subsea installations will be removed.

The decommissioning of marine pipelines is considered on a case by case basis by the UK authorities. Decommissioning options are evaluated by means of a Comparative Assessment (CA) that takes into account all feasible options. CA for decommissioning the A&C pipelines and umbilicals was therefore carried out to determine the optimal approach. This assessment of the options took into account safety, environmental, technical, societal and cost criteria (with cost only being a determining factor when other criteria emerged as equal). Results from the CA determined that the buried pipelines and umbilicals should be left in place following removal of the unburied ends with rock cover used to mitigate the cut ends and exposed sections that pose a potential risk of snagging to fishing gear.

Section 2 of the A&C Decommissioning Programmes provides full details of the equipment and infrastructure to be decommissioned. A summary is provided below:

Atlantic Field

The installations to be removed from the seabed in the Atlantic Field comprise:

- The subsea trees and integral protection structures of the two wells, following plugging and abandonment of the wells
- Concrete tunnels, mattresses, and grout bags protecting the surface-laid sections of pipelines, spools and umbilicals
- Two 8” production spools (PL2029JAW1 and PL2029JAW2) connecting the wells to the manifold and 4” MEG spools (PL2031JAW1 and PL2031JAW2). The spools are laid directly onto the seabed and protected with concrete mattresses
- The Atlantic manifold with its protective structure and the tops of the piles that secure it to the seabed
- Surface-laid ends of the production pipeline from Cromarty and its piggy-backed MEG line, where they are on the seabed in the Atlantic 500 m zone and spools connecting them to the Atlantic manifold
- Surface laid ends of the export pipeline and piggy-backed MEG line and umbilical and spools connecting it to the manifold

- Surface-laid ends of the umbilical from the Goldeneye platform and of its onward extension to Cromarty where they are on the seabed in the Atlantic 500 m zone.

This seabed infrastructure is located in an exclusion zone with a 500m radius from the Atlantic manifold.

Cromarty Field

The installations to be removed from the seabed in the Cromarty Field comprise:

- The subsea tree and integral protection structures of a single suspended well of the single well following plugging and abandonment of the well
- Concrete tunnels, mattresses, and grout bags protecting the surface-laid sections of pipelines, spools and umbilicals
- Surface-laid ends of the Cromarty production pipeline and its piggy-backed MEG line, and spools connecting them to the Christmas tree
- Surface-laid ends of the umbilical extension to Cromarty (from the Atlantic manifold).

This seabed infrastructure is located in the 500m exclusion zone around the Cromarty field.

Goldeneye Platform

The A&C installations to be removed from the 500 m exclusion zone around the Goldeneye platform comprise:

- Concrete mattresses covering the section of the umbilical that was laid on the seabed without rock cover
- The section of the umbilical from which the concrete mattresses are removed
- The section of umbilical installed in a J-tube to the platform's topsides.

Pipelines

Except the pipeline and umbilical ends that are laid on the seabed surface, within the two 500 m exclusion zones at Atlantic and Cromarty, all the pipelines and umbilicals are buried throughout their length. The installation in trenches targeted burial to 0.6m. Some of the trenches were mechanically backfilled and others were left to fill naturally. Where rocks and boulders prevented trenching, rock cover was placed to protect the pipelines, except for the section of the production pipeline located between 6.4 and 8.9 km from the shore at St Fergus, where the pipeline was laid on the seabed with spot rock cover, and the section between 8.9 and 10.4 km from the shore, where the pipeline was laid on the seabed with intermittent rock cover.

Flushing and cleaning displaced the pipeline contents to the SAGE terminal and reduced the hydrocarbon content of the water in the pipeline to 30 ppm. This meets the regulatory limit for oil in marine discharges of produced water. Because the WAGES production pipeline and piggybacked MEG line from Atlantic were to be placed under the IPR, they were filled with a 50:50 mixture of MEG and potable water treated with 1000ppm of

Roemex RX-5227 corrosion inhibitor. The Cromarty to Atlantic production pipeline was filled with a 50:50 mixture of MEG and seawater and it was also treated with 1000ppm of Roemex RX-5227 corrosion inhibitor. The production pipeline was disconnected from the wells and capped and disconnected from the SAGE terminal facilities.

Except where the ends of the umbilicals were laid on the seabed and protected by mattresses in the 500 m zones at Atlantic, Cromarty and Goldeneye, they were trenched to a target depth of 0.6 m and left to backfill naturally. 'Spot' rock cover corrected free spans. The hydraulic lines inside the umbilicals contain Macdermid Oceanic HW443R hydraulic fluid.

2.3 Regulatory Context

2.3.1 National Legislation and Regulations

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure including pipelines in the UKCS (UK Government, 2009). It requires the Department of Business, Energy and Industrial Strategy (BEIS), that took over the responsibilities of the Department of Energy and Climate Change (DECC) in July 2016, to approve a Decommissioning Programme, subject to statutory and public consultations, before the operator of an offshore installation or pipeline proceeds with decommissioning.

DECC's Guidance Notes on the 'Decommissioning of Offshore Oil and Gas Installations and Pipelines' (DECC, 2011) describe the processes introduced in UK regulations to implement OSPAR Decision 98/3 and the Petroleum Act 1988.

DECC's Guidance Notes requires assessment of feasible pipeline decommissioning options on a case by case basis. A Comparative Assessment (CA) of the feasible options must be carried out taking account of safety, environmental, technical, societal and cost factors. DECC's Guidance Notes state that a Decommissioning Programme for offshore installations must be supported by an EIA that includes an assessment of:

- Potential impacts on the marine environment, onshore environment, and atmosphere
- Consumption of natural resources and energy associated with reuse and recycling
- Interference with other legitimate uses of the sea
- Potential socio-economic impacts.

DECC's Guidance Notes clarify that in addition to the approval of a Decommissioning Programme, the operator must obtain relevant environmental consents and permits prior to undertaking decommissioning activity, including, but not limited to:

- Consents to use or discharge chemicals under the Offshore Chemicals Regulations 2002
- Marine licences to place items on or remove items from the seabed under the Marine and Coastal Access Act 2009

- Consent to locate a drilling rig under the Energy Act 2008
- Permit (PON 5) to abandon a well under the Petroleum Act 1998 (as amended)
- Licences under Waste Management Licensing Regulations.

The EIA will be a supporting document for permit applications submitted through the PETS system on BEIS's Energy Portal.

Protected Area Designation

The Scottish Government designates Nature Conservation Marine Protected Areas (MPA) under the Marine (Scotland) Act. Marine Scotland, Scottish Natural Heritage, the Joint Nature Conservation Committee and other organisations put forward MPA proposals for designation. The nearest designated MPA to the A&C project area of interest is the Turbot Bank, located approximately 66 km south of the Fields (Figure 5-9). However, the A&C export pipeline passes through the boundaries of an area that has been identified for possible future designation as an MPA (the Southern Trench MPA proposal). This is further discussed in Section 4.4.

2.3.2 International Legislation

OSPAR

The UK has ratified the 1992 OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR, 1992). OSPAR Decision 98/3 (OSPAR, 1998) on decommissioning provides for operators to apply for consent to leave the footings of steel structures weighing over 10,000 te in place on the seabed, where these were installed before 1998. The A&C installations are not, therefore, candidates for derogation and must be removed from the seabed. However, OSPAR Decision 98/3 does not apply to pipelines and umbilicals.

MARPOL

The Convention for the Prevention of Pollution from Ships (MARPOL 73/78) regulates the discharge of oil and wastewater discharges, and controls atmospheric emissions and waste management for commercial shipping. BG will require all vessels contracted for the A&C decommissioning works to demonstrate compliance with MARPOL.

EU Directives

The EU Habitats Directive (92/43/EEC) lists habitats (Annex I) and species (Annex II) whose conservation requires the designation of special areas of conservation (SAC) sites of community importance (SCI). The habitat assessment carried out as part of the Atlantic and Cromarty Pre-Decommissioning Environmental Survey (Fugro 2015a) determined that no Annex I habitat occurs in the project area of influence. Marine mammals listed in Annex II (cetaceans and pinnipeds) have been observed in the outer Moray Firth where the A&C Fields are located (bottlenose dolphin, harbour porpoise) and along the export pipeline route (common seal). However, the A&C Fields are approximately 125 km from the nearest SAC for marine species (the Moray Firth SAC designated for bottlenose dolphins).

Annex II of the Directive provides protection to cetaceans and pinnipeds, which are European Protected Species. It is an offence to disturb their life cycle in a way that affects the survival of the species or to disturb their local distribution or abundance.

The EU Birds Directive requires member states to nominate Special Protection Areas (SPA) for the protection of birds. The boundary of the nearest SPA to the A&C project area of interest (the Buchan Ness to Collieston Coast SPA, see Figure 5-9) is a coastal site approximately 7 km south of a location where BG proposes to place rock on the seabed.

2.4 Stakeholder Engagement

Stakeholders for the decommissioning project include, amongst others:

- Regulatory authorities and their advisory agencies and statutory consultees
- The energy industry, partners in the A&C Fields and operators with pipelines crossing A&C facilities, and the decommissioning supply chain
- Organisations and individuals with fishing, coastal, marine, environmental and community interests.

BG has implemented a stakeholder engagement programme to underpin development of the Decommissioning Programmes and ensure the proposals developed are comprehensive, well-founded and robust. A full report on stakeholder engagement activities is published alongside this EIA (BG 2016). Key elements included:

- Regular engagement with DECC's Offshore Decommissioning Unit (ODU) and Environmental Management Team (EMT), Marine Scotland, JNCC and SNH (amongst others) during the development of the programmes, with updates on the progress of planning activity and for clarification of regulatory expectations.
- Briefing documentation to explain the pre-planning process to all stakeholders before a comprehensive engagement programme by email, telephone and face-to-face meetings.
- A stakeholder workshop in November 2015, ahead of the comparative assessment of pipeline decommissioning options for briefing purposes and to identify stakeholder issues for further exploration.
- Sharing of the Pre-Decommissioning Environmental Baseline Survey with DECC EMT, JNCC, Marine Scotland and SNH for comment.
- Discussions with the Scottish Environment Protection Agency (SEPA) to understand the environmental arrangements necessary for compliance regarding waste.
- Formal meetings with the Scottish Fishermen's Federation (SFF) throughout the pre-planning phase of A&C decommissioning, together with a visit by BG's decommissioning project team to Fraserburgh Harbour to meet local fishermen to better understand the safety challenges which they face at sea.

- Involvement of the SFF at the comparative assessment of pipeline options (February 2016).

The Atlantic & Cromarty Fields Decommissioning Programmes Stakeholder Engagement Report (BG 2016) submitted as a supporting document to the Decommissioning Programme together with this EIA provides further details of the meetings held with stakeholders and the issues discussed with them. Appendix 4 Table 4 of this EIA summarises the key issues raised by regulators and consultees.

The formal statutory and public consultation process is triggered by the submission of the consultation draft of Decommissioning Programmes and supporting documents (including this EIA report) to BEIS.

2.5 Alternatives

BG has considered a range of alternative approaches for carrying out the decommissioning operations. Full details of the options for decommissioning pipelines and umbilicals are presented in BG's '*Atlantic and Cromarty Decommissioning Project Comparative Assessment Report*' submitted in support of the A&C draft Decommissioning Programmes.

2.5.1 Pipelines and umbilicals

The A&C pipelines and umbilicals are, for the most part, buried to a depth of 0.6 m. The decommissioning options that were compared included a 'do nothing' option, a 'total removal' option and 'partial removal' options. The options were compared in terms of defined, weighted criteria for safety (40%), environmental impact (20%), technical feasibility (10%), societal disturbance (15%) and relative cost (15%).

The environmental and societal component of the assessment took account of:

- The relative impact on the marine environment caused by the routine discharges and noise from vessels deployed during the decommissioning project, and the risk of accidental fuel spills taking account of the number of vessels
- The estimated energy use and atmospheric emissions from vessel engines, the estimated emissions from recycling recovered pipe, and the notional atmospheric emissions involved in manufacturing steel to replace the pipe that is left on the seabed
- The impact on the seabed of leaving pipelines and umbilicals in place, taking account of their persistence and toxicity
- The impact on commercial fisheries and the availability of the pipeline routes for fisheries during and after decommissioning
- The impact of onshore operations on the health, well-being, standard of living, structure or coherence of communities taking account of employment and nuisance factors (e.g. dust, odour and traffic).

The principal conclusion of the comparative assessment was that buried pipelines and pipeline crossings should be left in place, because this option has the lowest safety risk,

lowest environmental impact, lowest technical uncertainty and lowest cost. The industry has never removed a comparable concrete-coated pipeline that has a smaller line piggy-backed to it.

Although the steel pipe will remain in the seabed, the lines are buried and have been flushed free of hydrocarbon liquids. Free spans are not expected to form in the future. Excavation to unbury the pipelines would cause widespread seabed disturbance. Within 20 km from the WAGES pipeline's landfall, the pipeline passes through a more bio-diverse mixed sediment habitat than is present offshore. It is anticipated that removing the pipeline in this area would disturb a strip of up to 40 ha of seabed, partitioning a habitat in which species have adapted to its presence and removal would prolong the seabed recovery period.

Where the ends of pipelines and umbilicals are laid on the seabed in the 500 m exclusion zones around the A&C Fields installations, the comparative assessment recommended cutting and removing the surface laid ends. Rock placed on the ends of the pipe left on the seabed would reduce the risk of fishing gear snagging.

2.5.2 Goldeneye

The options for decommissioning the umbilical at the Goldeneye platform include:

- Cutting the umbilical where it emerges from rock cover, removing the section laid on the seabed, removing the umbilical from its J-tube from the seabed to the platform's topsides while leaving the J-tube itself and the termination unit on the platform's topsides to be decommissioned when the platform is decommissioned
- Cutting the umbilical where it emerges from rock cover and at the bell mouth of the J-tube, removing the section laid on the seabed, and leaving the termination unit on the platform's topsides to be decommissioned when the platform itself is decommissioned.

Both options are still under consideration. They are considered to involve the same environmental impact, which relates to cutting the umbilical and removing a section of it from the seabed.

2.5.3 Subsea installations

BG will remove all subsea installations on the seabed in the Atlantic and Cromarty 500 m zones, comprising: the three wellhead Christmas trees with integral protection structures; the Atlantic manifold, the concrete tunnels mattresses and grout bags, the spools and jumpers and the cut ends of pipelines and umbilicals.

BG has reviewed the available technical methods for removing these items from the seabed using support vessel's crane to lift them onto the deck. The heaviest lift will be approximately 90 te, so a heavy lift vessel (HLV) will not be required and the decommissioning fleet will comprise construction support vessels (CSV); dive support vessels (DSV) and ROV support vessels (ROVSV). The vessels will use dynamic positioning and will involve operational atmospheric emissions and discharges that are typical for their class.

Diving operations carry an inherent safety risk. BG has specified in the work scopes for the subsea decommissioning tender that contractors should minimise, as far as is feasible, options that require the use of divers.

Cutting pipelines, umbilicals and piles can be achieved with a wide range of technologies, including: hydraulic shears, grinding wheels, diamond wire, abrasive jets and oxy-acetylene torches. These methods generate moderate levels of underwater noise. The tender scope of work issued will invite contractors to propose a method for underwater cutting. The use of explosives for cutting, which generates high levels of underwater noise, is not deemed necessary for the A&C project. In order to minimise noise disturbance, the A&C project will not use explosives for cutting.

3.0 PROJECT DESCRIPTION

The Atlantic Field installations comprise the subsea Atlantic manifold and two wells (14/26a-A2Z and 14/26a-A1Y) with associated subsea trees and integral protection structures. The Cromarty Field contains a single well (13/30a-6Z) and associated subsea tree with integral protection structure.

The Atlantic manifold is connected to the onshore St. Fergus terminal by the 79.2 km WAGES production pipeline (PL2029 and a piggy-backed MEG pipeline (PL2031). The production pipeline is 18" diameter from the landfall to 1.2 km and thereafter 16" diameter. The MEG pipeline is 6" diameter from the landfall to 1.2 km and thereafter 4" diameter. The pipelines are buried in trenches or by rock cover throughout their length to a depth greater than 0.6 m, except for the section between 6.4 and 10.4 km from the shore, where the pipeline was laid on the seabed with only 'spot' rock cover. The WAGES pipeline and MEG pipeline were laid onshore from the landfall to the St Fergus terminal (1.4 km). This onshore section is not included in the Decommissioning Programmes and is not considered in this EIA.

Concrete tunnels and mattresses were laid to protect the ends of the pipelines at the approach to the manifold. The Atlantic manifold is connected to each of the Atlantic wells and pipelines by spools laid directly onto the seabed and protected with concrete mattresses.

Production from the Cromarty well was routed to the Atlantic manifold via a 11.8 km long 12" production pipeline. MEG was supplied to the Cromarty tree through a 4" pipeline which is piggybacked to the production pipeline. Apart from the approaches to the Cromarty Christmas tree and the Atlantic manifold these pipelines are trenched and buried throughout their length. Concrete tunnels and mattresses were laid to protect the pipelines at the approach to the Cromarty well.

A 31.4 km control umbilical (PLU2033) was installed from the Shell-operated Goldeneye platform to the manifold to provide hydraulic power, signals, and chemical injection to the A&C wells. A 12 km control umbilical (PLU2034) connects the Atlantic manifold to the Cromarty well. A satellite link from St Fergus gas terminal controls the umbilical's termination unit on the topsides of the Goldeneye platform. In the Goldeneye platform's 500 m exclusion zone, the first section of the umbilical was laid on the seabed and covered with mattresses. The remainder was protected with rock cover. From the edge of the 500 m exclusion zone, the umbilical was trenched and buried to a target depth of 0.6 m and left to backfill naturally. Remedial 'spot' rock cover has also been placed over the PLU2033 control umbilical from Goldeneye to the manifold to correct free spans.

Decommissioning the A&C Fields will involve the following activities:

- Mobilising a drilling rig to the fields to plug and abandon the three wells and remove the Christmas trees and their integral protection structures
- Mobilising survey vessels for pre-operation subsea location analysis and post-survey debris analysis

- Mobilising support vessels to cut pipelines and umbilicals, remove subsea installations and for transportation of removed facilities and materials to shore
- Mobilising a vessel to place rock on the seabed where required
- Onshore activities at a decommissioning yard, not yet selected, to prepare materials brought to shore for re-use, recycling or disposal.

The buried pipelines will be left in place in the seabed (see Figure 3-1)

3.1 Wells

Mechanical bridge plugs were installed in the two Atlantic wells and single Cromarty well when they were suspended. To permanently plug and abandon (P&A) the wells in accordance with the Oil & Gas UK guidelines (OGUK, 2015) and in compliance with regulatory and licence requirements, the following activities will be carried out:

- A semi-submersible rig will be mobilised and moored to anchors laid on the seabed
- A volume of cement will be pumped into the well above the mechanical bridge plugs to form a barrier isolating all porous, permeable and hydrocarbon bearing intervals
- Strings of intermediate casing will be cut and removed
- Cement will be pumped around the surface casing shoe to form a near surface barrier
- The surface and conductor casing will be cut approximately 3 m below the seabed
- The Christmas tree will be lifted from the seabed to the drilling rig together with the cut section of the casing
- The Christmas trees, wellheads and lengths of casing will be lifted and transferred to a supply vessel for transport to an onshore yard.

3.2 Subsea Installations

Vessels will be mobilised to Atlantic and Cromarty, including:

- A survey vessel that will carry out side-scan sonar and echo sounder ‘as-found’ surveys to verify the precise locations of the infrastructure to be removed and any debris that may interfere with the decommissioning activities. It will also carry out ‘as-left’ surveys
- A remotely operated vehicle support vessel (ROVSV) equipped with observation and work class remotely operated vehicles (ROVs) and a crane suitable for lifting equipment from the seabed
- A dive support vessel (DSV) or construction support vessel (CSV) equipped with a crane suitable for lifting the Atlantic manifold from the seabed
- A fall pipe vessel (FPV) to place rock cover on the seabed over the cut ends of pipelines and umbilicals and over the WAGES pipeline where there may be a risk of fishing gear snagging

- Guard vessels.

Within the two 500 m exclusion zones around the Atlantic manifold and the Cromarty well, the support vessel will deploy an ROV or divers (BG aims to minimise diving operations) to raise 18 sections of concrete tunnel, 145 concrete mattresses and approximately 600 grout bags from the seabed using lifting frames or half-height containers. The support vessel's crane will lift them to the deck of the support vessel.

An ROV (or divers) will cut the four surface-laid spools connecting the Atlantic manifold to pipelines, and the two spools connecting the Cromarty pipelines to the Cromarty well. The support vessel's crane will deploy a double grab to lift them to the deck. The production and MEG jumpers connecting the Atlantic manifold to the two Atlantic wells will be cut into sections to facilitate lifting. The support vessel will lift them in the same way.

Where the 16" production pipeline ends with piggy-backed 4" MEG lines are laid on the surface of the seabed within the 500 m exclusion zones at Atlantic and Cromarty, they will be cut. Up to 220 m of the surface-laid pipeline ends will be cut into sections and lifted by the support vessel's crane. The crane will deploy a double grab to lift them to the deck.

The umbilicals will be cut where they are laid on the surface of the seabed in the 500 m zones at Atlantic and Cromarty. In all, 360 m of surface-laid umbilical will be lifted by crane and reeled on the deck of the support vessel.

An FPV will be deployed to apply 'spot' rock to cover the cut ends of pipelines and umbilicals on the seabed to prevent potential snagging of fishing gear.

The Atlantic manifold comprises a 95 tonne piping skid in a 72 tonne piled protection structure. The roof panels of the manifold will first be disconnected and lifted by crane to the support vessel, giving access to prepare the piping skid for lifting. A support vessel with a suitably sized crane will lift the piping skid to the deck of the vessel. The pins locating the piles in the support structure will be disconnected, and the protection structure will be lifted in a second lift. The four piles will be cut at a sufficient depth (2-3 m) below the seabed to prevent fishing gear from snagging on them. The support vessel's crane will pull the cut ends of the piles out of the seabed and lift them onto the deck of the vessel.

A support vessel will be mobilised to the Goldeneye platform. In the platform's 500 m fishing exclusion zone, mattresses protecting the A&C umbilical will be removed and lifted by crane onto the support vessel's deck. The umbilical will be disconnected from the Topsides Umbilical Termination Unit (TUTU) on the topsides of the Goldeneye platform. The umbilical will be cut on the seabed and its end pulled down through a J-tube in the platform's jacket, onto a reel on the deck of the support vessel. With agreement from Shell UK, the A&C TUTU and other equipment on the platform's topsides that served the A&C umbilical will remain in place until the Goldeneye platform is decommissioned at a later stage.

From the point in the Atlantic 500 m zone where it is cut, the export pipeline and all the crossings of third party pipelines will remain in place. An FPV will be mobilised to the surface-laid section of the export pipeline between 7.5 and 10.4 km from the shore at St

Fergus to place rock so the pipeline will be covered in order to mitigate the potential snagging of fishing gear. Scallop dredging is known to occur in this area.

After removal of the seabed installations, the contractor will carry out debris clearance and perform an ‘as-left’ survey.

A chain mat will be deployed for debris clearance and to profile the rock cover so that it does not present a snagging hazard before overtrawl trials to verify that the seabed in the decommissioning area can be safely fished with trawling gear.

3.2.1 Schedule

It is estimated that the decommissioning vessel campaign would last two months if conducted in one stage, although it is possible that the work may be undertaken in stages in a three-year period based on the availability of vessels.

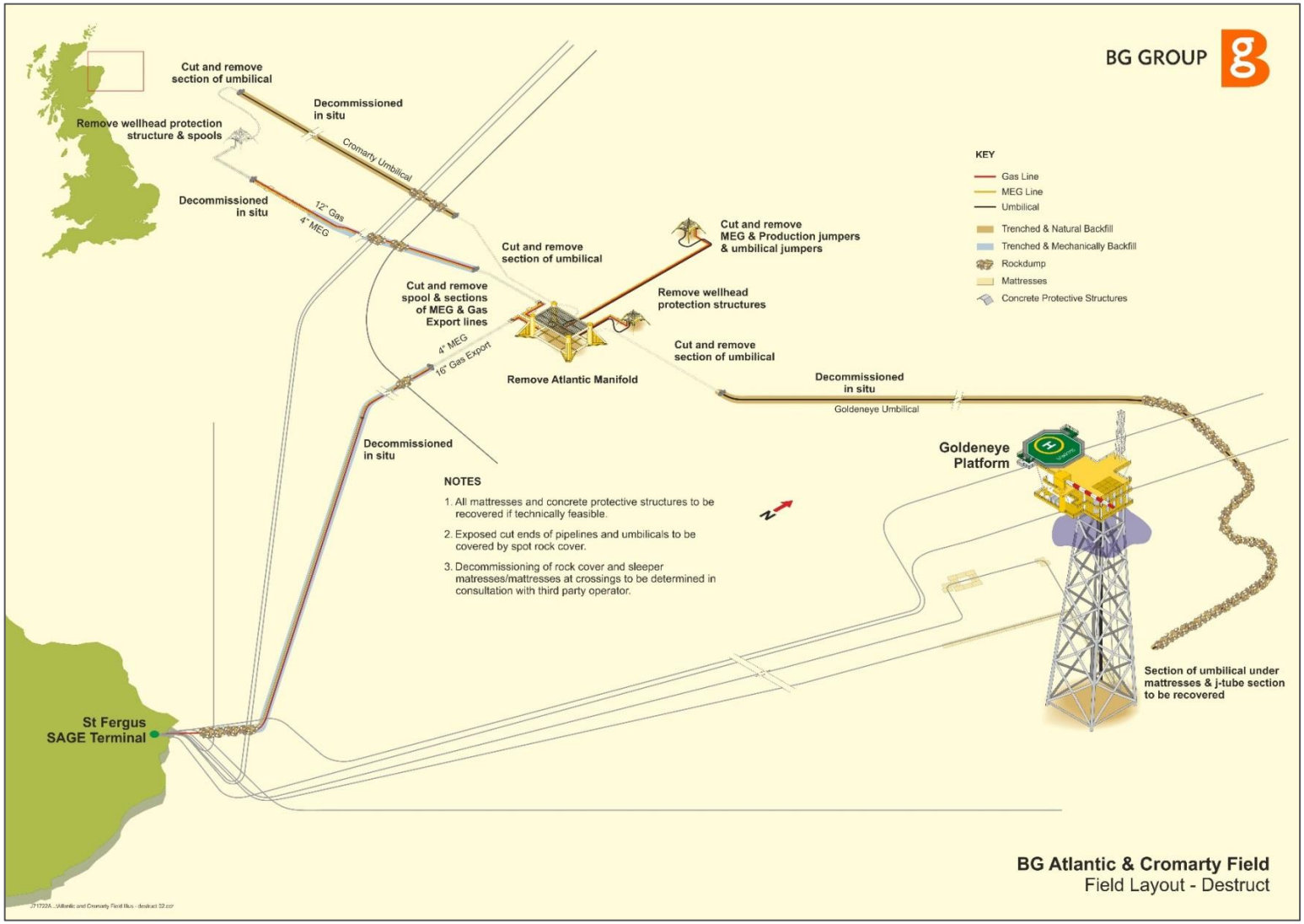

Figure 3-1: Summary of subsea decommissioning activities

3.3 Onshore

The three wellhead Christmas trees and their integral protection structures removed from the seabed during the rig campaign will be transported to shore by the rig's support vessel and delivered to an onshore supply base for re-use or recycling.

Subsea installations, infrastructure and materials removed from the seabed during the decommissioning vessel campaign will be transported and delivered to an onshore contractor's existing licensed decommissioning yard. The structures and materials will be transferred from the vessel to designated areas in the yard for appropriate cleaning, dismantling, segregation and storage.

At the onshore decommissioning yard, marine growth that has not dropped off during transit will be removed from the material. Anodes will be removed from the manifold and pipelines and stored separately. The ends of the umbilicals will be stripped to recover copper and steel components. Concrete may be crushed.

The segregated materials will then be batched for dispatch to appropriate facilities. Typically around 97% of the materials from decommissioning projects can be recycled, and these materials will be sent to licensed recycling facilities. The small amount of materials for which recycling is not available (e.g. marine growth) will be sent to appropriate disposal facilities.

4.0 SOURCES OF IMPACT

Potential sources of impact relating to the decommissioning activities outlined in the Project Description (Chapter 3) may include:

- Physical presence of the drilling rig and vessels
- Physical disturbance of seabed sediments
- Use of resources
- Atmospheric emissions
- Discharges to the sea
- Waste generation
- Noise generation
- Socio-economic effects.

4.1 Physical Presence of the Rig and Vessels

The physical presence of vessels on the sea surface during the decommissioning campaign will present a potential hazard to other shipping and fishing activities and will include:

- A semi-submersible rig and rig standby vessel during well plugging and abandonment procedures. P&A activities are anticipated to take up to 30 days at each well, therefore up to 30 days in the Cromarty field and up to 60 days at Atlantic. It is possible that plugging and abandoning the A&C wells will be included in the wider scope of work for a rig already mobilised for other operations in the North Sea.
- A survey vessel before the start of removal of subsea installations to carry out an 'as-found' survey. Survey activities are anticipated to take up to 22 days
- Support vessels (CSV, DSV, ROVSV) and guard vessels will be deployed to Atlantic and Cromarty to cut subsea facilities (including pipelines, spools, manifold piles and umbilicals) and to lift the equipment from the seabed onto the deck of the support vessel. It is estimated that this will involve 56 days of vessel deployment, but this may be done in stages as vessels are available
- An FPV deployed to place rock over the cut ends of pipe at A&C and over sections of the WAGES pipeline between 7.5 and 10.4 km from its landfall. It is estimated that the FPV will be deployed for five days, spending two days at A&C and three days at the WAGES pipeline location
- The survey vessel will perform an as 'as-left' survey and clear debris from the seabed. This activity is estimated to take 20 days
- A fishing vessel will be deployed to carry out overtrawling trials of the 500 m zones designated around the A&C Fields and along a 200 m wide corridor along the routes of each pipeline. This is anticipated to take up to 23 days.

The anticipated vessel use is detailed in Appendix 4 Table 1. At any one time, there could be a support vessel and a guard boat operating at Atlantic and Cromarty.

While the FPV is placing rock over the WAGES pipeline, the immediate area will not be available to third party vessels.

4.2 Physical Disturbance of Seabed Sediments

Assuming the sediments disturbed while setting or lifting rig anchors settle within 10 m of the point of disturbance and that sediments disturbed while running the anchor cables to a distance 2 km settle within 5 m, the footprint of sediment disturbance from mooring the drilling rig is approximately 8 ha.

The removal of the Christmas trees, the Atlantic manifold and the concrete mattresses and tunnels installed over surface-laid spools and pipelines will disturb and re-suspend seabed sediments. The cutting and removal of pipelines, spools and umbilicals will occur within the mattresses' footprint. Assuming that the sediment disturbed settles back onto the seabed within 10 m, less than 2 ha of seabed will be temporarily disturbed while removing the A&C installations. There will be further temporary disturbance of the same area when the debris clearance verification and overtrawling trials are conducted.

Placing rock over 2.5 km of the WAGES pipeline between 7.5 and 10.4 km from the shore at St Fergus is expected to affect a 10 m wide strip of the seabed and cover 2.5 ha of seabed, in an area comprising cobbles, muddy sand, gravel and boulders..

4.3 Resource Use

4.3.1 Fuel

The semi-submersible rig and the vessels deployed during decommissioning will consume fuel. A typical semi-submersible rig, stand-by vessel and supply vessel are estimated to consume approximately 2,500 te of diesel fuel in 90 days of operation. Deployment of a typical fleet of vessels (survey vessel, DSV, ROVSV, FPV, guard boat and fishing vessel) to complete the decommissioning work in a period of two months is estimated to consume approximately 2,000 tonnes of fuel assuming typical diesel fuel consumption for each class of vessel.

4.3.2 Rock

Quarried rock will be required for placement over the surface-laid section of pipe and the cut ends of pipe at Atlantic and Cromarty to prevent the snagging of fishing gear. The quantity of rock required for this purpose depends on the depth of cover to be achieved over the WAGES pipeline. This has yet to be finalised, but is not likely to exceed a single FPV cargo (e.g. 10,000 – 25,000 te).

4.4 Atmospheric Emissions

Combustion of fuel in the engines of the drilling rig and other vessels is the main source of atmospheric emissions from the proposed decommissioning activities.

However, DECC's Guidance Notes (DECC, 2011) specify that the EIA should estimate the atmospheric emissions associated with recycling decommissioned materials and the emissions associated with producing steel to replace the pipeline left buried in the seabed.

4.4.1 Emissions from Drilling Rig and Vessel Activity

Table 4-1 presents an estimation of fuel consumed by the rig and its supporting vessels during the programme to plug and abandon the A&C wells. The emission of CO2 and atmospheric pollutants associated with the fuel consumption has been calculated applying emission factors from the Environmental Emissions Monitoring System (EEMS) Atmospherics Calculations (EEMS, 2008).

Table 4-1 also presents an estimation of the emission CO_2 and atmospheric pollutants associated with fuel consumption of vessels deployed to remove the seabed installations and transport them to the onshore decommissioning yard. Appendix 4 Table lists predicted vessel use and fuel consumption. The calculation applies the EEMS emissions factors to the anticipated fuel consumption.

Table 4-1: Energy use and emissions associated with vessel activity

	Total fuel use (Te)	te						
		CO_2	NOx	N_2O	SO_2	CO	CH_4	VOC
Plug and abandonment campaign								
Drilling rig	1,080	3,456	64	0.2	4	17	0.2	2
Supporting vessels	1,416	4,531	84	0.3	6	22	0.2	3
Vessel campaign								
Vessels	1,937.5	6,200	115	0.4	8	30	0.3	4

4.4.2 Emissions from Recycling and Manufacture of Replacement Materials

Concrete and steel are the materials that will be transported to shore in the largest quantities.

Any potential reuse of concrete mattresses is likely to involve crushing and re-integration into fresh cement as aggregate. Crushing has a relatively low energy demand.

Table 4-2 presents an estimation of emissions from recycling the 383.5 te of steel expected to be transported to the onshore decommissioning yard calculated using the methods in the Institute of Petroleum Guidelines (IoP, 2000). It also presents an estimation of the emissions involved in the production of 14,850 te of new steel to replace the weight of the pipeline left buried in the seabed. (See Appendix 4, Table 2 for further details of steel recycling and

Table 4-2: Emissions associated with recycling of the recovered infrastructure

Activity	Total steel (te)	CO_2 (te)	NOx (te)	SO_2 (te)
Total emissions associated with recycling of recovered steel	383.5	369	1.5	0.6
Total emissions associated with replacing steel decommissioned *in situ*	14,850	28,051	50	74

4.5 Discharges to Sea

During well plugging and abandonment, a marine riser will connect the wells to the drilling rig. It is proposed that completion brines and other well fluids will be contained on the drilling rig and returned to the shore for treatment and/or disposal.

4.5.1 Routine Discharges

The rig and all vessels will only release routine discharges (e.g. ballast water, bilge water, sewage waste, food waste) to the sea in compliance with the requirements of MARPOL 73/78. Cement and and completion fluids from the wells will be contained on the rig and returned to shore.

4.5.2 Pipelines and Umbilicals

When the spools and jumpers are disconnected from the Atlantic manifold and lifted onto a support vessel, 12 m^3 of the water left in them under pressure when the pipeline was placed under the IPR will be released into the sea until the pressure has been relieved. This comprises water mixed with MEG, a product that OSPAR lists as posing little or no risk to the marine environment. The MEG/water mixture was treated with the corrosion inhibitor RX-5227 (at a concentration of 0.1% by volume). This is a relatively benign product with a Gold hazard quotient under CHARM. Similarly, when the production pipelines and piggy-backed MEG lines are cut at Atlantic and at Cromarty approximately 1 m^3 of this fluid will be released as the surface-laid pipe is cut into sections and removed. The initial discharge rate when the pipe is cut (estimated at 0.4 kg/s) is driven by the higher pressure inside the pipeline than the surrounding seawater. The fluids would only be discharged at this rate for a short time after the pipelines are severed until the pressures equalise. Environmental modelling of the dispersion of the RX-5227 in the discharge (by Osborne Adams calculation) predicted that the concentration of RX-5227 as the initial discharge disperses down current will reduce to below the predicted no-effect concentration (PNEC) within 100 m of the discharge source.

Some of the 9,500 m^3 of MEG/water mixture containing RX-5227 corrosion inhibitor (at a concentration of 0.1% by volume) inside the buried production pipelines and MEG lines may gradually find a route to the sea through the open ends of the pipelines once they have been cut. They may alternatively find a route to the sea in the long term if the pipeline decays. This release is driven by the density difference between the water in the pipeline fluid and the surrounding seawater and is much slower than the initial release on cutting the pipeline. The modelling for this scenario predicted the concentration of RX-5227 will reduce to below the PNEC within 20 m of the discharge source.

Some of the cores in the umbilicals contain a 50:50 MEG/water mix, but others contain 276 m^3 of the hydraulic fluid Oceanic HW443R. This is a glycol-based hydraulic fluid in OCNS class C. It is used to actuate valves at the wellhead Christmas trees, and a few litres were routinely discharged into the sea each time valves were opened or shut to control the well. When the umbilicals are cut, the hydrostatic head difference will initially cause hydraulic fluid to flow from the umbilical at a rate of up to 3m^3/hour until the pressures have equalised, but once the pressure has equalised, the subsequent flow due to the density difference will be much more gradual.

4.6 Waste Generation

The A&C installations have already been freed of all hydrocarbons, so no hazardous hydrocarbon materials are present. Naturally Occurring Radioactive Material (NORM) was never detected during A&C production, however, as a matter of precaution, the A&C infrastructure lifted from the seabed for transportation to shore will be routinely checked for NORM on board the lifting support vessels.

Section 3.8 of the draft Decommission Programme gives details of the following items that will be removed from the seabed and transported onshore:

- Christmas trees and wellhead protection structures
- The Atlantic manifold and piping skid
- Spools and cut sections of pipelines, jumpers and umbilicals
- Concrete tunnels, mattresses and grout bags

Table 4-3 presents the weight of steel, concrete, copper and plastic (from the umbilicals) and sacrificial anodes in the items that are to be transported.

Table 4-3: Estimates of material to be transported to shore

	te				
	Steel	**Concrete**	**Copper**	**Plastic**	**Anode**
Quantity	383.4	1924.4	0.5	6.4	0.9

The Christmas trees of the three wells will be removed by the rig and transported to an onshore supply base. They will be available for potential refurbishment and re-use.

The materials from removal of other subsea installations will be delivered to an onshore decommissioning yard as waste.

4.7 Underwater Noise

The A&C decommissioning activities are expected to involve temporary underwater noise from: vessels using dynamic positioning; the use of side-scan sonar and echo sounders for surveys; the use of cutting equipment such as shears or abrasive water jet cutters; and the placement of rock by an FPV.

4.8 Socio-Economic Impacts

In light of its small scale, the A&C decommissioning project is unlikely to create new jobs, but will provide work for the existing crews of the drilling rig and vessels, and for the staff at an existing decommissioning yard.

The offshore decommissioning activities will provide short-term work for the rig and decommissioning vessels. Cleaning and dismantling installations and materials will provide short-term work at an existing onshore decommissioning yard. Vehicles or vessels will be

employed to transport materials to recycling facilities or disposal sites. Recycling will provide short-term work for recycling facilities.

While the drilling rig and other vessels are on location performing decommissioning works at the A&C Fields, they will operate within the established 500 m exclusion zones. Other sea users must observe the normal collision regulations and avoid the area in which they are operating. The guard vessels deployed will intercept third party vessels that create a potential collision risk.

The decay of marine growth on installations removed from the seabed and brought ashore can result in nuisance odour on the vessels, at the decommissioning yard and, if the yard is located close to communities, it may give rise to complaints. The contractual requirements for yard facilities will require this to be addressed.

After decommissioning, the A&C Fields' 500 m exclusion zones will be relinquished and the areas will available to commercial fishing.

5.0 ENVIRONMENTAL DESCRIPTION

This chapter describes the current condition in the A&C Fields and pipeline route corridors that comprise the 'project area of interest' for the activities in the A&C Decommissioning Programmes, namely:

- The areas in which decommissioning activities will interact with the seabed:
- Inside the Atlantic field's 500 m exclusion zone where installations (the manifold, Christmas trees, protection structures, pipelines and umbilicals) will be removed, and the footprint of the drilling rig's mooring pattern where anchors will be placed up to 2 km from the Atlantic and Cromarty wells and anchor cables laid temporarily on the seabed
- Inside the Cromarty field's 500 m exclusion zone where installations will be removed
- Inside the Goldeneye platform's 500 m exclusion zone where mattresses and umbilical will be removed
- The section of the export pipeline between 7.5 and 10.4 km from the shore at St Fergus where an FPV will place rock on the seabed
- The sea surface where vessels mobilised for the decommissioning operations operate or through which they transit
- The decommissioning contractor's onshore yard. BG has not awarded this contract, so the location of the yard has not yet been determined
- Communities close to the onshore decommissioning yard.

The limit of the activities in the A&C Decommissioning Programmes that are assessed in this EIA is Mean Low Water Springs at the WAGES pipeline landfall at St Fergus. In the future, when the SAGE facilities and the A&C onshore pipelines at the St Fergus gas plant are decommissioned, a separate EIA will be prepared.

5.1 Sources of information

The environmental description has been prepared with reference to the available literature. It has been informed by site-specific survey data including:

- The Environmental Statement prepared in support of the A&C development (Genesis, 2002)
- The Goldeneye to Atlantic umbilical and Cromarty to Atlantic umbilical route surveys (Fugro, 2004)
- The Atlantic & Cromarty Fields Pre-decommissioning Survey (Fugro 2015a and Fugro, 2015b).

5.2 Physical Environment

5.2.1 Bathymetry

In the Atlantic field 500 m exclusion zone, the seabed is generally flat exhibiting very gentle gradients of <1º in a water depth of 114 m Lowest Astronomical Tide (see Figure 5-1). Several broad, gently dipping shallow depressions up to 220 m in diameter and less than 1 m deep are present, the closest of which lies 243 m north-east of the Atlantic manifold

The Cromarty well is located in 113 m water depth. In the southeast section of the 500 m exclusion zone the pipeline from Atlantic comes out of burial in about 112 m water depth. In seabed depressions to the southwest of the well the water deepens to 116 m (see Figure 5-1).

In the section of pipeline where rock will be applied (between 7.5 and 10.4 km from the landfall at St Fergus), the water depth over the export pipeline deepens with variable, but generally gentle, gradients from 50 to 70 m. Beyond 45 km from the landfall, the seabed deepens to over 90 m.

5.2.2 Currents

The tides in the outer Moray Firth generally flow in a north-south axis. The maximum speed of the mean spring tide is 0.51 m/s (UKDMAP, 1998). The residual current is driven by the Fair Isle Current and the anticlockwise Dooley Current, flowing southwards at 0.2 m/s.

5.2.3 Sea Temperature

The sea surface temperature ranges from 8.5°C in the winter to 15°C in the summer (UKDMAP, 1998). The annual mean water temperature at the seabed is between 8°C and 9°C (Scottish Government NMP1, 2014).

5.2.4 Salinity

The salinity of surface waters in the outer Moray Firth is between 35.0 ‰ and 35.2 ‰ with slight seasonal variation (BODC, 1998).

5.2.5 Seabed Sediments

The pre-decommissioning environmental survey of the A&C Fields and the pipeline routes (Fugro, 2015b) distinguished three biotopes (or biotope complexes) as defined by the European Nature Information System:

- The ‘circalittoral muddy sand’ biotope complex (EUNIS type A5.26) was found at all of the survey stations beyond 45 km from the shore. This is typical for the seabed with over 90m water depth and is a widespread habitat in the Central North Sea.
- The ‘circalittoral mixed sediments’ biotope complex (EUNIS type A5.44) was found at survey stations up to 45 km from the shore (see Figure 5-4). The seabed in these areas comprises quantities of shell material, gravel, pebbles, cobbles and in some places areas of numerous boulders. In the first 16 km from shore, the sediments are predominantly cobbles and boulders with gravel and sand. Beyond 16 km from the shore sand predominates with some pebbles and cobbles.
- Patches of a biotope ‘*Sabellaria spinulosa* on stable circalittoral mixed sediment’ (EUNIS type A5.611) between 3 and 16 km from the shore.

The seabed in the 500 m exclusion zones at Atlantic and Cromarty consists of muddy sand with shell fragments, typical of the widespread ‘circalittoral muddy sand’ habitat. Genesis (2014) observed that the seabed at Goldeneye comprises silt sediment over very soft, silty/sandy clay and soft to firm clay.

Fugro (2015b) examined three camera transects in the ‘circalittoral mixed sediments’ and ‘*Sabellaria spinulosa* on stable circalittoral mixed sediment’ habitats. Two of the transects coincide with the section of the pipeline route between 6.4 and 8.9 km from the shore, where the pipe was laid on the surface. The combination of indicators including elevation, the presence of cobbles and visible biota, allowed patches with moderate potential as stony reef to be identified (see Figure 5-2, transect TR02). Review of transect data (see Figure 5-3) suggested that *Sabellaria spinulosa* aggregations are likely to occur throughout the ‘circalittoral mixed sediment’ biotope complex, but assessment against indicators for elevation, area and patchiness concluded that that the aggregations in the nearshore pipeline area do not form a contiguous *Sabellaria spinulosa* reef.

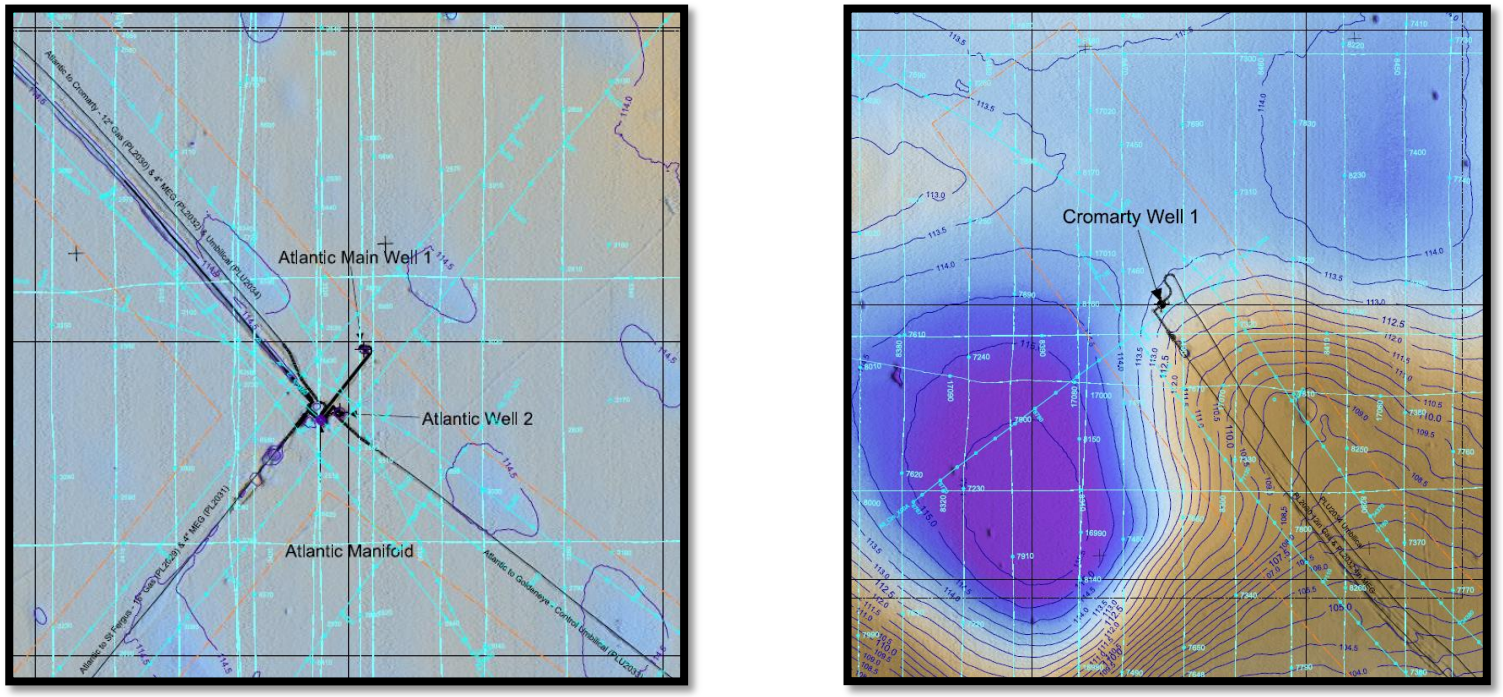

Figure 5-1: Bathymetry at the Atlantic field (left) and at the Cromarty field (right)

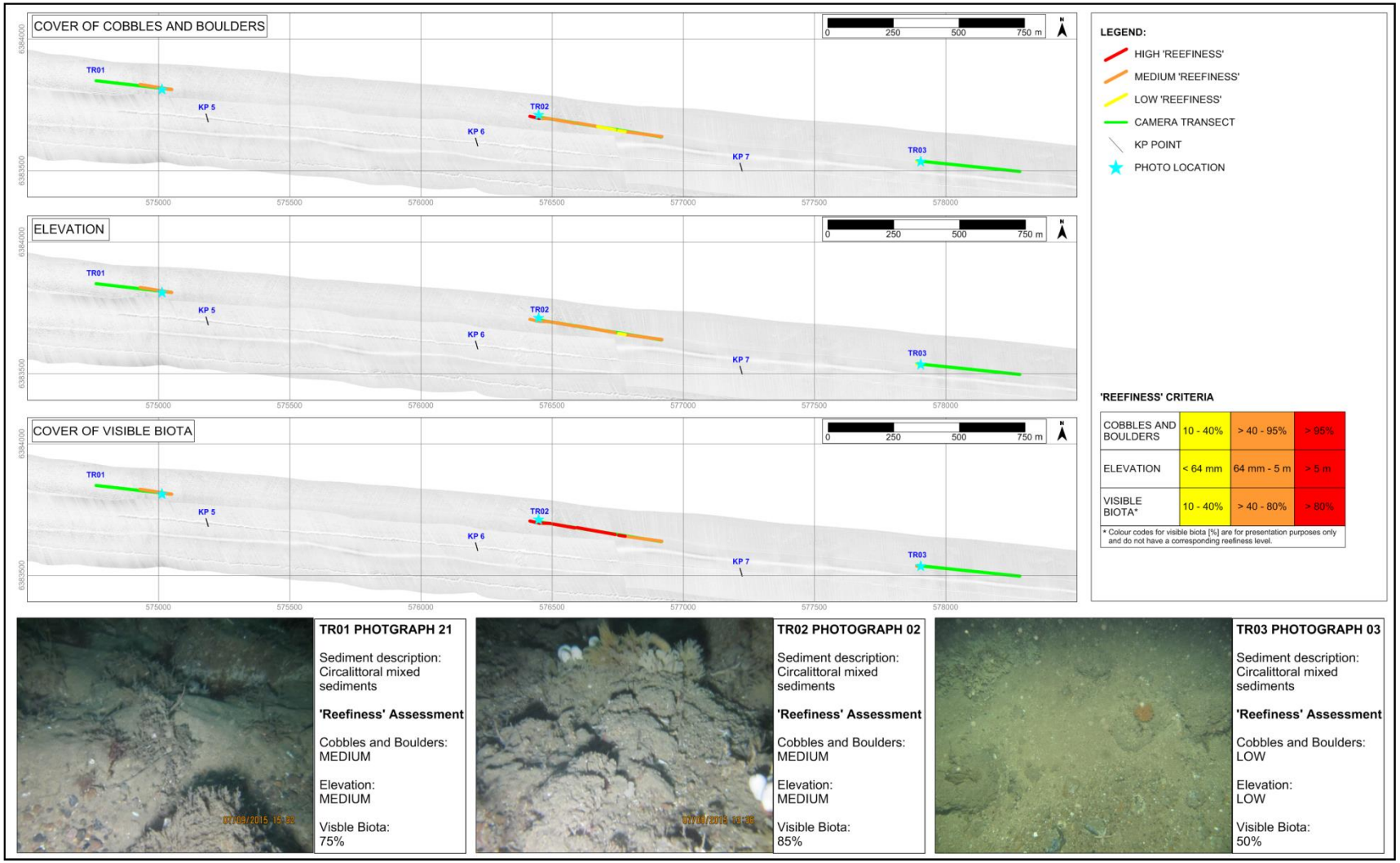

Figure 5-2: Pipeline Route Camera Transects Assessed for Stony Reef (KP4-KP8)(Fugro 2015b)

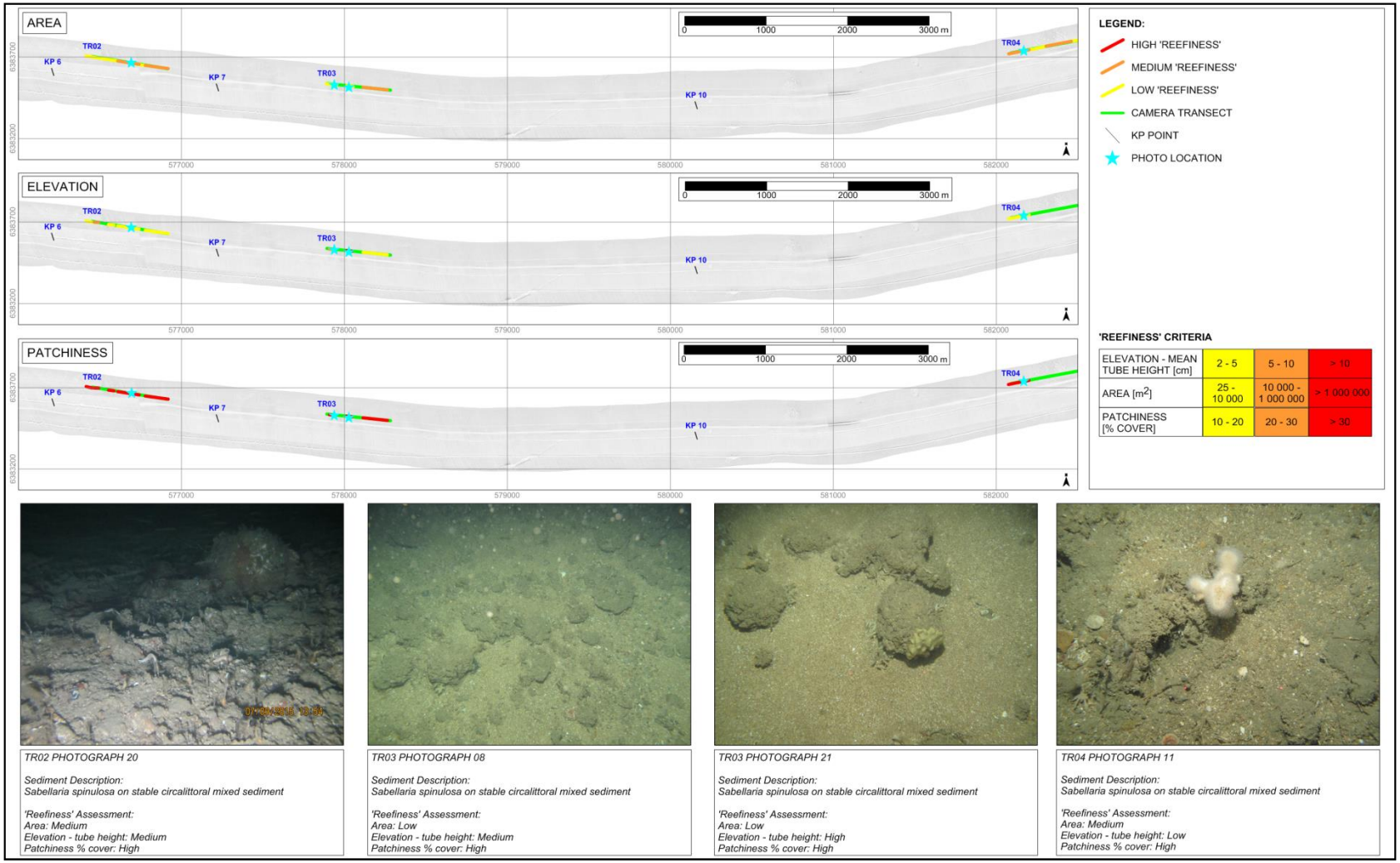

Figure 5-3: Pipeline Route Camera Transects for Sabellaria Reefiness Assessment (KP6-KP12) (Fugro 2015b)

5.3 Marine Flora and Fauna

The area of habitat the A&C decommissioning activities are likely to affect (approximately 12.5 ha) constitutes a tiny part of habitats that are widespread throughout the Central North Sea. It supports species that are found throughout the region.

5.3.1 Plankton

The A&C project area of influence currently has the common North Sea phytoplankton species, dominated by the dinoflagellate *Ceratium* and the diatom *Skeletonema*.

Water currents cause continual movement of individuals through the area (North Sea Task Force, 1993) and the rapid maximum doubling times of the phytoplankton cause blooms to occur in the North Sea each spring with a smaller peak in the autumn. The timing and species composition of these blooms can be variable (Bresnan *et al*., 2009).

Throughout the North Sea, the previously dominant population of cold water zooplankton species (e.g. *Calanus finmarchicus*) have declined in biomass by 70 % since the 1960s, and species with warmer-water affinities (e.g. *Calanus helgolandicus*) have been moving northward (Edwards *et al*., 2013).

5.3.2 Benthos

The A&C pre-decommissioning environmental survey (Fugro 2015a) collected sediment grab samples from 33 locations for physico-chemical and macrofauna analyses (see Figure 5-4). Camera observations of the seabed and epibenthos were undertaken.

Results of the macrofauna analyses indicated the presence of rich and diverse invertebrate benthic communities, the occurrence and distribution of which was strongly associated with depth and sediment type. This was further confirmed by the results of the multivariate analysis, which highlighted the presence of four main benthic communities across the area of the A&C Fields and WAGES pipeline route, each hosting taxa characteristic of the habitat identified in each group.

The deep ‘circalittoral muddy sand’ sediment beyond 45 km from the pipeline landfall hosts typical infaunal communities dominated by polychaetes such as *Galathowenia oculata, Spiophanes kroyeri, S. bombyx, Paramphinome jeffreysii, Prionospio dubia, Owenia sp. and Aricidea catherinae*. Other characterising species included the mollusc *Mendicula ferruginosa* and the horseshoe worm *Phoronis*. These species are typical of muddy sediment of the central North Sea (Glémarec, 1973; McGlade, 2002), and more specifically of the outer Moray Firth (DTI, 2004). The epifaunal diversity was generally low. Species observed on the seabed included seapens (*Pennatula phosphorea* and occasional *Virgularia mirabilis*), hermit crabs (Paguroidea), starfish (*Asterias rubens* and *Hippasteria phrygiana*), occasional Norway lobster (*Nephrops norvegicus*) and faunal burrows. 57 individuals of juvenile ocean quahog (*Arctica islandica*), which is listed under the OSPAR Convention (OSPAR, 2008) and by Marine Scotland as a Priority Marine Feature (JNCC 2012) were found in the A&C pre-decommissioning survey environmental samples. Five individuals were recorded in the Cromarty field, 42 at the Atlantic field and 10 along the umbilical route between the Atlantic manifold Atlantic and the Goldeneye Platform.

In the shallower section of the pipeline route within 45 km from its landfall, the survey found a ‘circalittoral mixed sediment’ habitat, some parts of which are predominantly sandy, while

others have substrates of gravel and cobbles. Gravel and sand habitats are ecologically important for supporting important commercial fisheries, such as those for scallops and flatfish.

The pipeline route hosted some communities that are characteristic of predominantly sandy sediments. These predominated between 20 km and 45 km from the shore, but patches occur also closer to the shore. This habitat has relatively low species diversity and abundance. The infauna is characterised by species such as the polychaetes *Spio goniocephala* and *Nephtys cirrosa* that are characterised by high reproductive rates, flexible body structures and an ability to burrow rapidly if disturbed. The low diversity of the predominantly sandy sediment is typical of continually disturbed environments where the substrate is subjected to tidal movement and seabed currents, resulting in the substrate being usually well sorted due to the grading action of repetitive water movements.

In the first 20 km of the pipeline route from shore, the survey found more heterogeneous sediments with notable percentage of gravel, hosting high species diversity and abundance and characterised by a dominance of the polychaete *Sabellaria spinulosa*, together with the brittlestar *Ophiactis balli*, the sipunculid worm *Nephasoma minutum*, the bivalve mollusc *Kellia suborbicularis*, and the polychaete *Lanice conchilega*. The sediment heterogeneity of the latter community is likely to have enhanced species diversity and abundance. The epifauna observed was associated with the provision of suitable substrate for attachment (shell, pebbles, cobbles and boulders). Faunal turf, consisting of Hydrozoa and Bryozoa (*Flustra foliacea*), was particularly common. Sea urchins (*Echinus esculentus*), anemones (*Urticina felina*), barnacles, crabs (*Cancer pagurus*), the soft coral 'dead man's fingers' (*Alcyonium digitatum*), and the tube worms (*S. spinulosa* and *Serpulidae*) were also commonly encountered. Plaice (*Pleuronectes platessa*) and haddock (*Melanogrammus aeglefinus*) were also observed.

The fourth community identified in the survey in the mosaic of mixed sediment habitats was transitional stage between sandy and gravelly sandy habitats with low species diversity and abundance. It is characterised by taxa typical of coarser sediments, such as sea anemones of the *Athenaria* infraorder, as well as polychaete worms, including *Glycera lapidum*, *Syllis parapari*, *S. garciai*, *Pisione remota* and *Goniadella gracilis*. The sea urchin *Echinocyamus pusillus* featured amongst the top ten most abundant and frequently occurring species in the shallower sandy and gravelly sandy habitats. Three sandeels of the family Ammodytidae, which provide an important food source for many fish, marine mammal and seabird species were recorded from a survey station 10 km from the landfall (ROU2 see Figure 5-4).

The survey noted the presence of several amphipod species of the genus Ampelisca across the pre-decommissioning survey area. This species is indicative of a seabed environment free of anthropogenic impacts associated with offshore oil and gas exploration (Gómez-Gesteira and Dauvin, 2000).

An environmental survey in 2009 (Fugro, 2009) assessed the benthic flora and fauna at the Goldeneye Field. The extensive bioturbation and burrows observed suggested the presence of a substantial burrowing megafaunal community comprising Norway lobster *Nephrops norvegicus,* hagfish *Myxine glutinosa*, the ghost shrimp *Callianassa subterranea* and the mud shrimp *Upogebia deltura*. The seapens *Virgularia mirabilis* and *Pennatula phosphorea* were frequently observed in the video footage and appeared in a high proportion of grab samples. In the samples, Polychaetes were dominant in terms of abundance (86 % of the faunal specimens), followed by molluscs (10 %) and crustaceans (3%).

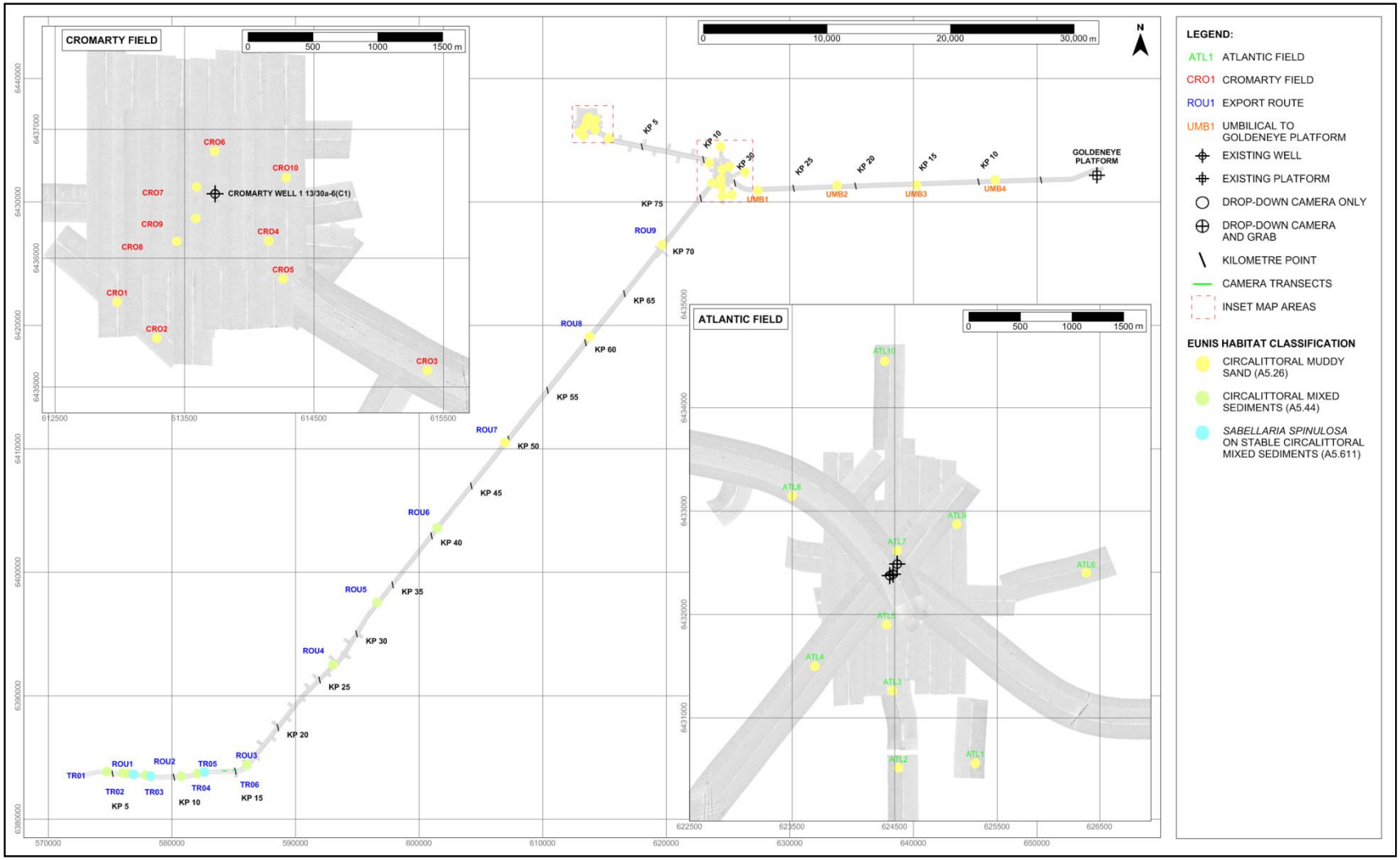

Figure 5-4: Habitats (circles represent pre-decommissioning environmental survey stations) (Fugro 2015b)

5.3.3 Fish

More than 330 fish species are thought to inhabit the shelf seas of the UKCS (Pinnegar et al., 2010). Pelagic species (e.g. herring (*Clupea clupea*), mackerel (*Scomber scombrus*), blue whiting (*Micromesistius poutassou*) and sprat (*Sprattus sprattus*) are found in mid-water and typically make extensive seasonal movements or migrations. Demersal species (e.g. cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), sandeels (*Ammodytes* sp.), sole (*Solea solea*) and whiting (*Merlangius merlangus*) live on or near the seabed. Many demersal species also migrate between areas during their lifecycles.

The pelagic and demersal species listed in Table 5-1 spawn seasonally in extensive spawning areas that take in the outer Moray Firth and the waters off northeast Scotland (see Figure 5-5) including the project area of interest of the A&C offshore decommissioning project. Table 5-1 shows the approximate spawning seasons. Ellis *et al*. (2012) reported cod, plaice, sandeel and whiting spawning at low densities. Some species require specific types of seabed sediments for spawning. Nephrops, for example, spawns all year round in the 'circalittoral muddy sand' habitat. Herring spawn on gravelly sediment that occurs in the 'circalittoral mixed sediment' habitat. The eggs and larvae of many pelagic and demersal species drift with the water currents.

Some of the fish species spawning in the area require specific sediment types. For example, herring spawns on gravel and *Nephrops* spawns on a muddy seabed.

The fish species listed in Table 5-1 (except herring) use the waters off the east coast of Scotland area as nursery areas throughout the year. Figure 5-5 shows the nursery areas of these species. Ellis *et al*., (2012) found low densities of juvenile anglerfish, blue whiting, cod, European hake, herring, ling, mackerel, sandeel, spotted ray, spurdog and whiting in the areas around the A&C Fields.

Table 5-1: Spawning activity and nursery areas within the blocks (Coull et al., 1998)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Nursery Area
Herring													
Blue Whiting													
Lemon Sole													
Norway Pout		P	P										
Whiting													
Haddock													
Nephrops				P	P	P							
Sprat					P	P							
Sandeel													
Saithe	P	P											
Plaice	P	P											
Key	Spawning				P = Peak spawning					Nursery			

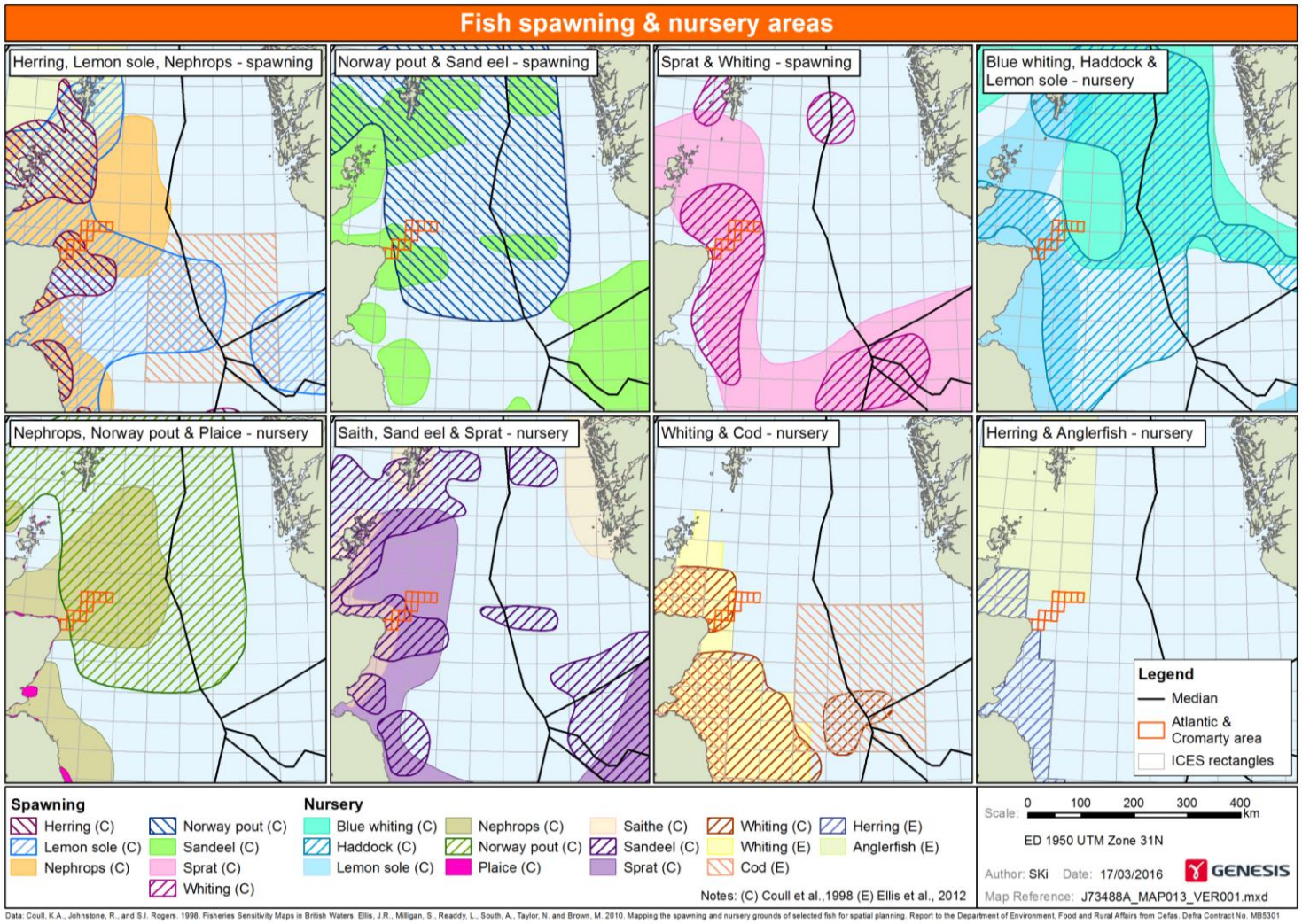

Figure 5-5: Fish spawning and nursery areas

Marine Scotland (Aires *et al*., 2014) used Species Distribution Modelling (SDM) to predict where aggregations of fish in the first year of their life are likely, based on environmental information and catch records. Figure 5-6 indicates the 500 m zones at Atlantic and Cromarty coincide with areas where juvenile haddock, hake and Norway pout are likely to be present.

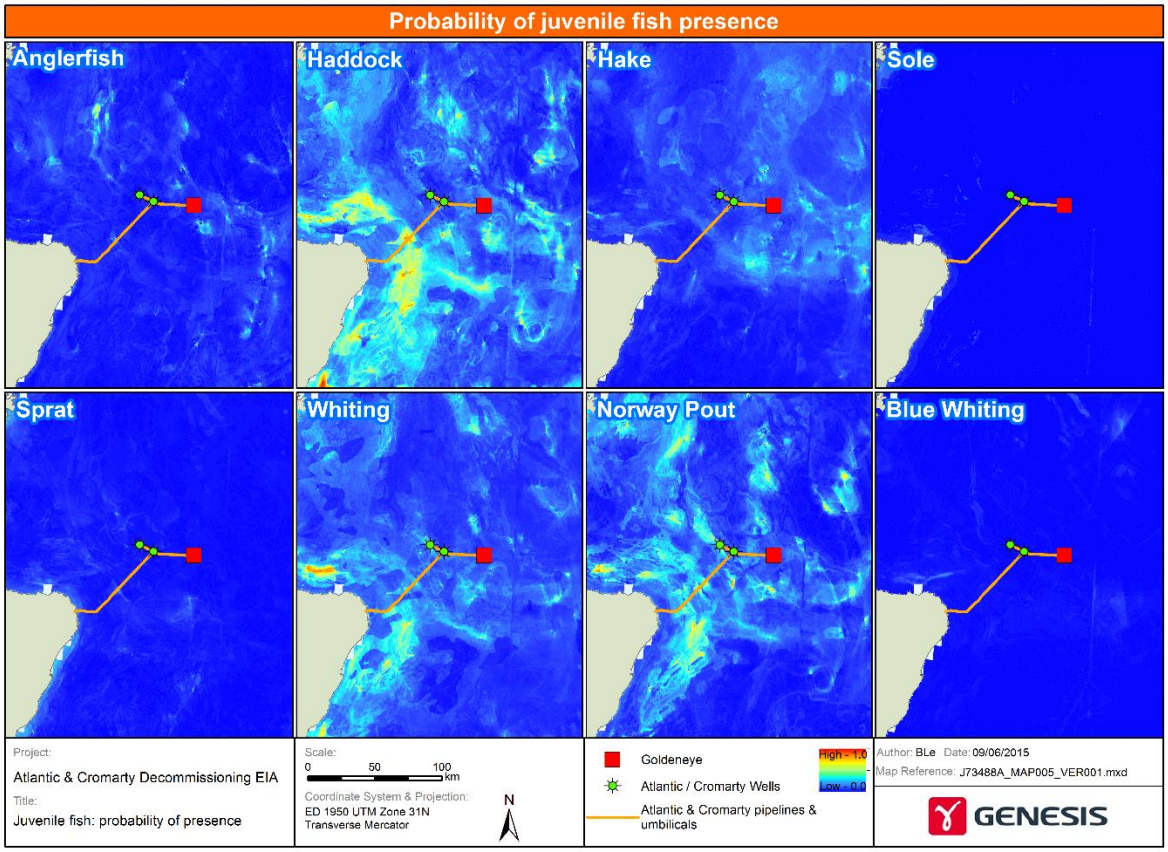

Figure 5-6: Probability of juvenile fish presence (Aires *et al*., 2014)

5.3.4 Marine Mammals

Cetaceans

The cetacean species that are most likely to be observed at the A&C Fields are Atlantic white-sided dolphin, harbour porpoise, bottlenose dolphin, white-beaked dolphin and minke whale (Reid et al., 2003). These same species are also the most regularly sighted cetacean species throughout the North Sea. Risso's dolphin and large baleen whales are also occasionally sighted.

Table 5-2 presents the months in which these species have most commonly been recorded around the A&C Fields. However, St Andrews University's study 'Small Cetacean Abundance in the North Sea' (SCANS) (Sea Mammal Research Unit, SMRU 2008) suggested that they are present at low-moderate densities (see Table 5-3)

Pinnipeds

Large populations of grey seal (*Halichoerus grypus*) occur along the east coast of Scotland. Tracking of individual grey seals has shown that they can feed up to several hundred

kilometres offshore although most foraging tends to be within approximately 100 km of the coast (Sparling *et al*., 2012; Thompson and Duck, 2010). Figure 5-7 presents distribution maps based on telemetry data (1991-2012) and count data (1988 – 2012). This mapping indicates the A&C export pipeline passes through an area where grey seals are present at medium densities, whereas the density is low at the A&C Fields.

The foraging range of the harbour seal (*Phoca vitulina*) (also known as common seal) is typically 40 – 50 km from their haul-out site. Results from telemetry data indicate that harbour seals are unlikely to occur in the project area of interest (see Figure 5-7).

Table 5-2: Cetaceans species within the vicinity of the A&C Developments (Reid et al., 2003)

Species	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Atlantic white-sided dolphin												
Harbour porpoise												
Minke whale												
White-beaked dolphin												
Bottlenose dolphin												
Key	Species not recorded						Species present					

Table 5-3: SCANS-II data for marine mammals in the vicinity of the developments (shipboard surveys only)

Species	Density (animals / km^2)
Harbour porpoise	0.294
Minke whale	0.028
White-beaked dolphin	0.049
Bottlenose dolphin	0.08
Common dolphin	0.010
Lagenorhynchus spp.	0.040
Lagenorhynchus spp.: Refers to possible white-beaked dolphin or Atlantic white-sided dolphin (due to difficulty in distinguishing the two species in the Field). Source: SMRU, 2008.	

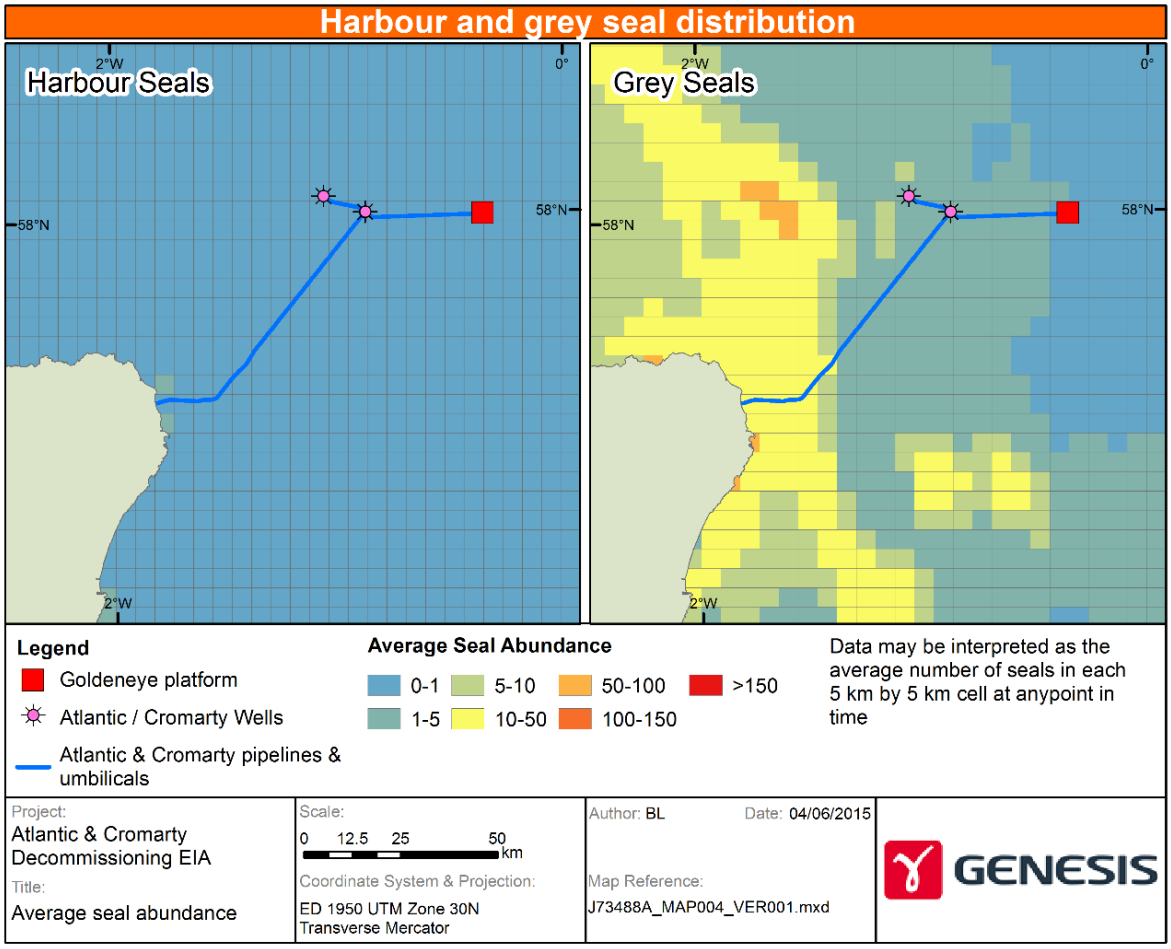

Figure 5-7: Harbour and grey seal distribution in the North Sea (SMRU, 2012)

5.3.5 Seabirds

The large seabird colonies on the coast of Aberdeenshire support important populations of:

- Gulls including herring gull (*Larus argentatus*), kittiwake (*Rissa tridactyla*), gannet (*Morus bassanus*), fulmar (*Fulmarus glacialis*),
- Auks including guillemot (*Uria aalge*), razorbill (*Alca torda*) and puffin (*Fratercula arctica*).
- Shags (Phalacrocorax aristotelis),

The birds forage at sea for fish and occur throughout the A&C project area of influence. Some species depend on particular fish species, for example puffin breeding success is closely associated with the availability of sand eels. Seabirds in nearshore areas spend much of their time in the water and are vulnerable to pollution throughout most of the year. Species such as fulmar spend more time on the sea surface, than herring gull, great black-backed gull (*Larus marinus*) and kittiwake and are consequently more vulnerable to pollution (Stone *et al*., 1995).

After the breeding season ends in June, auks disperse into offshore waters including the A&C decommissioning project area of interest. The auks spend much of their time on the

surface of the water and raft in large numbers to moult, at which time they are flightless. Any auks at the A&C Fields are therefore particularly vulnerable to surface pollutants between July and September.

The Joint Nature Conservation Committee's Offshore Vulnerability Index maps monthly seabird vulnerability to surface pollution taking account of seasonal changes in the species and number of birds present in each UKCS offshore block (see Figure 5-8).

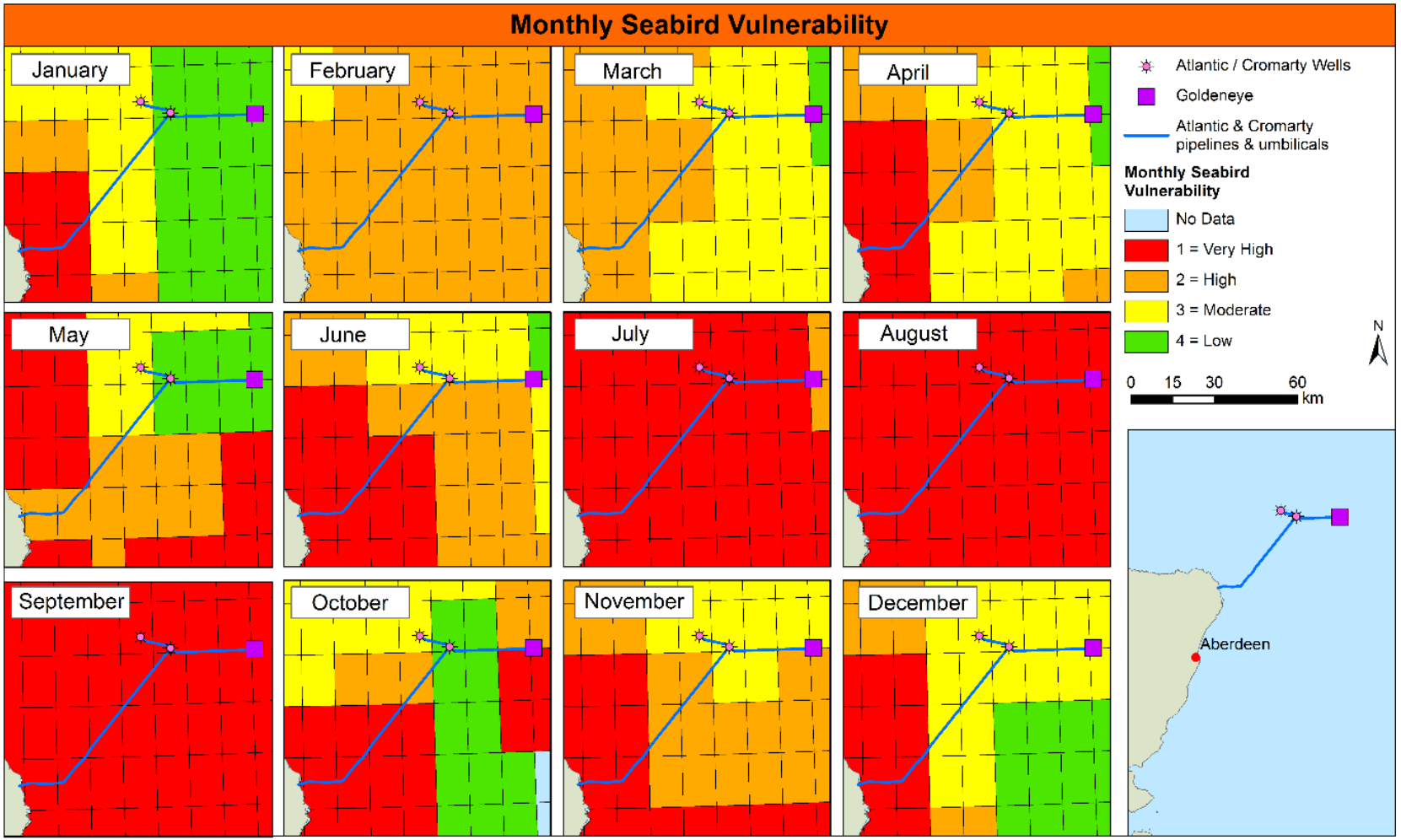

Figure 5-8: Monthly seabird vulnerability to surface pollution

5.4 Protected Areas

The area extending for 12 nm from the Aberdeenshire coast between Buckie and Peterhead is being studied by Scottish Natural Heritage with regard to potential future designation as a Nature Conservation Marine Protected Area (MPA). The A&C export pipelines pass through this area that is termed the Southern Trench MPA proposal. The Southern Trench, after which the site is named, is an enclosed glacial seabed basin 200 m deep located 10 km north of Fraserburgh. The WAGES pipeline passes about 30 km southeast of this basin. A thermal front extends round Rattray Head towards Peterhead that is associated with plankton richness and juvenile fish. The proposed boundary of the MPA proposal would encompass this front. The WAGES pipeline passes through the part of the site where the front occurs.

Three Special Protection Areas (SPAs) designated under the EU Birds Directive are in the vicinity of the A&C export pipeline landfall at St Fergus (see Figure 5-9):

- Buchan Ness to Collieston Coast SPA: the northern boundary of the SPA is approximately 6 km south of the pipeline landfall (see Figure 5-9). Its designation protects a seabird assemblage (guilliemot, kittiwake, herring gull, shag, puffin and fulmar) of international importance. During the breeding season the area supports 95,000 seabirds (JNCC, 2001a)
- Loch of Strathbeg is a dune loch approximately 4 km north of the pipeline landfall. Gulls, terns and wading birds nest there in summer. In winter, thousands of wild geese, swans and ducks fly in, including 20 per cent of the world's population of pink-footed geese
- The Troup, Pennan and Lion’s Heads SPA: the eastern boundary of the SPA is located approximately 20 km west of the pipeline landfall. It was designated for its breeding guillemot population of European importance and seabird population (razorbill, kittiwake, herring gull, fulmar) of international importance. The SPA supports 150,000 seabirds during the breeding season (JNCC, 2001b).

The Turbot Bank Marine Protected Area located approximately 30 km south of the A&C export pipeline and 50km south of the A&C Fields is a site of particular importance for sand eels which are an important source of food for seabirds including puffins and kittiwakes (JNCC, 2001c).

Annex I to the EU Habitats Directive lists stony reefs and biogenic reefs as protected habitat types. During the A&C pre-decommissioning survey, BG commissioned a habitat assessment which evaluated the ‘circalittoral mixed sediment’ habitat against ‘reefiness’ against criteria for stony reef and biogenic reef. Although the reef-forming species *Sabellaria spinulosa* was observed, the assessment concluded it did not form a contiguous reef in this area.

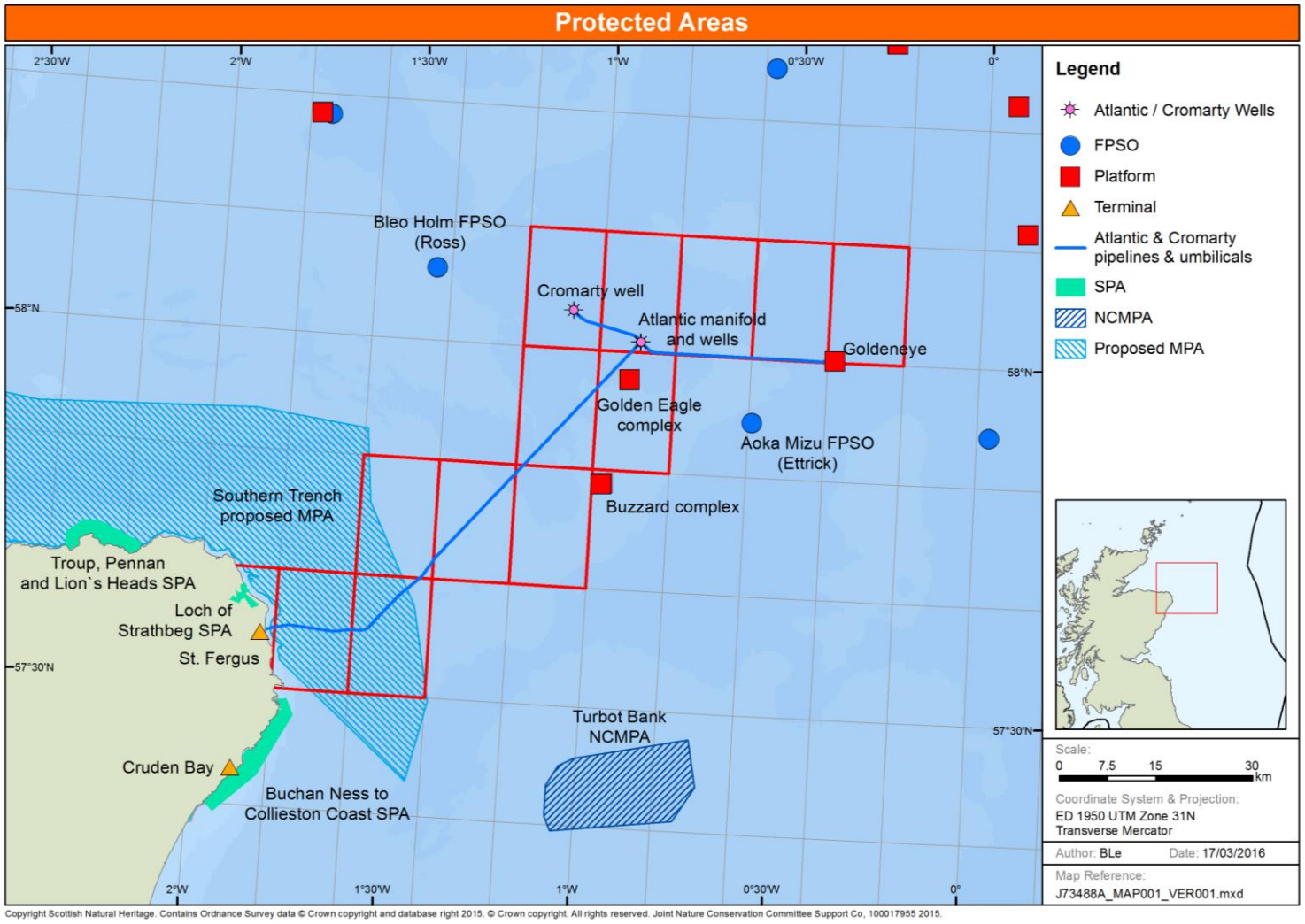

Figure 5-9: Protected areas in the vicinity of the A&C infrastructure.

5.5 Socio-Economic Environment

This EIA does not describe the socio-economic conditions at the location of the onshore decommissioning yard to which A&C decommissioned installations and materials will be transported, as at the time of writing the EIA, the yard has not been identified. In addition, onshore A&C facilities inside the SAGE terminal and landfall pipelines along the beach are beyond the scope of this EIA.

Socio-economic activities in the offshore area where A&C decommissioning activities will take place include commercial shipping and fishing.

5.5.1 Commercial Shipping

There is a concentration of coastal shipping on routes rounding Rattray Head a few km north of St Fergus. The vessels entering or leaving the Moray Firth typically pass by several kilometres out to sea. Commercial shipping traffic on routes from the UK to continental ports or to supply offshore oil and gas operations is less dense.

DECC categorised the coastal shipping activities in the UKCS block off Rattray Head as having a high density (see Figure 5-10). This includes the area where the FPV will place rock over a section of the A&C export pipeline. Further offshore, where vessels will remove installations from the seabed at the A&C Fields, the level of shipping activity is considered moderate.

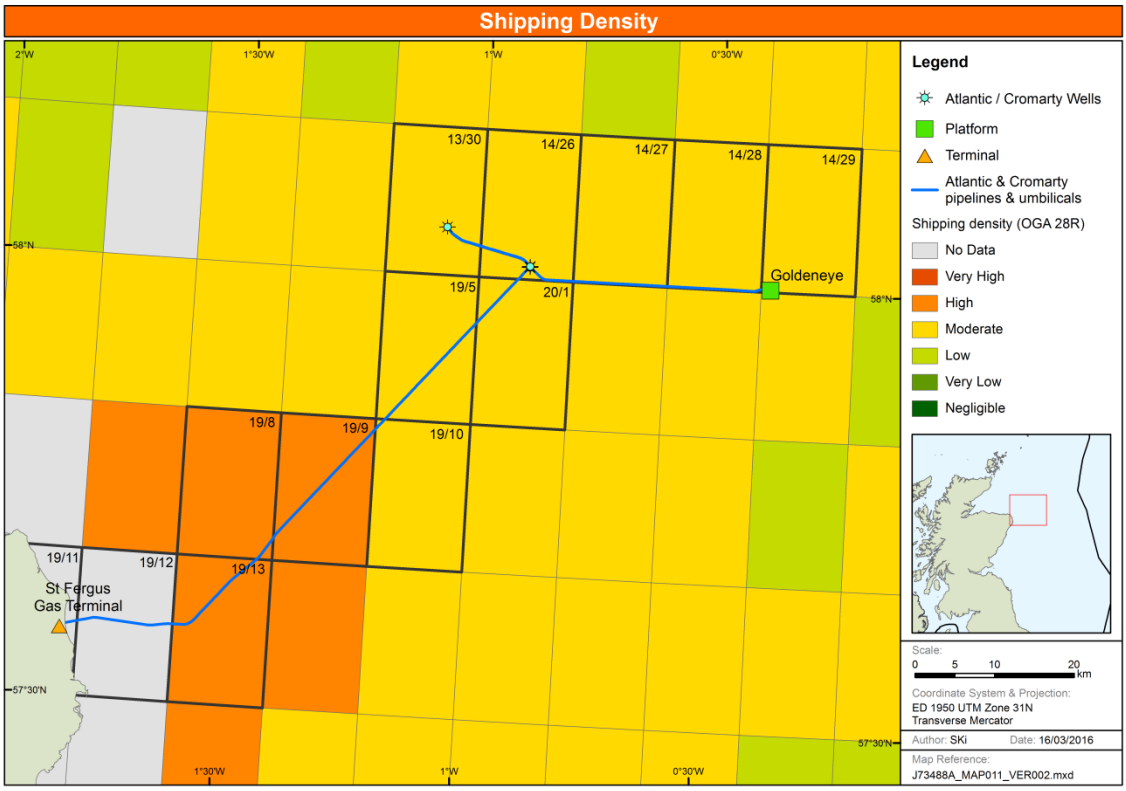

Figure 5-10: Shipping density (as classified by DECC, 2015)

5.5.2 Fishing

For management purposes, the International Council for the Exploration of the Sea (ICES) collates fisheries information by rectangles measuring 30 nm by 30 nm. The A&C decommissioning project's area of interest lies within ICES rectangles 44E8, 44E9, 45E8 and 45E9 (see Figure 5-11).

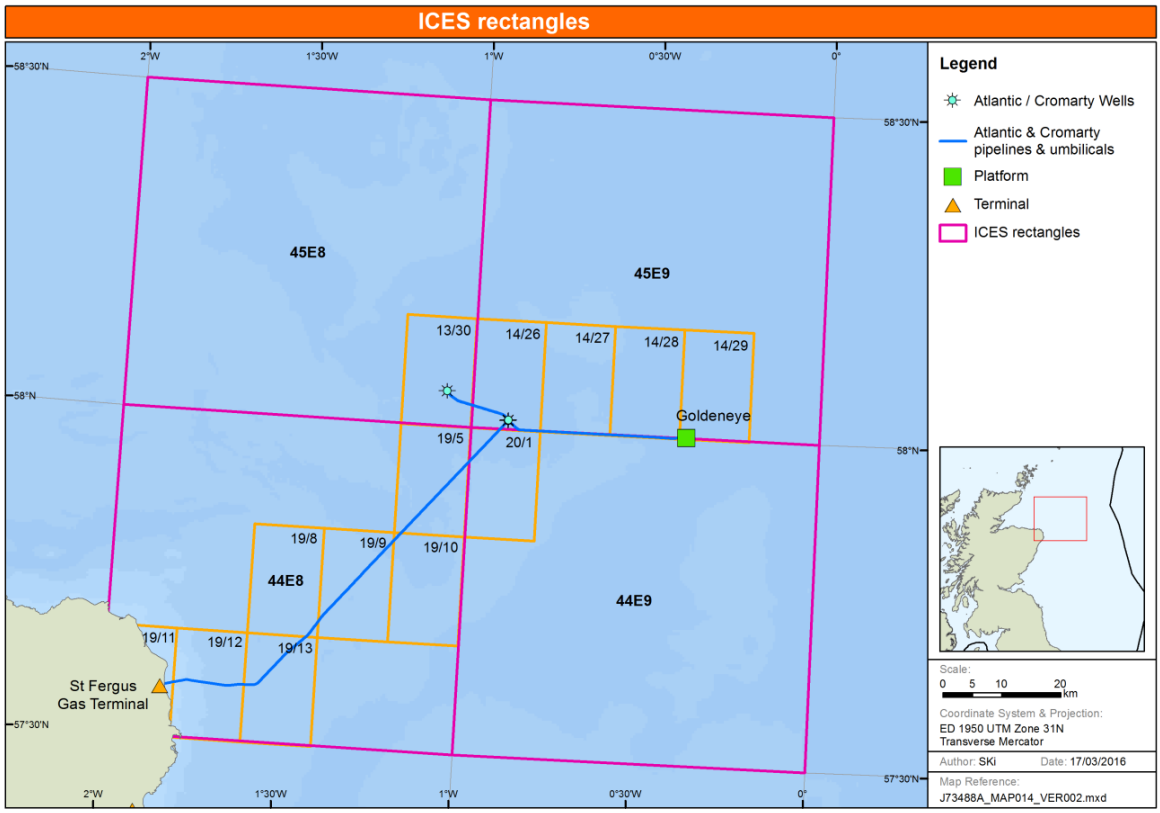

Figure 5-11: ICES rectangles covering the A&C area

The importance of an area to the UK fishing industry is assessed from reports of the fishing effort in each ICES rectangle where five or more UK vessels are active (based on the number of days and the tonnage and engine power of the fleet, the location of hauls, the type of gear and duration of fishing), even though fishing activity may not be evenly distributed over the whole area of an ICES rectangle.

The average effort by UK fishing vessels in the ICES rectangles encompassing the A&C decommissioning project between 2010 and 2014 was 956 vessel days per year (see Table 5-4 and Figure 5-12)

Table 5-4: Average fishing effort between 2010-2014 (days by UK fishing fleet in ICES rectangles 44E8, 44E9, 45E8 and 45E9)

Effort (Days) and the Corresponding Percentage of UK Total Catch (%)						
Year	UK Total	44E8	44E9	45E8	45E9	Mean
Average 2010 - 2014	178,383	761	1,010	773	1,282	956
		0.43	0.57	0.43	0.72	0.54

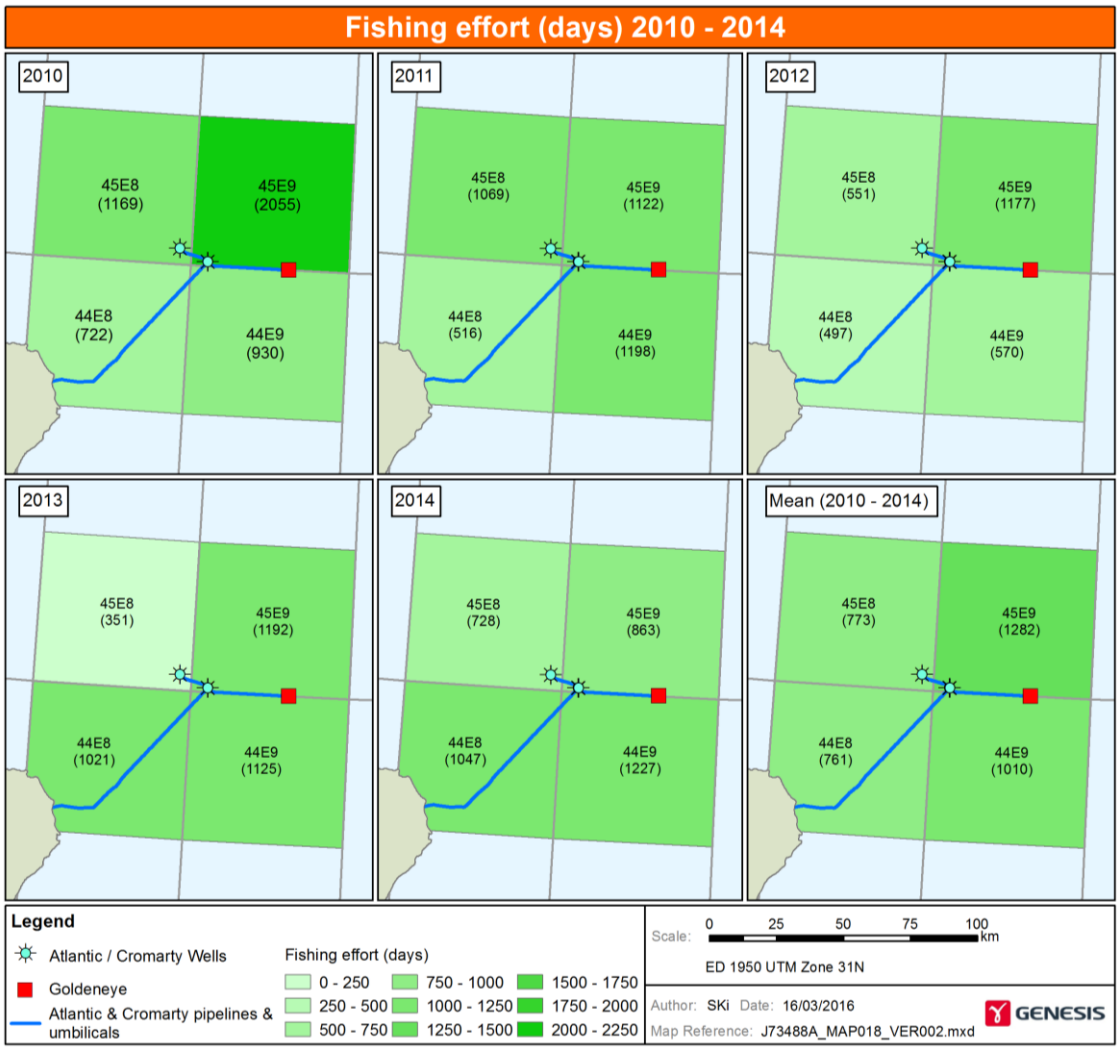

Figure 5-12: Fishing effort (days) in the A&C area (Scottish Government, 2016)

GIS layers developed from Vessel Monitoring Systems (VMS) for UK registered commercial fishing vessels ≥ 15 m in the period 2007-2013 combined with landings information describe the areas that are most intensely fished (see Figure 5-13) (Kafas et al., 2012). Demersal fishing with mobile gear is most intense in ICES rectangle 44E8 south of the WAGES pipeline. The *Nephrops* fishery is most intense to the northwest of

Cromarty and on the Fladen Ground to the east of the Goldeneye platform (ICES rectangle 45E9). The WAGES pipeline passes through areas of intense pelagic herring fishing in ICES rectangle 44E8.

On average over the period 2010-2014, ICES rectangle 44E8 has a greater quantity of landings of demersal, pelagic and shellfish taken together (4,557 te/year) than the other three ICES rectangles (see Table 5-5) and returns a higher overall catch value (see Table 5-6). Demersal fishing in ICES rectangle 44E9 however landed the largest demersal catch (2,493 te/year) with the highest value for demersal fishing (£2,747,037).

Table 5-5: Average quantity of fish landings between 2010-2014 in ICES rectangles 44E8, 44E9, 45E8 and 45E9 (Scottish Government, 2016)

Year	Species type	UK total quantity (tonnes)	44E8		44E9		45E8		45E9	
			total (tonnes)	% of UK total	total (tonnes)	% of UK total	total (tonnes)	% of UK total	total (tonnes)	% of UK total
Average 2010-2014	Demersal	157,365	1,536	0.97	2,493	1.62	1,407	0.96	843	0.54
	Pelagic	340,150	1,740	0.51	3	0.00	0	0.00	1,926	0.53
	Shellfish	125,041	1,281	1.03	533	0.46	168	0.16	552	0.44
	Total	622,556	4,557	0.73	3,029	0.49	1,575	0.26	3,321	0.54

Table 5-6: Average value of fish landings between 2010-2014 in ICES rectangles 44E8, 44E9, 45E8 and 45E9 (Scottish Government, 2016)

Year	Species type	UK total value (£)	44E8		44E9		45E8		45E9	
			total value (£)	% of UK total	total value (£)	% of UK total	total value (£)	% of UK total	total value (£)	% of UK total
Average 2010-2014	Demersal	254,119,388	1,650,410	0.66	2,747,037	1.15	1,659,052	0.72	1,016,453	0.41
	Pelagic	218,396,220	1,202,641	0.55	3,741	0.00	565	0.00	565,267	0.24
	Shellfish	240,631,650	2,507,117	1.04	1,910,947	0.81	529,726	0.24	2,001,454	0.82
	Total	713,147,258	5,360,168	0.75	4,661,725	0.66	2,189,342	0.32	3,583,173	0.50

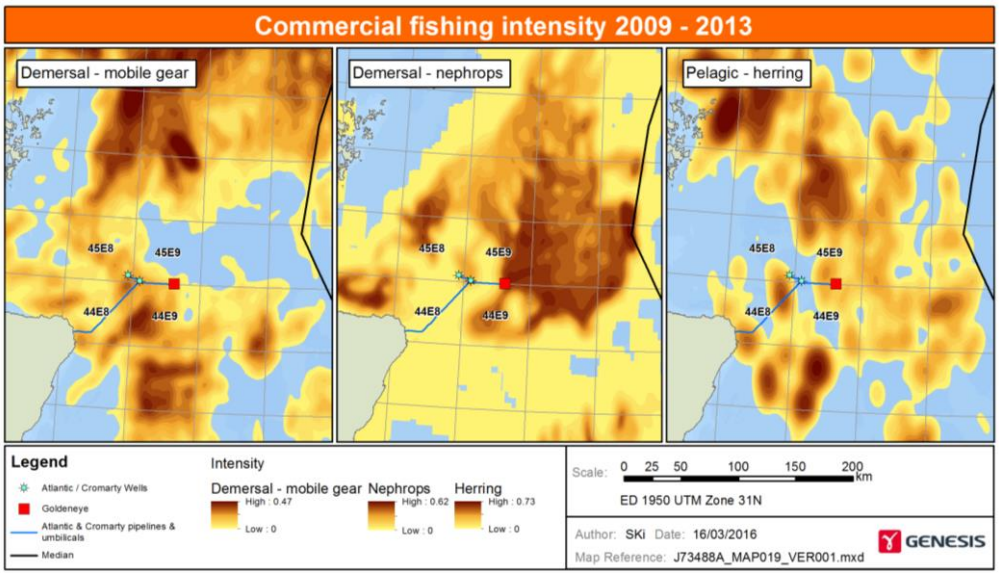

Figure 5-13: VMS data combined from 2009 - 2013 showing the fishing intensity by fishing vessels >15 m in length in the North Sea using demersal mobile gears, *Nephrops* mobile gears and pelagic gears

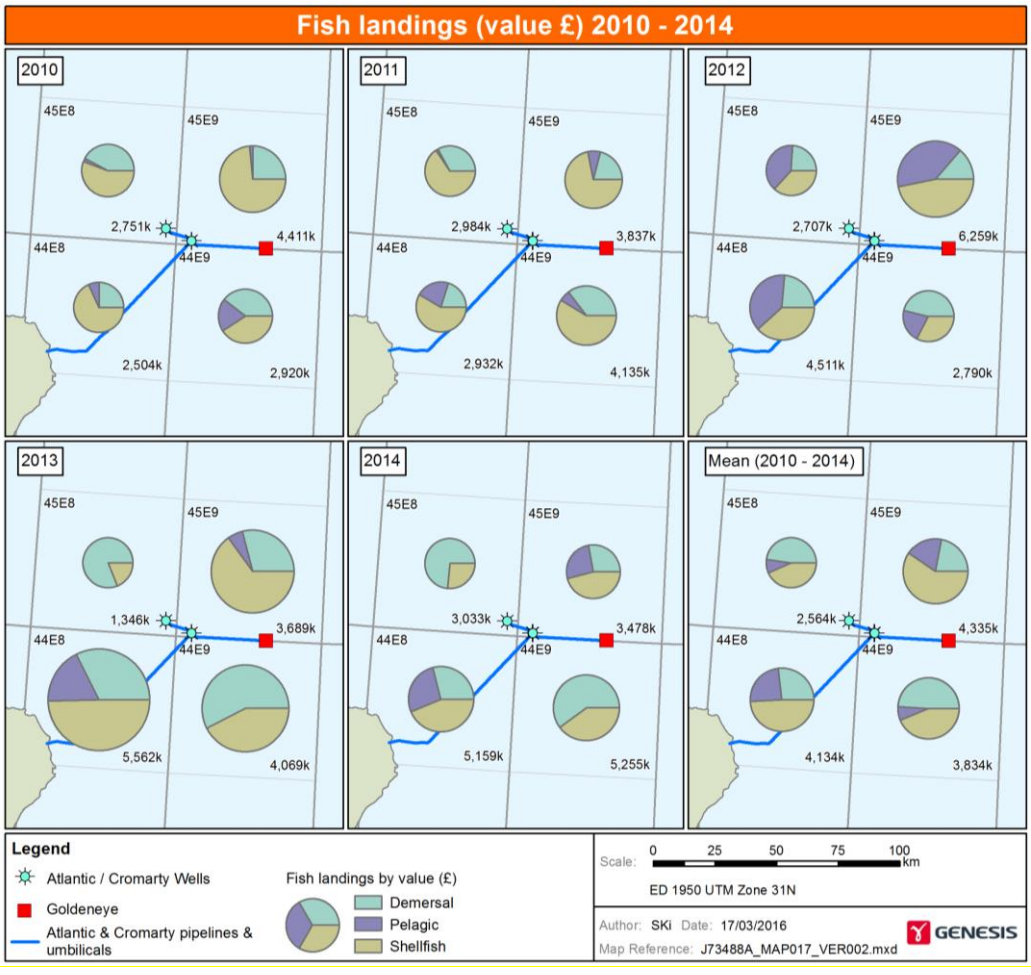

Figure 5-14: Fish landings (£) by species type (Scottish Government, 2016)

BG commissioned Brown & May Marine to study the socio-economic and health and safety impacts of fishing activity in the A&C decommissioning project's area of interest (BG Group, 2015). The study concluded that:

- Up to five full-time creel boats operate from the shore up to about 10km from the shore
- Demersal otter trawlers target squid in waters from 4.6km to about 20km from the shore in the summer and autumn
- Scallop dredgers operate between approximately 7.5km and 37km from the shore in autumn and winter
- There is some pair trawling beyond 20km from the shore
- In the deeper water beyond 45km from the shore there is some seine netting and twin rig trawling for prawn s and white fish.

The findings of the study are summarised in Table 5-7 and Figure 5-15.

Table 5-7: Fishing activity along the pipelines

Nearshore (KP0 – KP 16.6)	
Activity	**Description**
Creel fishing	Small vessels < 12 m in length, limited in operational range. Use strings ('fleets') of up to 40 baited pots ('creels') for capture of brown crab and lobster.
Bottom (demersal) otter trawlers	Vessels using this method in this area are > 12 m in length (and mostly > 15 m). They mainly target squid on a seasonal basis (summer/autumn) using a single net towed behind the vessel.
Scallop dredging vessels	Vessels are mostly > 15 m in length and periodically target grounds around the UK. A number of heavy rectangular dredges (typically 6-10) are attached to a beam (one on each side of the vessel) and towed behind the vessel.
Offshore (KP16.6 – KP77.6)	
Pair trawling	Vessels are exclusively > 15 m in length and mainly target grounds further north of the areas under consideration. Two vessels tow one large net between them along the seabed to target species such as cod, haddock and whiting.
Twin rig otter trawling	Vessels are predominately > 15 m in length and tow two nets along the seabed for the capture of prawns and whitefish depending on the area being fished.
Seine netting	Vessels are exclusively > 15 m in length and use ropes laid on the seabed to encircle a shoal of fish (e.g. cod, haddock and whiting) that are then herded into the net when the vessel begins to retrieve the net.

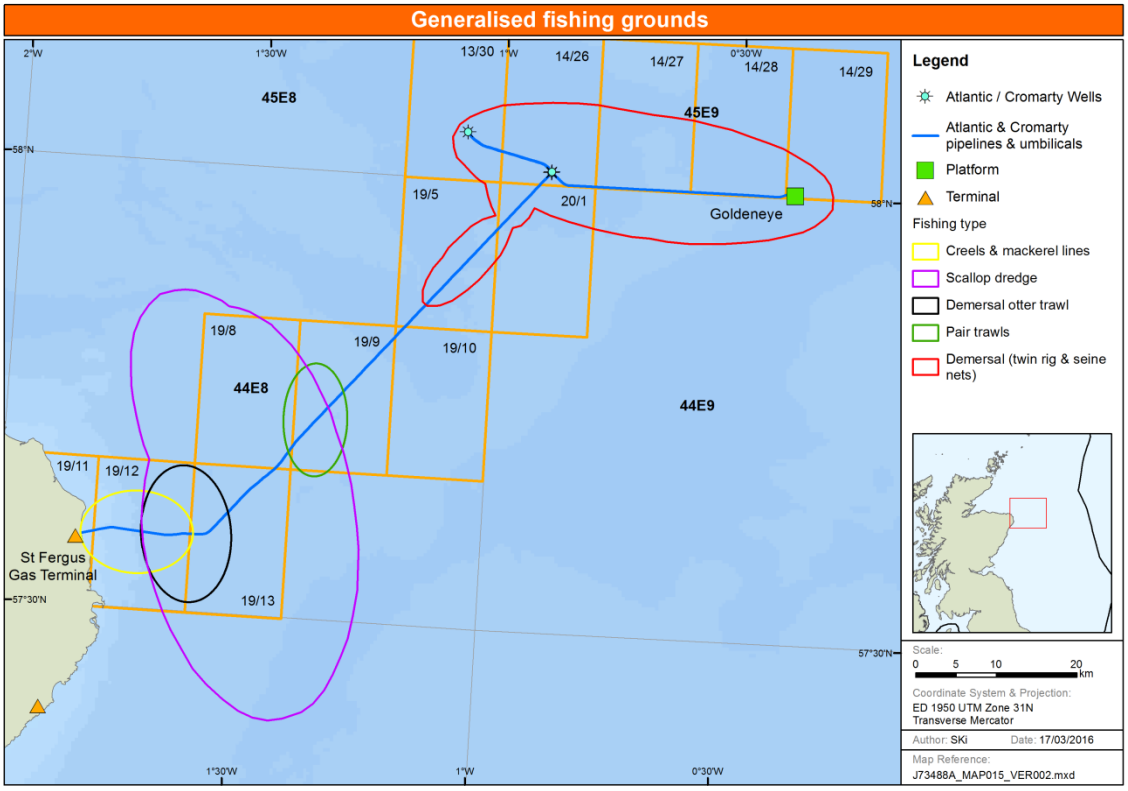

Figure 5-15: Use of fishing gears in the A&C Decommissioning Project area of interest (BG Group, 2015).

5.5.3 Military Activity

There are no military training areas within the A&C decommissioning project's area of influence.

5.5.4 Renewable Energy Developments

There are no offshore wind farms or active cables in the A&C decommissioning project's area of influence. (The Crown Estate, 2015).

5.5.5 Cultural Heritage

The pre-decommissioning survey confirmed the position of previously identified relict anti-submarine defences from World War II, comprising lines of seabed features interpreted as 'sinker' weights used to moor mine curtains. Two of the items identified at Cromarty have been previously been interpreted from ROV images as unexploded ordinance. They are located 293° from the Cromarty Well at a distance of 773 m and 253° from the Cromarty well at a distance of 494 m.

Relict lines of mine sinkers were observed crossing the umbilical survey corridor between Goldeneye and Cromarty, and one crossing the A&C export pipeline approximately 65 km from the shore. At this location one unexploded mine was identified 40 m from the pipeline and five more between 206 m and 303 m from the pipeline.

The decommissioning activities will not disturb any of these mines.

5.6 Summary of Sensitivities

The circalittoral mixed sediments in the nearshore sections of the A&C export pipeline are relatively biodiverse. The communities appear to have recovered after the installation of the WAGES pipeline and adapted to its presence. Stakeholder engagement with the JNCC suggested that further disturbance of the habitat in this area, for example by removing a buried pipeline, would be undesirable as it would initiate a further recovery period. The presence of *Sabellaria spinulosa* accumulations at the extreme of their geographic and depth range, even if they are not considered at present to form a continuous reef, suggests that unnecessary disturbance of this habitat should be avoided.

Fish are most vulnerable during the egg and larval stages of their life cycles. Bottom-spawning species such as herring are sensitive to disturbance of seabed gravel, and fish eggs in the zooplankton are sensitive to oil pollution. In the nearshore, sprat spawn in early summer, herring spawn in late summer and sandeel spawn in the winter. Further offshore, whiting and Norway pout spawn in the spring.

Marine mammals are sensitive to underwater noise. Marine mammals are not resident in the A&C decommissioning project area of interest, but are most likely to pass through the area in late winter and in high summer.

Seabirds sensitive to oil pollution of the sea surface are known to be present in the area, especially auks during August and September when they moult and are flightless.

Commercial fishery adapts to short-term changes in fish stocks. Historic fish landing statistics do not necessarily provide a good indication of future fishing trends. If the catch of a target species is lower than expected in a particular season, fishing boats may move to other fishing grounds and target other species. Demersal fishing is sensitive to seabed features and debris that can snag the fishing gears.

6.0 IMPACT ASSESSMENT METHODOLOGY

The initial scoping of potential risks and impacts relating to the A&C Decommissioning Programmes considered the planned decommissioning activities in the context of the prevailing physical, biological and socio–economic environment. In order to identify aspects of the proposed decommissioning activities that involve potential environmental and socio-economic risk and impact, BG held an initial environmental issues identification (ENVID) workshop following the methodology prescribed in BG Guideline Environmental Issues Identification BG-GL-ECC-ENV-1520.

BG engaged with stakeholders to identify risks and impacts that could be considered as potentially significant in order to conduct a full impact assessment of the most significant issues identified.

Comparative Assessment of the pipeline decommissioning options took account of their relative impact on the marine environment, atmospheric emissions, stakeholder concerns and the legacy issues of leaving them in place.

BG commissioned Genesis to lead a detailed ENVID and Impact Assessment workshop to consider the risks previously identified and discussed, and to assess the significance of the consequential impact of implementing the A&C Decommissioning Programmes in the context of the prevailing environment. BG's risk management hierarchy was applied that implements best available technology (BAT), preferentially avoids inherent risks and impacts, and then seeks to minimise impacts that cannot be avoided.

The refinement of impact significance continued throughout the impact assessment process as additional information was gathered and became available, such as the reports of Fugro's pre-decommissioning environmental survey (Fugro 2015a and 2015b) and of Brown and May's socio-economic study (Brown and May 2016).

Potential risks and impacts were assessed in terms of how likely they are to occur and the significance of potential consequences. BG Group Guideline Technical Environmental Risk Management defines criteria for scoring the probability of an impact occurring (see Table 6-1) and for the significance or severity of environmental and social consequences (see Table 6-2).

The significance of an impact takes account of the following factors:

- Type: whether the effect is direct, indirect or cumulative
- Extent: the portion of a biotope, ecosystem, settlement, or activity affected
- Duration: the time required for natural recovery
- Magnitude: scale of environmental components affected (diversity, population density, trophic levels, natural resources, number of people)
- Nature: from negative effects associated with damage, pollution, nuisance, intrusion to positive social effects such as providing employment, training, income

Table 6-1: Likelihood of realisation of an impact

Likelihood of event	Likelihood category
Occurs more than twice per year, is continuous or certain to occur	5
Likely to occur once or twice per year	4
Likely to occur once or more in life of facility/organisation	3
Unlikely to occur but known of in the industry	2
Very unlikely, not known in the industry	1

The likelihood of occurrence of an unplanned event leading to an impact was given a score between 1 and 5. Planned Decommissioning Programme activities are considered certain to happen, and in this case it is the likelihood of their causing an impact that was assessed.

The severity of an impact's environmental and social consequences was ranked at five levels, taking account of the criteria defined for waste, stakeholder concern, amenity, ecology and BG's external relations. The environmental or social impact was ranked against the criteria listed in Table 6-2. Where the severity appeared to fall between two rankings, the higher one was selected to provide a worst case scenario for the purposes of assessment.

Combining likelihood and severity, the environmental risk was determined using the risk assessment matrix presented in Table 6-3.

This method was applied to all aspects of the A&C decommissioning project that the ENVID workshop identified as having the potential to affect the environment in order to evaluate the level of environmental and social risk. This includes the plugging and abandonment of wells, the deployment of vessels and cutting and removal of subsea equipment and materials, and activities at the onshore decommissioning yard related to their dismantling, sorting, storage and recycling.

Table 6-2: Criteria for Impact Significance

		Categories				
		Waste	**Stakeholder Concern**	**Amenity**	**Ecology**	**Public Image/Regulator Concern**
High		Compliance failure results in fine/prosecution	BG actively targeted by stakeholders in relation to an aspect or impact of a specific BG operation on more than one occasion. Is identified as a priority for study/improvement by BG	Major claim possible. Prevents subsistence/commercial use of a renewable resource on a permanent basis	May affect a number of populations or species in sufficient magnitude to cause extinction at a particular site	Catastrophic deterioration in public/regulatory relations, international scale
		Breach of waste management legislation	Legitimate concern expressed that an aspect or impact of a specific BG operation is undesirable on more than one occasion by one or more stakeholder. Is identified as a priority for study/improvement by BG	Multiple, serious complaints. May affect the wellbeing of those who use the resource beyond the life of the operation	May affect the whole population or species in sufficient magnitude to cause a change in abundance and/or distribution, or the size of genetic pool such that natural recruitment would not return to that population, or any population of species dependent upon it	Serious deterioration in public/regulatory relations, national scale
Medium		Storage and disposal represent large operating cost	Legitimate concern expressed by one or more stakeholder indicating that they would prefer the aspect or impact not to occur but that designated controls and mitigation measures are acceptable. Is identified for improvement by BG	Target of interest or source of complaint. May affect the wellbeing of those who use the resource over the short term	May affect a portion of the population over one of more generations but does not change the integrity of the population as a whole	Significant local interest by media/regulator
		Storage and disposal represent minor operating cost	Potential legitimate stakeholder concern confined to the acknowledgement that such an aspect or impact whilst not desirable cannot be avoided during day to day operations	May be noticed but not produce complaint	May affect a group of individuals of a population at a localized area and/or over a short period (one generation or less). Does not affect other trophic levels or the integrity of the population itself	Little adverse publicity
Low		Storage and disposal of small quantities of non-hazardous waste	No expressed stakeholder interest	Not noticed by other resource users	Effect on the environment indistinguishable from natural variations	No adverse publicity

Table 6-3: Risk Assessment Matrix

		Probability				
		Low		Medium	High	
		1	2	3	4	5
Severity/ Significance	High					
	Medium					
	Low					

HIGH	Unacceptable risk
MEDIUM	Acceptable if the risk and impact has been reduced to as low as is reasonably practical
LOW	Ensure appropriate controls in place

6.1 Assessment of Risks and Impacts

The screening and assessment of risks is presented in Appendix 3 and the results of the assessment are discussed in Chapter 7.

The following aspects were assessed for their risk and impact significance:

- Physical presence of the drilling rig and vessels
- Physical disturbance of the seabed and marine species
- Resource use (e.g. fuel, quarried rock for rock placement)
- Atmospheric emissions
- Discharges of liquids
- Waste management offshore and onshore
- Nuisance (e.g. noise, odour)
- Social disturbance (e.g. to other users of the sea, to onshore communities).

For those aspects of the Decommissioning Programmes involving the most significant risk of impact, BG has developed mitigation measures to avoid the risk or reduce it to a level that is as low as reasonably practicable (ALARP).

7.0 IMPACT ASSESSMENT

Scoping found that the significance of the potential risks and impacts relating to the following environmental and social aspects associated with the planned A&C decommissioning activities required further investigation in order to establish appropriate mitigation controls:

- Activities that physically disturb the seabed sediments
- The release of a proportion of the inhibited water in the pipelines to the sea when they are cut and of hydraulic fluid when the umbilicals are cut
- Underwater noise from cutting operations
- Waste management and recycling
- Atmospheric emissions
- Potential for accidental vessel collisions and consequent spills to sea
- Interaction with fishing equipment during and post-decommissioning.

The risks and impacts associated with these identified aspects and mitigation measures to be adopted are discussed in the following sections.

7.1 Physical Disturbance of the Seabed

7.1.1 Potential Impact

Direct physical disturbance of the seabed will result from:

- The handling of the rig anchors and cables during installation for well plug and abandonment activities
- Jetting the seabed around the Atlantic manifold to allow access to the manifold piles for cutting operations
- Lifting and recovery of equipment and materials from the seabed including, the wellhead Christmas trees, cut pipeline and manifold ends, spool and jumpers, the Atlantic manifold and concrete tunnels, mattresses and grout bags
- Placement of rock cover on exposed pipe ends and unburied pipeline sections.

Indirect disturbance of the seabed will result from the suspension of seabed sediments disturbed during the above activities and re-deposit of the sediment in surrounding areas.

The disturbance from each activity will be localised and of short duration. Subsea operations including rig positioning, jetting, cutting, lifting and recovery activities as well as rock dumping operations will occur over a relatively small footprint of the seabed and therefore seabed disturbance is predicted to be small, estimated at up to 10 ha in the Atlantic and Cromarty Fields and approximately 2.5 ha along the export pipeline. Within this small footprint, disturbed sediment particles may be suspended, increasing sub-surface turbidity in the water column over a short duration and smothering nearby benthos. The disturbance may result in short term local affects to individual sessile filter feeders, as the disturbed sediments disperse and re-settle (Nicholls *et al*., 2003), although crabs, fish and other

mobile species are able to avoid harm from suspended solids. Juvenile fish are susceptible to effects of abrasion and clogging of gills (FeBEC 2010), however the area affected is a small part of the wider habitat available for juveniles. Given the short duration and temporary nature of the disturbance that would result from A&C decommissioning activities, sediment disturbance is expected to be limited and close to the area of operations and no material adverse impact would result. Dominant infaunal species present, such as polychaetes are typical of muddy sediment of the central North Sea. The epifauna, such as amphipod crustaceans, is more resistant to smothering from re-suspended sediments. Re-colonisation occurs when burrowing species work their way back to the seabed surface and re-work and re-settle the sediments. As the decommissioning work will not pollute the sediments, it is likely that the seabed disturbed will fully recover within 100 days.

Spots of rock cover will smother an area of seabed but will be available for re-colonisation post-operations. An area of exposed export pipeline located between 7.5 km and 10.4 km offshore from the beach will require rock cover along 2.5 ha of seabed. This specific operation will be conducted over a period of up to three days. The seabed area at this location currently consists of mixed sediment habitat comprising a mosaic of gravel, cobbles and sand. The rock cover to be used will be selected and sized in such a way that it will resemble the existing natural cobbles present in the area to represent the natural conditions as far as possible and aid recovery. Aggregations of *Sabellaria spinulosa* have been found in the seabed habitat where rock will be placed, but do not form a contiguous reef (Fugro, 2015a). The short duration of disturbance, relatively small area to be covered, careful selection and sizing of rock to be used, expected rapid re-colonisation and absence of *Sabellaria spinulosa* reef indicates that no adverse impact will result to this area of seabed to be rock covered.

Following rock cover operations, chain mats and fishing gear will be towed across the seabed to ensure it is safe for future fishing activity. Disturbance of the seabed is inherent in ongoing seabed fishing activities and temporary disturbance to the seabed sediments will occur during these operations. Collie *et al*. (2000) found that sediment communities recover from disturbance by bottom towed fishing gear within about 100 days.

7.1.2 Mitigation

The environmental baseline survey carried out in 2015 to characterise the condition of the seabed and benthic communities found no potential sensitive or protected habitats in the project area of influence confirming that no sensitive areas will be affected by the decommissioning activities.

BG will ensure all consents and licences are in place for these activities including:

- The required consents to position a semi-submersible rig on location to plug and abandon the A&C wells
- The marine licence under the Marine and Coastal Access Act 2009 (MCAA) via the PETS portal prior to removing equipment and materials from the seabed or placing rock cover or other materials onto the seabed.

Before removing subsea equipment and materials from the seabed, the decommissioning contractor will perform an ‘as-found’ side-scan sonar/echo sounder survey to positively locate the installations. BG expects that the subsea contractor will deploy dynamically

positioned vessels which will not disturb the seabed sediments and therefore minimise the footprint of disturbance caused by anchor laying.

After the installations and any debris have been recovered from the seabed, the contractor will perform an 'as-left' survey of the areas where work has been carried out in the A&C 500 m exclusion zones and where rock cover has been placed over the WAGES pipeline between 7.5 km and 10.4 km from the shore at St Fergus. The 'as-left' survey will include side-scan sonar and echo sounder measurements of the seabed. In the A&C 500 m exclusion zones environmental grab samples will be taken to characterise the condition of the seabed and benthos at the end of the decommissioning activity.

BG will commission a follow-up 'post-decommissioning survey' at a time to be agreed with BEIS, nominally two years after the A&C decommissioning works, to verify the rate of recovery of the habitats and benthic communities, and to confirm the continued burial of the pipelines left buried in the seabed. This survey will also verify whether the natural process of sediment movement continues to bury the pipeline where rock cover is added during decommissioning. Following the 'post-decommissioning survey', BG will agree with BEIS the frequency of inspections of buried pipelines required to address any longer-term responsibilities.

7.2 Discharges of Liquids to Sea

7.2.1 Potential impact

Liquid discharges to the sea will result from:

Routine discharges from vessels (e.g. bilge, ballast water, treated sewage and food waste)

Pipeline, spool and jumper cutting pipelines releasing inhibited water

Umbilical cutting releasing hydraulic fluid.

All contractor vessels will comply with MARPOL requirements for the handling, treatment and discharge of liquid wastes that are set at levels to avoid environmental risk.

When the A&C Fields were placed under the IPR in 2011, the A&C subsea pipeline infrastructure including the WAGES export pipeline was flushed until it was free of hydrocarbons and filled with a 50/50 monoethylene glycol (MEG) and water mixture containing 1,000 ppm (0.1% by volume) of the corrosion inhibitor RX-5227. OSPAR lists MEG as posing little or no risk to the marine environment (PLONOR). CEFAS currently lists RX-5227 with a CHARM Gold HQ (i.e it is in the most benign product category).

The chemical injection cores in the umbilicals contain a 50:50 MEG/water mix. The hydraulic cores contain the hydraulic fluid Oceanic HW443R. This hydraulic fluid is currently on the CEFAS list of chemicals approved for offshore use in OCNS category C.

When the pipelines and umbilicals are cut or disconnected, the contents will be released to the sea until the pressure in the pipeline/umbilical equalises with the ambient pressure at the seabed. Modelling of the release of a product at a given rate (the Osborne Adams calculation), is considered likely to be environmentally acceptable if the timescale to reach its predicted no effect concentration in the water column is longer than the timescale in which the water column is refreshed. In the case of RX-5227 and Oceanic HW443R the modelling result predicts that the discharge on initially cutting a pipeline or umbilical is likely to be

environmentally acceptable. A computational fluid dynamics model of the local discharge plume when the pipeline is cut predicted that the concentration of corrosion inhibitor would reduce to a concentration that is below the predicted no effect concentration (PNEC) for this product within 100 m of the point of release. The release and dispersion of the relatively small volume of pipeline contents is considered to represent an acceptable risk to the environment. Environmental survey has also confirmed that there are no specific sensitivities in the area of decommissioning activities.

The hydraulic fluid will be released from the umbilical cores much more slowly than the discharge from the production pipeline. However, Osborne Adams calculations for the release of HW443R when the umbilicals are cut concluded that the water column will refresh before the release reaches the concentration at which it would cause an effect on the marine flora and fauna in the area. This release is considered to be acceptable.

7.2.2 Management of discharges

Environmental permit applications for the decommissioning activities will be submitted via the portal environmental tracking system (PETS).

The drilling contractor will maintain an offshore discharges management plan to record the quantities of routine waste waters discharged from the rig.

During tender evaluation, BG will review the subsea contractor's waste water management plan. Each vessel shall manage its wastewater (ballast water, bilge, food waste and treated sewage) to meet the requirements of MARPOL. BG's pre-mobilisation marine assurance audits will confirm that each vessel is equipped to meet MARPOL standards and BG's internal requirements in respect of routine discharges.

7.3 Noise

7.3.1 Potential impact

Underwater noise generation will result from

- Vessel movements (e.g. propellers and particularly when dynamic positioning is used)
- Cutting and lifting operations
- Vessel equipment and debris locating surveys (echo sounder and side scan sonar).

Cumulatively or independently, these noise sources have the potential to impact any marine mammals present in the vicinity of the decommissioning activities at the time of operations.

Cetaceans in particular are sensitive to underwater noise. Exposure to sound levels over 145 dB re.1µPas has been found to cause aversive behavioural reaction (Lucke *et al.* 2009). Exposure to louder levels of noise can cause physical or physiological effects including temporary or permanent shifts in hearing thresholds (TTS and PTS) and auditory damage. Southall *et al. (*2007) suggested a TTS threshold for cetaceans of 183 dB re.1µPas and a PTS threshold of 198 dB re.1µPas. Anthony *et al.* (2009) report sound pressure levels for an underwater high-pressure water jet lance, chainsaw, grinder and oxy-arc cutter were in the range 148-170.5 dB re.1µPa and likely to cause an avoidance reaction by cetaceans in the area.

The A&C decommissioning project will mobilise a variety of vessels during operations that are all typical of routine oil and gas industry operations. Vessel propeller noise is continuous when the vessel is in motion, although noise levels change with vessel type, speed and load. Vessels operating in dynamic positioning mode use more propellers or thrusters and generate more underwater noise. Vessels under 50 m have source levels 160-175 dB re.1µPa, vessels 50-100 m have source levels 165-180 dB re.1µPa and vessels over 100 m have source levels up to 190 dB re.1µPa (Richardson *et al*. 1995). The frequency of peak acoustic energy of vessel propellers is below 1 kHz and at this frequency, the noise is audible to some of the whale species that are sometimes observed in the Outer Moray Firth. Richardson *et al*. (1995) noted that noise from vessels can affect the behaviour of marine mammals, although it is not always possible to distinguish between effects due to the sound, sight or even smell of a vessel to an animal. Cetaceans' reactions range from ignoring the noise to avoiding it, which can lead to temporary displacement from an area. Jensen *et al*. (2009) found that vessel noise can mask communication calls between cetaceans, reducing their communication range. Southall (2007) reported the response of animals to wane with repeated exposure to noise and marine fauna in the project's area of interest is already exposed to noise from moderate levels of shipping. Although the vessels involved in the short-term decommissioning activities will add to the background noise, they are unlikely to cause more than short term avoidance behaviour in marine mammals.

The use of side-scan sonar and echo-sounding equipment to generate images of the seabed during 'as-found' and 'as-left' surveys generate low power, high frequency noise. Richardson *et al*. (1995), found pulsed sound from echo sounders and sonar operating at frequencies around 3 kHz to 13 kHz normally caused no obvious response in marine mammals, but even at these frequencies when received noise levels were very high, behavioural responses included avoidance and changes in swimming behaviour and vocalisation.

The decommissioning activities are unlikely to cause more than temporary changes in the behaviours of any marine mammals that may be present. It is likely that any cetaceans in the area at the time of operations would quickly move away from the vessels undertaking decommissioning works.

7.3.2 Noise management

BG believes that the use of explosives to cut equipment on the seabed before removal is not warranted the A&C installations. It has been rejected in favour of mechanical shears, jet cutting and diamond wire cutting that produce less noise. BG will require the subsea decommissioning contractor to demonstrate that the underwater cutting techniques it proposes to use will not generate noise levels that may affect marine mammals.

7.4 Waste Management

7.4.1 Waste generation

Routine vessel wastes and wastes from the rig will be segregated and shipped to shore for disposal in accordance with the contractor's waste management arrangements

The equipment and materials lifted from the seabed will be transported to the selected onshore decommissioning yard for further dismantling, re-use, recycling or disposal. Due to the small scale of the decommissioning operations, only small quantities of waste will be generated. The estimated quantities of decommissioned equipment and materials transported to shore are as follows:

- Three wellhead Christmas trees and integrated protective structures (144.5 te steel)
- The Atlantic manifold and protective structure (169 te steel)
- Sections of cut pipeline ends (70 te steel)
- Cut umbilical ends containing 0.5 te of stripped copper
- 18 sections of concrete tunnel, 201 concrete mattresses and 600 grout bags (1,925 te concrete)
- Sacrificial anodes attached to the subsea installations (9 te other metals)
- Marine growth attached to the subsea installations and protection structures.

The key objective will be to maximise the re-use and recycling of recovered equipment.

Material for which no re-use or recycling is available will be sent to a disposal facility. This will include the marine growth cleaned from the material at the onshore yard. Decomposition of the marine growth may cause temporary odour issues.

7.4.2 Waste management

The Christmas trees could possibly be refurbished for re-use. All the rest of the material will be classed as waste when it is offloaded at the onshore contractor's existing decommissioning yard.

During tender evaluation, BG will review the contractor's waste management plan (WMP) against BG's waste management hierarchy. The waste hierarchy aims to minimise disposal by optimising reuse and recycling. The contractor's WMP will:

State how waste will be segregated when the installations are brought ashore and dismantled, and the conditions in which wastes in different hazard categories are stored.

Explain the availability of the existing recycling arrangements it has in place for the steel, copper, concrete, plastic and anodes identified in the decommissioning programme (see Section 7.4 of the Decommissioning Programmes).

Set recycling targets for each material.

BG will agree and endorse the onshore yard contractor's project-specific WMP prior to operations. The plan will take account of the contractor's preference as to how, for example, concrete materials (tunnels, mattresses and grout bags) are laid down on the support vessels to facilitate offloading. It will take account of the requirement to test pipeline sections for NORM contamination on the support vessels and, if necessary, to segregate them for transportation to shore. It will take account of the contractor's proposed methods for removing anodes, separating the components in the umbilicals and their arrangement for storing hazardous materials. The WMP will define the recycling facilities to be used taking advantage of the onshore decommissioning contractor's existing arrangements with available recycling facilities.

In relation to vessel operations, BG will review the waste management plans to ensure their routine operational waste is contained, segregated and transferred in accordance with MARPOL requirements.

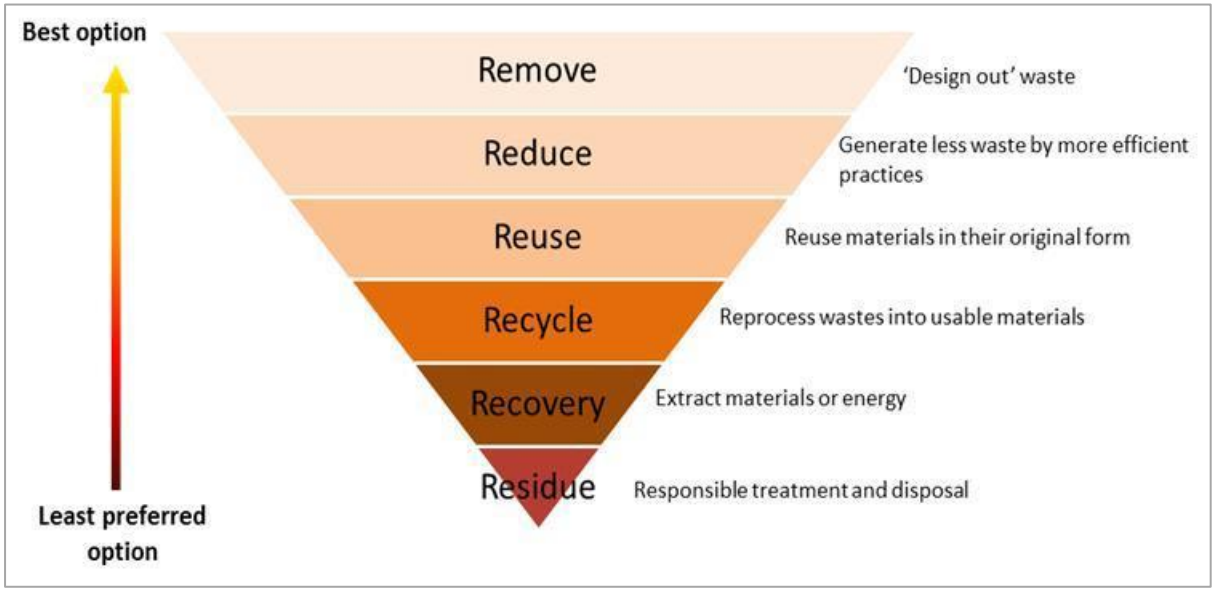

Figure 7-1: Waste Hierarchy

The project WMP will specify the system of waste records that will create an audit trail for waste materials from all vessels, through to the onshore decommissioning yard to the recycling facility or disposal site. The onshore yard contractor will keep an inventory of the types, quantities and dates of waste received and the quantities and dates of dispatch from the site. The recycling facilities and disposal sites will certify the type, quantity and date the material is received and processed. The onshore yard contractor will report waste quantities by type to BG.

For the relatively small quantity of materials from A&C decommissioning where there is no option for reuse or recycling, disposal to landfill will be the option of last resort. The onshore yard contractor will verify that any material sent to a landfill site meets the landfill site acceptance standards. BG will audit the onshore decommissioning contractor's waste management performance and inspect waste transport arrangements and the disposal sites.

7.5 Atmospheric Emissions

7.5.1 Potential impact

The consumption of fuel by the rig and decommissioning vessels and recycling of the steel from the A&C structures recovered and shipped to shore will emit combustion gases including carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (NOx), sulphur dioxide (SO_2) and Volatile Organic Compounds (VOCs).

Emissions from the rig and vessels during the decommissioning operations are typical for normal operations. The amounts emitted from these combustion sources, based on fuel consumption are provided in Section 4.4.1 Table 4-1.

Estimated total NO_x emissions (117 te) and SO_2 emissions (82 te) are unlikely to cause even local reduction of air quality in the prevailing North Sea weather conditions. The estimated total CO_2 emissions (6,200 te) comprise 0.09% of 10.9 million tonne total UKCS domestic and international shipping CO_2 emissions for 2012 (Committee on Climate Change, 2015).

Recycling the steel will emit an additional estimated 370 te of CO_2 from an existing onshore recycling facility in accordance with the terms of its operating licence.

Leaving a pipeline comprising 14,850 te of steel buried in the seabed has a notional energy cost, reflecting the atmospheric emissions released when the steel was produced. The CO_2 emitted when the steel was produced is estimated at 28,000 te. The emissions involved in removing the pipeline from burial, transporting it to shore and recycling the steel would far outweigh this, and have been estimated at 55,000 te (see Appendix 4 Table 3)

7.5.2 Management of the fuel use and emissions

The subsea contractor will ensure that each vessel implements measures to reduce atmospheric emissions in line with Annex VI of MARPOL.

BG will perform a pre-mobilisation marine assurance audit of the rig and each vessel. The audit will check that engines and generators are maintained to a standard consistent with good fuel efficiency.

The fuel consumption of vessels is highest when they are in transit between the port and the field. BG will review the subsea contractor's proposed vessel schedules to optimise vessel deployment and minimise transit times.

The drilling contractor and subsea contractor will record fuel consumption by each vessel on daily progress reports submitted to BG. BG will use reported fuel consumption to calculate the project's emissions of CO_2, NO_x and SO_x with a view to identifying opportunities for continual improvement.

7.6 Social-Economic Impacts

7.6.1 Potential Impact

The A&C decommissioning project is too small to generate new employment. It will provide short-term work for the rig crew, vessel crews and the operational staff of an existing onshore decommissioning yard.

The physical presence of the rig and vessels at the A&C Fields may be a minor source of disturbance to commercial shipping on passage through the area.

The main socio-economic risk resulting from the Decommissioning Programmes is the potential for the snagging of commercial fishing gear on items that are left on the seabed post A&C decommissioning. Fishing gear snagging can cause:

- Damage to fishing gear
- Loss of catch
- Damage to fishing boats and injury to fishermen
- Fishing boat instability and capsize.

The majority of the A&C pipelines were trenched to a target depth of 0.6 m and backfilled or left to fill naturally. In the nearshore, some sections of the WAGES pipeline were laid on the seabed below rock cover. Inspections and surveys carried out since they were installed suggest that where the pipeline was trenched or rock covered, they have remained buried.

However, the section between 6.4 and 8.9 km from the shore at St Fergus was installed on the seabed without rock cover and between 8.9 and 10.4 km from the shore, the rock cover is intermittent. Even in these sections of the pipeline, comparison of inspection videos from 2011 and videos from the pre-decommissioning environmental survey in 2015 shows that sediment moving across the pipeline has tended to cause the pipeline to self-bury. In much of this section of the pipe, only the crown of piggy-backed MEG line is currently visible.

To decommission the pipeline in this section where scallop dredges are known to operate, remedial rock will be placed on the seabed to cover the pipeline, while it continues to be buried by natural processes. This will make the pipeline safe for fishing without constructing deep rock berms, which themselves are a potential snagging hazard. The ends of the cut pipelines at the A&C Fields will also be covered with spots of rock cover to remove the risk of fishing gear snagging.

7.6.2 Social Impact Management

BG will apply for consent to locate the drilling rig and publish notices in the Kingfisher Bulletin to advise other sea users of the dates and locations where the drilling rig and vessels will be operating. BG will also give notice to the maritime authorities of the mobilisation of the drilling rig and vessels engaged in decommissioning in accordance with HSE regulations.

During the three months the drilling rig will be on station, fishing vessels are expected to avoid the drilling rig's mooring pattern. While vessels are deployed to remove subsea installations and while the FPV is placing rock over the WAGES pipeline, other sea users are expected to observe the 500 m exclusion zones as well as the International Regulations for the Prevention of Collisions at Sea (International Maritime Organisation, 1972). A fishery liaison officer will be present at A&C when installations are raised from the seabed.

BG has held discussions about the risk of snagging with the Scottish Fishermen's Federation during planning of the Decommissioning Programmes and the comparative assessment of available decommissioning options and will maintain this engagement during the decommissioning activities.

For commercial fishing, it is most important that the seabed is left in a condition that removes the risk of fishing gear snagging. To provide this assurance:

- The minimum quantity of rock will be placed to assure that the crown of pipelines is covered
- The maximum rock size, expected to be 3-4" is unlikely to be picked up by a typical scallop dredge and this will avoid destabilising the fishing boat when the nets are hauled to the surface
- An 'as-left' survey will confirm the pipelines' burial status
- Debris clearance and rock profiling will be undertaken to remove snagging hazards
- Overtrawl trials with appropriate types of trawl nets will be undertaken to verify that the seabed in the project area of interest can be fished safely.

When the SFF has issued a Seabed Clearance Certificate confirming that the seabed at Atlantic and Cromarty has been cleared satisfactorily, the 500 m exclusion zones will be lifted. Removal of this restriction will benefit commercial fishing.

7.7 Onshore Impact

7.7.1 Potential Impact

Although the onshore decommissioning yard has not yet been selected, BG recognises that onshore dismantling, storage and transport of equipment and materials removed from the seabed can give rise to environmental and social issues including:

- Noise
- Light pollution
- Odour (from rotting marine growth)
- Increase in vehicular traffic
- Disturbance of wildlife and habitats.

7.7.2 Management of Onshore Impacts

BG will not construct an onshore decommissioning yard for this project but will select an onshore contractor that operates an existing coastal yard. In selecting an appropriate contractor, BG will audit the onshore decommissioning yard to verify its facilities are suitable for the reception, storage, dismantling and transfer of the expected quantities and types of waste. BG will verify that handling waste from the A&C projects will not breach the yard's environmental permits. The scope of the audit will include:

- Review of licences, consents and permits
- Review of the facility's HSE management system, including environmental management procedures and waste management processes and planning
- Assess the contractors HSE performance record
- Review of yard layout, storage areas, secondary containment, emissions and noise management, traffic management, drainage, and waste-water treatment and relevant community complaints procedures

7.8 Potential Accidental Events

The accidental events that pose the most serious risk of impact are those that may result in a spillage of oil or chemicals to the sea. Activities that could possibly result in a spill to sea are outlined below with the measures taken to reduce the risk

7.8.1 Loss from the suspended wells during well P&A activities.

When the A&C wells were suspended, mechanical plugs were installed in them to isolate the reservoir sections although the pressure in the reservoirs is so depleted that the wells can't flow. The wellhead Christmas trees were disconnected from the pipelines. These measures that have already been taken assure that the wells can be plugged and abandoned and the

seabed installations removed with minimal risk of hydrocarbon spills into the offshore environment.

7.8.2 Loss from A&C subsea facilities

The A&C pipelines and the Atlantic manifold have been hydrocarbon free since 2011, so there is no risk of an unplanned hydrocarbon spill from the pipelines.

Loss from third party pipelines

No decommissioning activity will be carried out where the buried A&C pipelines cross third party pipelines. All buried pipelines are to be left in place, so there is no risk of the decommissioning works causing an oil spill or gas leak from a third-party pipeline.

7.8.3 Bunkering spill

While the drilling rig is on location, it will receive fuel from supply vessels following the drilling contractor's procedures that are put in place to prevent oil spillage. These include the inspection and testing of transfer hoses prior to use, stationing observers to watch the sea surface during the transfer and the maintenance of radio communications to stop the transfer if necessary. Spills reported from offshore bunkering incidents are usually small, seldom exceeding one tonne of fuel.

The subsea contractor's vessels will be deployed for short periods and will not require to transfer fuel while at sea.

7.8.4 Vessel collision

Decommissioning will increase vessel activity at the A&C Fields. Three or four vessels could be deployed at any one time in the A&C Fields, and although a collision is extremely unlikely as the normal navigation practice adopted applies collision prevention regulations, a vessel collision or sinking potentially means the loss of its inventory of fuel into the sea. In the worst case, a collision scenario would result in the instantaneous release of hydrocarbons, limited by the inventory of fuel in the vessel's tanks. For work at the Atlantic field by the well intervention vessel, *Well Enhancer*, in May 2014, an Addendum to the A&C Oil Pollution Emergency Plan presented modelling using BMT Argos Oil Spill Information System of a potential release of a well support vessel's fuel inventory of 1,762 m^3 of diesel from the Atlantic Field location with an onshore wind. The modelling predicted no diesel would remain on the surface after 9 hours. In that time, 646 m^3 would evaporate, 1,116 m^3 would disperse into the water column and none of the diesel would beach. This is conservative in terms of impact assessment, since the fuel capacity of most support vessels is less than the quantity modelled and accident scenarios involving releases from multiple vessels are considered to be highly improbable.

While seabirds are on the surface of the sea, they are vulnerable to oil pollution. Oiling of a seabird's plumage results in loss of insulation, mobility, buoyancy and waterproofing. Ingestion of oil while feeding or preening may be toxic or cause chronic health problems. Seabird vulnerability to pollution is very high from July to September and high during February. In the nearshore where the FPV will place rock over the export pipeline, the seabird vulnerability to pollution is high in February and March and very high during the rest of the year.

Oil spills are unlikely to harm fish or cetaceans. Fish metabolise hydrocarbons relatively quickly. The smooth skin of the cetacean species most likely to occur in the project's area of interest prevents diesel from sticking to them. Smultea & Wursig (1995) found that bottlenose dolphins apparently did not detect oil sheen and that, although they detected slick oil, they did not avoid traveling through it.

7.8.5 Mitigation

It is not expected that the subsea contractor's vessels will need to bunker fuel at sea during the A&C decommissioning operations. Vessels will return to port to bunker, where the port's spill response equipment may also be deployed in the event of a bunkering spill.

BG will prepare a Temporary Operations Oil Pollution Emergency Plan (TOOPEP) for the rig well plugging and abandonment operations. This will describe the mobilisation of a tiered response to any hydrocarbon spill.

The rig and all the vessels engaged in decommissioning activities will display visual signals during the daytime and navigation lights at night in accordance with the international collision regulations. The rig will show aviation obstruction lights in accordance with the Standard Marking Schedule for Offshore Installations (DECC, 2011). The rig and all vessels will be equipped with fog-horns, radar beacons, radar, and radio communications. BG will commission a Vessel Traffic Survey in support of the application for consent to position the rig on location.

BG will perform a pre-mobilisation Marine Assurance audit on all vessels deployed for decommissioning activities. The auditors will examine third party certificates that confirm the integrity of the vessels' equipment (including fuel hoses) and the availability of spill response equipment to contain a deck spillage. BG will review the vessels onboard chemical management plan and ensure the contractor maintains a catalogue of Materials Safety Data Sheets for any chemicals present on board. Before mobilising the vessels, BG will assess any collision risks from simultaneous operations, including the possible presence of vessels engaged in other activities, such as third party surveys.

All vessels engaged in the A&C decommissioning operations will have an approved Shipboard Oil Pollution Emergency Plan (SOPEP) developed within the requirements of Regulation 37 of MARPOL Annex 1 (MARPOL, 1973). In the unlikely event of a spill, the SOPEP will be implemented and the spill response equipment kept on board the vessel will be deployed in the first instance.

The Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998 as amended require that decommissioning operations in relation to an offshore installation or pipeline which may present a risk of marine pollution by oil are the subject of an OPEP approved by the Secretary of State for Energy and Climate Change. BG's 5-year renewal of the Oil Pollution Emergency Plan (OPEP) for the A&C Fields and WAGES pipeline was approved by DECC in July 2012. The OPEP allows for the mobilisation of Oil Spill Response Ltd.'s aerial surveillance within 4-6 hours, and deployment of aerial dispersant spraying capability within 9 hours, although this response will not be necessary for a vessel spill to sea. It notes that dispersant application is not recommended for diesel or condensate spills.

7.9 Cumulative Impact

The outer Moray Firth is a mature oil and gas exploration and production area, with a number of facilities in late life operations and scheduled for decommissioning in the coming decade.

The nearest developments to A&C are Nexen's Golden Eagle platform and its Solitaire subsea tieback. At 3 km from Atlantic, these are too distant to directly affect the habitat and ecology in the A&C Fields.

Numerous pipelines from offshore installations are routed to the St Fergus facility. Some run close together and cross each other. Leaving the A&C pipelines buried in the seabed avoids the need to work over third party oil and gas pipelines. It also minimises the potential cumulative impact of repeatedly disturbing the 'circalittoral mixed sediment' habitat.

The scale of North Sea decommissioning activity envisaged over the coming decade will create a demand for onshore decommissioning yards. This will create employment to construct and operate coastal facilities where structures and materials from offshore assets can be dismantled. The A&C decommissioning project is not large enough to influence the development or location of a new onshore decommissioning yard. Operators of onshore decommissioning yards rightly consider the structures and materials from A&C would make only a small contribution to their operation.

The A&C decommissioning project will contribute temporarily to the onshore decommissioning contractor's operational issues around noise, traffic and light pollution, but the scale and duration of this contribution will be very limited.

7.10 Transboundary Impact

The main potential for transboundary impacts into Norwegian waters would arise from atmospheric emissions and accidental events leading to an offshore spill during vessel activities. The UK/Norway median line is 160 km east of the A&C Fields and therefore any emissions resulting from the decommissioning activities would not be measurable at the median line. Similarly, the inventory of fuels carried by any of the vessels during operations would not create a spill sufficient to reach the UK/Norway boundary, even in the unlikely event that the entire inventory is lost to sea. The relatively small scale of the project and its proximity to shore mean that it is likely that the A&C equipment and materials removed from the seabed will be sent to an onshore decommissioning yard located in the UK.

7.11 Conclusion

The proposed A&C decommissioning activities will result in a minor localised impact on seabed sediments and benthos within the footprint of the rig mooring pattern and the part of the 500 m exclusion zones from which subsea installations are removed. The smaller sedentary species in the benthic community (e.g. polychaete worms) have short lifecycles and will recover from compression and sediment re-suspension by recruitment of new individuals from outside the area disturbed. The benthic communities are expected to recover within about 100 days. This will not affect other trophic levels of the integrity of the wider ecosystem, and, in terms of the criteria defined in Table 6-2 and the risk assessment matrix in Table 6-3 is an impact of medium significance.

Placement of rock cover over the nearshore pipeline will cause a lasting change to the balance of species within the footprint of the activity, but as the species are present within the matrix of habitats in the mixed sediment area, it will not affect the integrity of the populations concerned. In terms of the criteria defined in Table 6-2 and the risk assessment matrix in Table 6-3, this is an impact of medium significance.

Modelling suggests that the release of the contents of pipelines, spools and umbilicals when the ends are initially cut could affect marine species at a distance of less than 100 m from the release point for a very short time. No sensitive flora and fauna or habitats are present in the area of these operations. The more gradual release of the contents as the pipelines and umbilicals left in the seabed corrode over time will have an even less pronounced effect. The fluids released will quickly dilute and disperse in the seawater. In both cases, the impact is likely to be within the range of natural variation. In terms of the criteria defined in Table 6-2 and the risk assessment matrix in Table 6-3, this is an impact of low significance.

The avoidance behaviour in marine mammals that may be caused by underwater noise from decommissioning activities and the deployment of dynamically positioned vessels is not expected to harm sensitive marine mammals. As A&C is in an area with established oil and gas and commercial shipping activity the effect is likely to be within the range of existing variability. In terms of the criteria defined in Table 6-2 and the risk assessment matrix in Table 6-3, this is an impact of low significance.

The subsea equipment and materials transported to an onshore decommissioning yard raise issues around waste segregation, handling and storage. Recycling steel and other materials will reduce the severity of environmental impact. The decay of marine growth on the structures at the decommissioning yard may give rise to legitimate stakeholder complaints about odour. Dismantling activities may also give rise to stakeholder complaint about noise and vehicle traffic. In terms of the criteria defined in Table 6-2 and the risk assessment matrix in Table 6-3, odour and noise are impacts of medium significance.

Decommissioning involves the customary emissions from vessels that meet the MARPOL regulations. They could only cause a minor temporary reduction in air quality and the A&C area has no receptors sensitive to such a small change in air quality. The onshore decommissioning yard and the recycling facilities for steel will also operate in line with licences that limit combustion emissions to acceptable levels. While it is recognised that all combustion emissions make a small contribution to global greenhouse gas issues, the contribution from these activities is negligible. Activities will not reduce air quality in a way that would cause change to species populations that is detectibly different from natural variation, or cause concern to local communities. In terms of the criteria defined in Table 6-2 and the risk assessment matrix in Table 6-3, emissions are of low significance.

Commercial fishing may resume at A&C when the installations have been removed and the SFF. has verified that the seabed can be fished without risk of snagging. Although the area made available is small, removal of fishing restrictions will be beneficial to fishermen.

The A&C decommissioning project will generate work for existing rig crews, vessel crews and the workforce of onshore decommissioning yards and recycling facilities. This will be beneficial, but due to the small scale of the project, it is not expected that any new jobs will be generated.

In the event of a vessel collision leading to a spill of a vessel's fuel inventory, it is expected that the fuel would form sheen on the surface that would disappear in nine hours by processes of evaporation and dispersion into the water column. If this occurred at a time of year when seabird vulnerability to pollution is high, populations of some seabird species could be affected in the medium-term. In terms of the criteria defined in Table 6-2 and the risk assessment matrix in Table 6-3, the risk of an accidental oil spill is of medium significance.

BG will implement a project-specific environmental risk and social performance plan (as outlined the following chapter) to management the decommissioning activities so that the risk they pose is as low as reasonably practicable (ALARP).

8.0 ENVIRONMENT AND SOCIAL PERFORMANCE MANAGEMENT

BG will implement measures to mitigate and manage the environmental and social risks and impacts and, where possible, enhance the benefits of the A&C decommissioning project. The approach will prioritise the designing out of environmental and social risks during project planning in order to avoid impacts entirely and, where avoidance is not possible, ensure control measures are implemented so as to minimise impacts to levels that are as low as reasonably practical. BG will continue to engage with stakeholders as appropriate and will seek ways to mitigate impacts that may affect them. Where possible, BG will seek to enhance the social benefit of decommissioning the A&C installations.

8.1 BG Group Business Principles, Policy, Standards and Guidelines

The effective management of environmental and social risks lies at the heart of BG's operations and is incorporated into the comprehensive governance framework hierarchy through:

- Adherence to the BG Group Business Principles and Policies
- Adherence to the BG Group HSSE Management System Framework, that manages HSSE risk through all levels of the company in business planning, execution and delivery
- Adherence to BG Group Standards.

BG Group policies and standards are mandatory. They ensure BG operates in accordance with its Business Principles. BG Group Business Principles aim to go beyond compliance with local environmental regulations to make a positive contribution to environmental protection and reduce any adverse effects of its operations on the environment to the minimum practicable. BG Group's Safety and Sustainability Policy states the belief 'that all incidents and injuries are preventable and unacceptable' and the 'aim to deliver a safe, secure and responsible business that takes into account environmental impacts, social consequences and human rights. BG's goal is:

- To protect the health, safety and security of our employees, contractors, partners, suppliers and neighbouring communities
- To ensure the integrity and safe operation of our assets
- To understand and minimise the impacts of our operations on people and the environment
- To build a reputation, externally and internally, for strong safety and sustainability performance
- To make an enduring positive contribution in our neighbouring communities and host societies.

Application of the HSSE Management System Framework and compliance with the BG Group Standards: Environment & Climate Change (ECC) and Social Performance (SP) through project development and execution ensures the effective identification and management of HSSE and SP risks through all stages of the development and planning of

the project. For the A&C decommissioning project this has involved the characterisation of the environmental and socio economic baseline in the area of proposed activities, including a study of potential impacts on commercial fisheries, engagement with relevant interested and potentially affected stakeholders and identification of environmental and social risks associated with the planned activities. Environment and social performance risk identification (ENVID) along with health and safety hazard identification (HAZID) workshops were conducted through the development of the A&C Decommissioning Programmes to identify HSSE and SP aspects and hazards, assess risks and develop effective risk management strategies to be included in detailed project planning.

This EIA considers the environmental and social risks inherent in the A&C Decommissioning Programmes in detail in the context of the prevailing natural, physical and social environment in the area of operations in order to identify potential adverse impacts and their significance so that specific management measures and controls can be developed for implementation during project execution. Internal assurance through peer review and challenge is a key component of the process at each stage of project development to ensure effective management of identified risks will be implemented and high quality project delivery is achieved in accordance with Company Policy, Standards and in compliance with the law.

8.2 Contractor Management

To execute the A&C decommissioning project, BG will manage a range of specialist contractors. The main contractors will include the well plug and abandonment rig contractor, a subsea contractor to cut and remove the seabed installations and an onshore decommissioning yard contractor. The management of contractors' HSSE is important to the success of the project, so all contractors involved in the project must conform to BG's own HSSE standards.

BG will assess HSSE risks in contract scopes of work at the tender stage and will apply appropriate HSSE considerations and criteria to the pre-qualification and selection of contractors. Environment and social risk management requirements will be included as specific terms and conditions of the contract agreement with each selected contractor. Contractor compliance with these requirements will be mandatory. BG's project team will engage with the selected contractor prior to mobilisation in detailed risk assessment workshops focussing on the contractor's proposed decommissioning methods and proposed mitigation controls to ensure the requirements can be met.

Contractors will draw up HSSE interface documents demonstrating that their own HSSE management systems are consistent with BG's HSSE policy and management systems.

BG will require the contractors to develop an environmental management plan that will contain field actionable procedures with appropriate controls in place as identified in this EIA that when implemented will protect the environment, reduce environmental risks to levels that are as low as reasonably practicable and achieve the expected high standards of environmental performance. BG will ensure that contractor plans and procedures will comply with BG standards and the law and that the contractors make provision to include competent and suitably qualified environmental personnel in their decommissioning team. Where contractor roles have specific responsibilities for environmental protection, contractors must provide personnel with an appropriate level of training. BG will review the contractors' provisions for the resolution of social issues and will maintain the ongoing programme of social engagement that commenced at the decommissioning project's planning stage and

has been documented in the Stakeholder Engagement Report (BG 2016) included with the Decommissioning Plan. When contractor readiness is assured by the BG project management team, approval to mobilise will be provided to the contractor

Throughout the A&C decommissioning project, BG will engage regularly with contractors, putting in place a comprehensive monitoring plan to include audits to monitor contractor competence and review their HSSE performance against requirements and deliverables agreed in the contract to assure effective delivery of BG's HSSE policy objectives. A BG representative will be present on board the rig plugging and abandoning the wells and on any CSV, DSV or ROVSV deployed for decommissioning operations.

8.3 Summary of Mitigation Commitments

BG will manage the environmental and social risks and impacts of the Decommissioning Programmes that cannot be fully eliminated by ensuring contractor implementation of the agreed mitigation measures during operations. The proposed mitigation measures are summarised in Table 8-1. These will be further developed with contractors and will form the basis of an A&C Project Environmental and Social Management Plan (PEMP) that will be developed during detailed project planning taking account of contractors' technical proposals and BG's bridging arrangements with contractor HSE management systems. The PEMP will define roles and responsibilities for implementing environmental management.

Table 8-1: A&C Field Decommissioning Project specific commitments

Aspect	Commitment
Physical disturbance of the seabed and benthic species	• BG will minimise the footprint of the decommissioning works in the A&C 500m zones • BG will seek to restrict the area of seabed on which rock cover is placed • BG's contractors will perform debris clearance and 'as-left' surveys
Underwater noise	• BG will not use explosives for cutting activities
Atmospheric emissions	• BG will carry out pre-mobilisation marine assurance audits including checks that all vessels have well-maintained engines and generators which leads to better efficiency • Contractors will monitor and report their fuel consumption daily
Discharges to sea	• BG will confirm in pre-mobilisation marine assurance audits that that all the vessels mobilised manage wastewaters and discharges to conform with MARPOL • BG will apply for environmental consents with regard to the fluids in the pipelines and umbilicals that will be released to the sea when they are cut
Waste generation	• BG will confirm that all the vessels mobilised manage their waste to conform with MARPOL • BG will review and endorse the onshore decommissioning

Aspect	Commitment
	contractor's waste management plans to implement a waste hierarchy that maximises reuse and recycling of materials • The onshore decommissioning contractor will document all materials and wastes so the audit trail tracks them to their recycling facility or disposal site • BG will audit waste management procedures at the onshore decommissioning yard
Social disturbance	• BG will commission a Vessel Traffic Survey to support an application for consent to position the rig on location for well plugging and abandonment • BG will publish notices of the offshore decommissioning activities in the Kingfisher Bulletin and will notify the appropriate maritime authorities of drilling rig moves and vessel deployments • The rock cover placed over sections of the export pipeline to prevent scallop dredges from snagging will be sized to avoid causing instability when the scallop boats lift their fishing gear • BG will engage the SFF to carry out trials to confirm that the seabed in the project area of interest is clear of debris and safe for commercial fishing • BG will review the onshore decommissioning yards arrangements for engagement with local communities, their process for responding to complaints from interested parties and their track record in closing out complaints
Pollution prevention	• BG will submit a Temporary Operations OPEP for the well plugging and abandonment activity • BG will ensure that vessels undertaking decommissioning activities have an approved Shipboard Oil Pollution Emergency Plan that conforms with MARPOL Annex 1 • BG will carry out pre-mobilisation audits to check that vessels deployed for decommissioning are equipped to comply with IMO Collision Regulations and have adequate radar, navigation and communication equipment to prevent collisions • BG will assess simultaneous operations risks before vessels are mobilised

9.0 CONCLUSIONS

The subsea A&C Fields were commissioned in 2006 and produced gas and condensate through the WAGES export pipeline to the SAGE terminal at St Fergus for three years. In 2012 the pipelines were disconnected from the A&C wells and cleaned and flushed to shore facilities until declared hydrocarbon free. Filled with water and monoethylene glycol with a low concentration of corrosion inhibiting fluids, they were placed under an Interim Pipeline Regime to allow potential alternative uses to be evaluated. No viable alternative uses have been found, BG proposes to decommission the A&C Fields' installations together with the pipelines and umbilicals that served them.

The technical studies carried out and detailed comparative assessment of decommissioning options available resulted in the following decommissioning approach:

- Plugging and abandoning two wells in the Atlantic field and one well in the Cromarty field and removing the Christmas trees and wellhead protection structures and transportation to shore for recycling
- Leave buried pipelines place following the cutting and removal of the unburied ends and placement of rock cover at the locations where the pipeline end cuts are made to prevent snagging by fishing gear
- Placement of rock cover over any areas of exposed pipeline to prevent snagging by fishing gear.
- Removal of the following infrastructure from the A&C 500m exclusion zones and transportation to shore for recycling and disposal:
    - pipeline and infrastructure protection concrete tunnels, mattresses and grout bags
    - the Atlantic subsea manifold, and its protective structure
    - the cut ends of pipelines and umbilicals
    - seabed surface laid tie-in spools and control jumpers
- Transportation of the installations and materials removed from the seabed to an onshore decommissioning yard, where they will be dismantled and batched for transportation to recycling facilities or disposal sites. Current estimates are that less than 400 te of steel, 2,000 te of concrete and small quantities of copper, plastic and anodes will be returned to shore for recycling
- A post removal debris survey of the seabed and removal of debris for transportation to shore
- Post rock cover trawling trials to verify the seabed is safe for commercial fishing
- Two post removal seabed pipeline and environmental surveys.

Activity-specific mitigation measures will be planned and managed to avoid adverse environmental and social impacts and, where avoidance is not possible, ensure potential impacts are minimised to a level that is as low as reasonably practicable. This includes

management of contractors commissioned to carry out the decommissioning activities, and monitoring and auditing contractor performance during the execution of the work. Agreed mitigation controls, regulatory requirements as well as BG standard requirements will be included as terms and conditions in the contract and the measures to be adopted. Monitoring measures required to ensure compliance will form part of the contractors' decommissioning plans and procedures to be approved by BG prior to mobilisation. BG will carry out pre-mobilisation audits to assure that effective planning and operational procedures are in place and that all vessels comply with International Maritime Organisation requirements, including MARPOL requirements with regard to emissions, discharges, waste management and collision avoidance.

This Environmental Impact Assessment has identified potential environmental and social risks and impacts that may arise during the proposed A&C decommissioning activities and assessed their significance. Decommissioning activity for the A&C infrastructure is of limited scope and activities will be of short duration. It may cause changes to a small area of seabed within the project footprint, but will leave the seabed available for re-colonisation by local species and rapid recovery is expected. No specific high risk environmental or social sensitivities were identified in the footprint of the planned decommissioning activities.

Mitigation controls have been identified for implementation to ensure that risks to other users of the sea have been reduced to as low as reasonably practicable by implementing routine ship navigation and notification measures. Where rock cover is placed on the seabed, grades will be used that avoid hazards to fishing gear and over-trawl trials will assure that the rock cover does not present a hazard to fishing.

Overall, the activities will be of relatively short duration, irrespective of whether the decommissioning work programme is carried out in a single deployment or in stages. The plugging and abandoning of the three wells will require the presence of a rig in the field for a period of approximately three months and surface vessel deployment during subsea installation cutting and removal activities anticipated to last for approximately two months.

The mitigation measures to be implemented during the planned activities, including the adoption of regulatory requirements and approvals and the careful management of contractors, will be fully integrated into the planning of decommissioning and the award of contracts. BG will closely supervise and monitor contractor compliance with contract requirements. With appropriate implementation of the mitigation measures and controls, no adverse residual impacts of high significance are expected and the minimal impacts within the project footprint will be localised, of short duration and reduced to acceptable levels.

BG has screened all the decommissioning activities against criteria for the severity of associated potential environmental and socio-economic risks and impacts. The results show that through careful selection, planning and optimisation of available decommissioning options and the effective implementation of mitigation and management controls identified through the risk and impact assessment process, impacts to the existing biological, physical and socio-economic environment will be minimal with no adverse or long-lasting impacts predicted.

APPENDIX 1
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APPENDIX 2
ABBREVIATIONS/DEFINITIONS

º C	Degrees Celsius
µPa	Micropascal
A&C	Atlantic and Cromarty
ALARP	As Low As Reasonably Practicable
BEIS	Department of Business, Energy and Industrial Strategy
BG	BG-Group
CA	Comparative Assessment
CCS	Carbon Capture and Storage
CFD	Computational Fluid Dynamics
CHARM	Chemical Hazard & Risk Management
CNS	Central North Sea
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoP	Cessation of Production
CSV	Construction Support Vessel
CSV	Construction Support Vessel
dB	Decibels
DECC	Department of Energy and Climate Change
DP	Dynamic Positioning
DSV	Dive Support Vessel
DTI	Department of Trade and Industry
EC	European Commission
EEMS	Environmental Emissions Monitoring System
EIA	Environmental Impact Assessment
EMT	Environmental Management Team
ENVID	Environmental Issues Identification
EPS	European Protected Species
EQS	Environmental Quality Standard

EUNIS	European Nature Information System
FPV	Fall Pipe Vessel (rock placement)
ha	Hectares
HSE	Health and Safety Executive
HSSE	Health, Safety, Security and Environment
HSSEQ	Health, Safety, Security, Environment and Quality
ICES	International Council for the Exploration of the Sea
IoP	Institute of Petroleum
IPR	Interim Pipeline Regime
JNCC	Joint Nature Conservation Committee
kg	Kilograms
km	Kilometres
km2	Square kilometres
m	Metre
m/s	Metres per second
mm	Millimetres
m^2	Square metres
m^3	Cubic metres
MARPOL	International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978
MAT	Master Application Template
MCAA	Marine and Coastal Access Act
MDAC	Methane Derived Authigenic Carbonate
MDS	Multi-dimensional Scaling
MEG	Monoethylene Glycol
mg/l	Milligrams per litre
MS	Marine Scotland
MPA	Marine Protected Area
N_2O	Nitrous Oxide
NCMPA	Nature Conservation Marine Protected Area

nm	Nautical miles
NORM	Naturally Occurring Radioactive Material
NOx	Nitrogen Oxides
OCNS	Offshore Chemical Notification System
ODU	Offshore Decommissioning Unit
OGA	Oil and Gas Authority
OGUK	Oil & Gas UK
OPEP	Oil Pollution Emergency Plan
OSPAR	Oslo and Paris Convention
OVI	Offshore Vulnerability Index
PETS	Portal Environmental Tracking System
PLONOR	Poses Little or No Risk to the Environment
PMF	Priority Marine Feature
ppm	Parts per million
ROV	Remotely Operated Vehicle
ROVSV	Remotely Operated Vehicle Support Vessel
SAC	Special Areas of Conservation
SAGE	Scottish Area Gas Evacuation
SFF	Scottish Fishermen’s Federation
SNH	Scottish Natural Heritage
SO_2	Sulphur Dioxide
SOPEP	Shipboard Oil Pollution Emergency Plan
SOx	Sulphur Oxides
SPA	Special Protection Area
SPL	Sound Pressure Level
te	Tonnes
TUTU	Topside Umbilical Termination Unit
UK	United Kingdom
UKCS	UK Continental Shelf
UKOOA	United Kingdom Offshore Operators Association

VMS	Vessel Monitoring System
VOC	Volatile Organic Compound
WAGES	Western Area Gas Evacuation System (pipeline PL2029 and piggybacked PL2031 MEG pipeline)
WBM	Water Based Mud
WMP	Waste Management Plan

APPENDIX 3
EIA TABLES

High	Moderate	Low

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
Plugging and abandonment of wells (3 in total)																					
Rig mobilisation	Physical presence									x					x		Rig at A&C for 90 days.	P		Notification of maritime authorities and notice in Kingfisher Bulletin	
	Seabed disturbance					x				x	x						Anchor spread of the drilling rig to 2000 m.	P		Mooring spread to avoid disturbing identified UXO	
	Emissions to air	x															Typical rig engine emissions (mobile source).	P		Rig to conform to MARPOL	
	Discharges to sea (routine)		x		x												No introduction of invasive species from ballast water as rig will be European water sourced.	P		Rig to be in compliance with BG's Marine Assurance Standard and MARPOL	

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
	Underwater Noise						x	x									Temporary low level noise	P			
Pump cement into well. Cut casing below seabed. Remove Christmas trees and protective structures from seabed	Discharges to sea		x		x	x											Discharge of cement permitted chemicals. Increased suspended solids in the water column before settling on seabed.	P		Suitable technology for cutting will be selected to ensure the effectiveness of the cutting, minimising the duration, disturbance and risk of requiring the activity to be repeated.	
	Seabed disturbance			x		x											Pulling the conductor from the seabed will dislodge sediments. Seabed will recover once operation is complete.	P			
	Waste												x				Scrap metal. Marine growth on Christmas trees. NORM not expected.	P		Develop WMP prioritising reuse and recycling.	

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
Removing Subsea Installations																					
Mobilise vessels	Physical presence									x	x	x			x		Vessels in field intermittently for short periods over three years	P		Notification of maritime authorities and notice in Kingfisher Bulletin	
	Seabed disturbance			x		x											Anchored vessels. Benthos in c. 100 days	P		Vessels likely to use dynamic positioning.	
	Emissions to air	x															Typical vessel engine emissions (mobile source)	P		All vessels to conform to MARPOL	
	Discharges to sea		x		x												Typical routine vessel emissions (cooling water, bilge)	P		All vessels to conform to MARPOL	
	Underwater noise						x	x									Noise continuous while vessels are on location. Peak noise below 1,000 Hz.	P			

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
Removal of manifold including cutting piles	Seabed disturbance			x		x	x										Possible jetting around manifold and excavation of seabed around piles. Localised disturbance by jetting, tool baskets and divers. Seabed will begin to recover once structures have been recovered.	P		Internal cutting of piles, minimises disturbance.	
	Waste												x				Scrap metal	P		Develop WMP prioritising the recycling of steel	
Lift concrete tunnels mattresses, and grout bags	Seabed disturbance			x		x											Lifting tunnels, mattresses and grout bags from the seabed will re-suspend sediments. Seabed will quickly settle. Benthos will begin to recover once they have been removed.	P			

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
	Waste												x				Concrete. Marine growth will fall off items into the sea and onto vessels in transit.	P		Develop WMP prioritising reuse and recycling concrete.	
Cut and recover spools, jumpers and surface-laid ends of pipelines and umbilicals	Discharges to sea		x		x												Initial discharge of MEG and corrosion inhibitor when pipelines are cut. Initial discharge of hydraulic fluid when umbilicals are cut.	P		Modelling of shows the discharges are environmentally acceptable. The use and/or discharge of all chemicals will be subject to risk assessment and permitting under PETS.	
	Seabed disturbance			x		x											Cutting and lifting will be in the footprint of the removed mattresses	P		Limit the footprint of the activities	
	Offshore waste: marine growth		x														Marine growth will fall off items into the sea and onto vessels in transit. It will be naturally dispersed into the marine environment.	P		None identified.	

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
	Waste												x				Scrap metal	P		Develop WMP prioritising the recycling of steel	
Bury and rock cover exposed pipeline and umbilical ends	Seabed disturbance			x		x				x							Placement of spots of c.50 te rock over cut ends of pipeline and umbilical. Long-term localised change in substrates present.	P		SFF Services Ltd to verify the rock cover is safe for fishing.	
Pipelines left buried in the seabed (>0.6 m below seabed)																					
Leave buried pipelines in place. Rock placement over WAGES pipeline 7.5 - 10.4 km from landfall.	Discharges to sea		x			x											Gradual release of MEG, corrosion inhibitor and hydraulic fluid over time as pipe and umbilicals corrode.	P		Modelling of shows the discharges are environmentally acceptable.	
	Seabed disturbance			x		x				x							Addition of rock to mixed sediment habitat with existing cobbles. It has adapted to existing pipeline rock cover. This is to reduce the snag risk to scallop trawls.	P		Limit the rock cover to the area where scallop dredging is known to be practised.	
Accidental Event																					

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
Collision	Fuel spill		x		x	x		x	x	x				x	x	x	Loss of fuel inventory. Diesel spill can persist on the sea surface for 9 hours before dispersing.	U		Pre-mobilisation Vessel Assurance Inspection. Vessels to have SOPEP plans and equipment. Arrangements in place to track spill.	
Decommissioning Yard Operations																					
Lift and Laydown, Cutting and Dismantling Storage and Waste Management	Physical presence												x	x	x		Yard location not yet known, but an will be an existing yard with approved EIA and licenced to receive the materials decommissioned from A&C.	P		Environmental audit of decommissioning yard	
	Emissions to air	x												x			Yard to operate under existing permits.	P		Contractor to monitor fuel use and report emissions to BG.	
	Discharges		x										x				Yard to operate under existing permits. BG to audit drains and bunding.	P		Contractor to monitor and report discharges to BG.	

Activity	Aspect	Receptors															Observations	Plammed / Unplanned	Inherent Risk	Mitigation	Residual Risk
		Climate/Air Quality	Water Quality	Seabed/Soil	Plankton	Benthic Fauna	Fish	Marine Mammals	Seabirds	Fisheries	Shipping	Other sea users	Landfill resources	Communities	Landscape/Seascape	Protected areas/ species					
Lift and Laydown, Cutting and Dismantling Storage and Waste Management (cont.)	Waste			x													Yard to segregate waste materials to miximise reuse and recycling	P		Contractor to maintain a waste audit trail through to recycling or disposal facility. Contractor to report waste inventories to BG. BG to audit the yard's waste management.	
	Nuisance (noise, vibration, odour)													x			ROV inspections suggest A&C installations have little marine growth.	P		Yard to engage with local communities. BG to review records of engagement with communities and close out of issues.	
	Road Traffic													x			The small scale of the A&C decommissioning will contribute little to existing road traffic.	P		Yard to engage with local communities. BG to review records of engagement with communities and close out of issues.	
	Community Interaction and Livelihoods													x			A&C project is too small to create new jobs, but will provide work for yard's existing workforce and vessel crews.	P		Removal of the A&C fishing exclusion zones will be beneficial to fishermen.	+

APPENDIX 4
SUPPORTING TABLES

Table 1: Anticipated drilling rig and vessel use to support P&A and vessel campaigns

Vessel type	Activity	No. of days	Fuel use per day (te)	Total fuel use (te)
Plug and Abandonment campaign				
Tow tugs to bring drilling rig on site and mobilise between wells (x3)	towing	21	25	525
Drilling rig	Infield	90	12	1,080
Standby vessel	Port	1.5	1	1.5
	Transit	1.5	8	12
	Infield	90	4	360
Supply vessel (assumes half time in transit and half the time on location)	In transit	45	10	450
	Infield	45	1.5	67.5
Total				2,496
Vessel Campaign				
Survey vessel (pre-decommissioning)	Port	3	1.5	4.5
	Transit	3	8	24
	Infield	19	11	209
ROV support vessel (ROVSV)	Port	7	1.5	10.5
	Transit	11	27	297
	Infield	31	21.5	666.5
Dive support vessel (DSV)	Port	1.5	3	4.5
	Transit	1.5	21	31.5
	Infield	12.5	14	175
Rock cover vessel	Port	2.5	2	5
	Transit	2	9	18
	Infield	3	15	45
Guard vessel	Port	1.5	1	1.5
	Transit	1.5	8	12
	Infield	31	4	124
Fishing vessel for debris clearance sweeps and over	Port	2	1	2
	Transit	2	4	8

Vessel type	Activity	No. of days	Fuel use per day (te)	Total fuel use (te)
trawlability surveys	Infield	21	4	84
Survey vessel (post-decommissioning)	Port	3	1.5	4.5
	Transit	3	8	24
	Infield	17	11	187
Total				**1,937.5**

Table 2: Emissions associated with the recycling of recovered infrastructure and the production of steel to replace that decommissioned in situ.

Infrastructure	Total Steel (te)	CO_2 (te)	NOx (te)	SO_2 (te)
Emissions associated with recycling of recovered steel				
Atlantic installations	260	250	1	0.4
Atlantic pipelines and umbilicals	41	39	0.2	0.1
Cromarty installations	53.5	51	0.2	0.1
Cromarty pipelines and umbilicals	29	28	0.1	0.05
Total	**383.5**	**369**	1.5	0.6
Emissions associated with replacement of steel left *in situ*				
Atlantic installations	31	58	0.1	0.1
Atlantic pipelines and umbilicals	13,248	25,025	45	66
Cromarty installations	0	0	0	0
Cromarty pipelines and umbilicals	1,571	2,968	5	8
Total	14,850	28,051	50	74

Table 3: Emissions from recycling and steel production of buried pipelines left in place.

Phase	Total fuel use (te) / total steel (te)	CO_2 (te)	NOx (te)	SO_2 (te)
CO_2 emissions associated with leaving buried pipelines in place				
Vessel and drilling rig activity	1,937 te of fuel	6,200	115	8
Recycling of steel	383.5 te of steel	369	1.5	0.6
Production of steel in the buried pipelines	14,850 te of steel	28,051	50	74
Total		**34,620**	**166**	**83**
CO_2 emissions associated with complete removal of pipelines				
Vessel activity	13,000 te of fuel	41,004	761	51
Recycling of all steel	14,850 te of steel	14,624	58	24
Total		**55,628**	**819**	**75**

Table 4: Summary of issues from stakeholder engagement

Date	Comment	Response
DECC Offshore Decommissioning Unit (ODU) and Environmental Management Team (EMT)		
10.3.15	As execution plans progress, BG will need to discuss well P&A and changes to OPEPs and duty holders with BEIS inspectors.	Noted.
10.3.15 and 9.6.15	BG should model the fate of the corrosion inhibitor, and MEG/water in the export.	See Section 4.5.2
10.3.15	BG must conduct a pre-decommissioning environmental baseline survey to demonstrate seabed stability, trends and characteristics since the development of the field	Survey results provided to DECC EMT, JNCC, Marine Scotland and Scottish Natural Heritage (SNH) March 2016 and incorporated into Section 5.0 of this ESIA.
10.3.15	A leave *in situ* approach to the export pipeline based on a future possibility that it might be reintroduced into service at a later date (e.g. for Carbon Capture and Storage) is not an acceptable justification for this approach to decommissioning.	Noted.
9.6.15	Flushing chemicals back to shore needs to be considered as an option.	The WAGES pipeline is disconnected at both ends so flushing is no longer practical.
26.8.15	The government does not normally expect removal of rock-covered pipeline, but partially-covered pipelines is a grey area. There are no precedents for removal of rock cover. The CA should consider full removal of pipeline including rock cover and removal of pipeline without removing the rock cover. The EIA should address the impacts of disturbance or addition of further rock cover.	Noted. This was considered in the CA. See section 2.5.1 of this EIA for discussion of pipeline removal
10.12.15	The risk of pipelines ever becoming exposed in highly mobile sea areas needs to be examined.	See Section 7.6
10.12.15	Where mattresses are buried to a depth of 0.6 m or more, a full CA is required for any proposal for leaving them *in situ*. Derogation for mattresses at less than 0.6 m burial depth is not an option.	Noted.
10.12.15	Unless there is a firm reuse opportunity for the pipeline, ODU would not consider deferral of decommissioning. On 17.3.16 DECC advised BG to bring forward draft Decommissioning Programmes.	Noted.
DECC Environmental Management Team (EMT); Joint Nature Conservation Committee (JNCC); Marine Scotland (MS); Scottish Natural Heritage (SNH) (via JNCC)		
7.5.15	BG shared the scope of work for the pre-decommissioning environmental baseline survey for the fields and export pipeline prior to meeting to obtain comment before undertaking the survey.	n/a

7.5.15	DECC EMT requested map showing seabed sampling locations relative to infrastructure to be decommissioned.	Provided to DECC and scope of work for baseline survey updated.
7.5.15	DECC EMT requested that samples be obtained to characterise the baseline environment around two pipeline free spans identified in 2007 (KP 6.4) and 2011 (KP 8.7) in the context of the draft Decommissioning Programmes. Any variability in samples (depending on results) may require a broader sampling programme.	See Figures 5.2-5.4
SEPA		
28.5.15	While no naturally occurring radioactive material (NORM) has been identified to date, a permit application should be made on a precautionary basis for the removal of any subsea structure to allow authorisation of any vessel within 500 m to accumulate and dispose of any NORM-contaminated waste should the need arise.	Noted.
Joint Nature Conservation Committee (JNCC)		
3.12.15	Solutions which least affect the substrate and habitats are to be preferred. Leaving pipelines in place may be most appropriate from an ecological perspective, dependant on the state of the infrastructure and ecological habitats nearby.	Noted.
3.12.15	The preference for minimum disturbance means that JNCC would be unfavourably disposed to removal of pipelines from rock cover.	
3.12.15	In some habitats, trenching and burying has a more temporary impact than rock cover since the latter fundamentally changes the seabed (if in a sandy/silty environment).	Noted.
3.12.15	The scopes for post-decommissioning surveys will depend on the extent of the work that is done and the need to understand damage to, and/or recovery of, markedly changed environments and habitat recolonisation and recovery. Safety will also be an important factor in these surveys to ensure there is no snagging risk.	Noted.