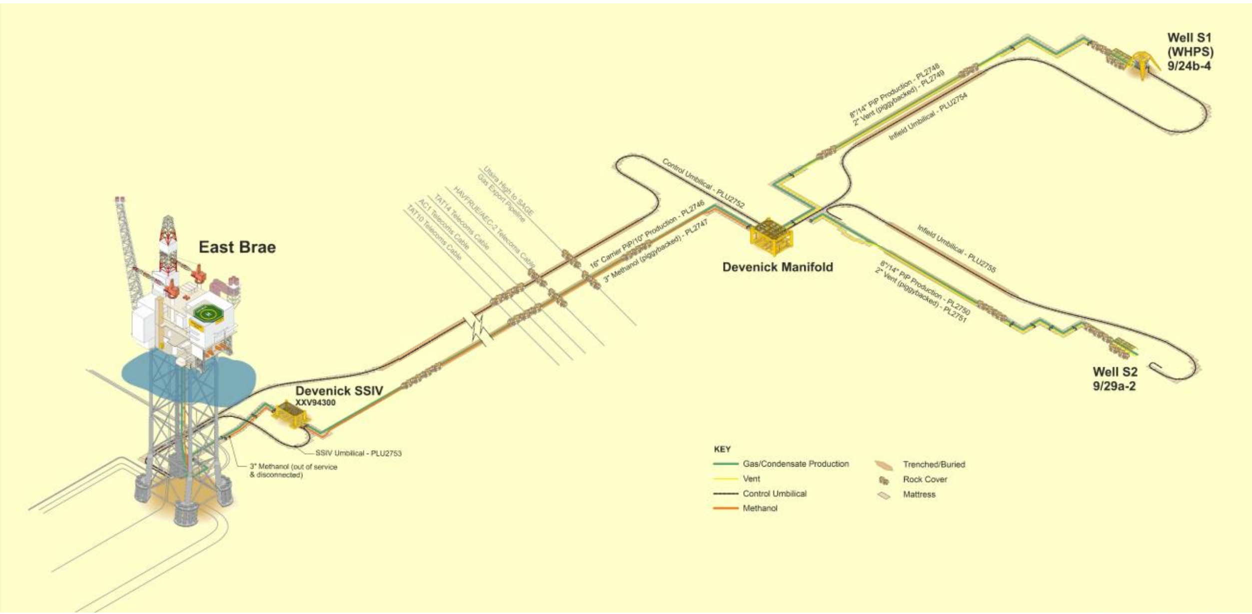
DEVENICK DECOMMISSIONING

Subsea
Decommissioning Environmental Appraisal



77IFS-175422-H99-0002

TAQA INTERNAL REVISION SUMMARY						
Document Owner:	TAQA Bratani Limited					
Revision No:	09		**Revision Date:**	25/08/2022		
Revision Summary:						
Authorisation:	**Prepared by**		**Verified by**		**Approved by**	
	Xodus					

OPRED REVISION SUMMARY			
Revision No.	Reference	Changes/Comments	Issue Date

DISTRIBUTION LIST		
Company	Name	No. Copies
TAQA Bratani Limited		1

CONTENTS

ABBREVIATIONS

Abbreviation	Meaning
AIS	Automatic Identification System
ALARP	As low as reasonably practicable
AWMP	Active Waste Management Plan
BAP	Biodiversity Action Plan
BAT	Best Available Technique
BEIS	Business, Energy and Industrial Strategy
BEP	Best Environmental Practise
CA	Comparative Assessment
CNRI	Canadian Natural Resources International Ltd
CPR	Continuous Plankton Reader
c/w	Combined with
DECC	Department for Energy and Climate Change
DoB	Depth of Burial
DP	Decommissioning Programme
DSV	Dive Support Vessel
DTI	Department of Trade and Industry
EA	Environmental Appraisal
EEMs	Environmental Emissions Monitoring System
EIA	Environmental Impact Assessment
EMS	Environmental Management System
ERL	Effect range low
EU	European Union
EUNIS	European Nature Information System
EWC	European Waste Catalogue Codes
FRS	Fisheries Research Services
GJ	Gigajoules
HSE	Health, Safety and Environment
HSSE	Health, Safety, Security and Environment
ICES	International Council for the Exploration of the Sea
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
KP	Kilometre Post
LAT	Lowest astronomical tide
MARPOL	International Convention for the Prevention of Pollution from Ships
MCZ	Marine Conservation Zone
MDAC	Methane-derived authigenic carbonates
MEG	Monoethylene glycol
MMO	Marine Management Organisation
NCMPA	Nature Conservation Marine Protected Areas

Abbreviation	Meaning
NMP	National Marine Plan
NMPI	National Marine Plan Interactive
NNS	Northern North Sea
NOAA	National Oceanic and Atmospheric Administration
NORM	Naturally Occurring Radioactive Material
OGA	Oil and Gas Authority
NSTA	North Sea Transition Authority
OGUK	Oil and Gas UK
OEUK	Offshore Energy UK
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	The Oslo Paris Convention
PETS	Portal Environmental Tracking System
PiP	Pipe-in-pipe
PMF	Priority Marine Feature
ROV	Remotely Operated Vehicle
SAC	Special Areas of Conservation
SCOS	Special Committee on Seals
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation
SMRU	Sea Mammal Research Unit
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area
SSIV	Subsea Isolation Valve
SSS	Side Scan Sonar
te	Tonnes
THC	Total Hydrocarbon Content
UHB	Upheaval Buckling protection
UKCS	UK Continental Shelf
UKHO	UK Hydrographic Office
UKOOA	UK Offshore Operators Association
UNESCO	The United Nations Educational, Scientific and Cultural Organisation
VMS	Vessel Monitoring System
WHPS	Wellhead protection structure

Tables and Figures

APPENDICES

EXECUTIVE SUMMARY

Introduction and background

This non-technical summary provides an outline of the findings of the Environmental Appraisal (EA) conducted by TAQA Bratani Limited (TAQA) for the proposed decommissioning of the Devenick subsea facilities, comprising the Devenick S1 wellhead and protection structure, manifold, pipelines and protection structures, and umbilicals. The purpose of the EA is to understand and communicate the potential significant environmental impacts associated with the proposed decommissioning activities.

The Devenick subsea infrastructure and associated export pipelines are located in UKCS Blocks 16/3a, 16/3e, 9/24b, 9/24c, 9/28c and 9/29a, in the North Sea, 185 km south east of Fair Isle, 310 km north east of Aberdeen and 3.2 km west of the UK/Norway median line (Figure A-1). Devenick is a high pressure, high temperature, gas condensate field. The main Devenick pipelines run for approximately 33.8 km between the Devenick Manifold and East Brae Platform, with shorter pipelines from the Devenick manifold to the S1 wellhead (1.49 km from the manifold) and the location of the S2 wellhead (1.29 km from the manifold) which has been previously removed and is not included within the scope of this EA.

The facilities included in the Devenick subsea decommissioning campaign and therefore the scope of this EA, are listed below and shown in Figure A-2.

Subsea structures:

- Devenick manifold;
- 9/24b-4 (S1) wellhead protection structure (WHPS);
- S1 and S2 cooling spool protection frames; and
- Devenick Subsea Isolation Valve (SSIV).

Pipelines & Umbilicals:

- The production pipeline, methanol pipeline and control umbilical connecting the Devenick manifold and the East Brae platform;
- Production flowlines and umbilicals connecting the S1 and S2 well locations to the Devenick manifold. The majority of both the flowlines and umbilicals remain buried. The short surface laid sections of the S2 flowlines and umbilical at the well and the manifold were removed and recovered to shore for recycling and disposal in 2017 along with S2 wellhead;
- Cooling spools forming part of the production flowlines at the S1 and S2 well locations; and
- The SSIV control umbilical.

Stabilisation materials:

- Concrete mattresses;
- Grout bags; and
- Rock cover.

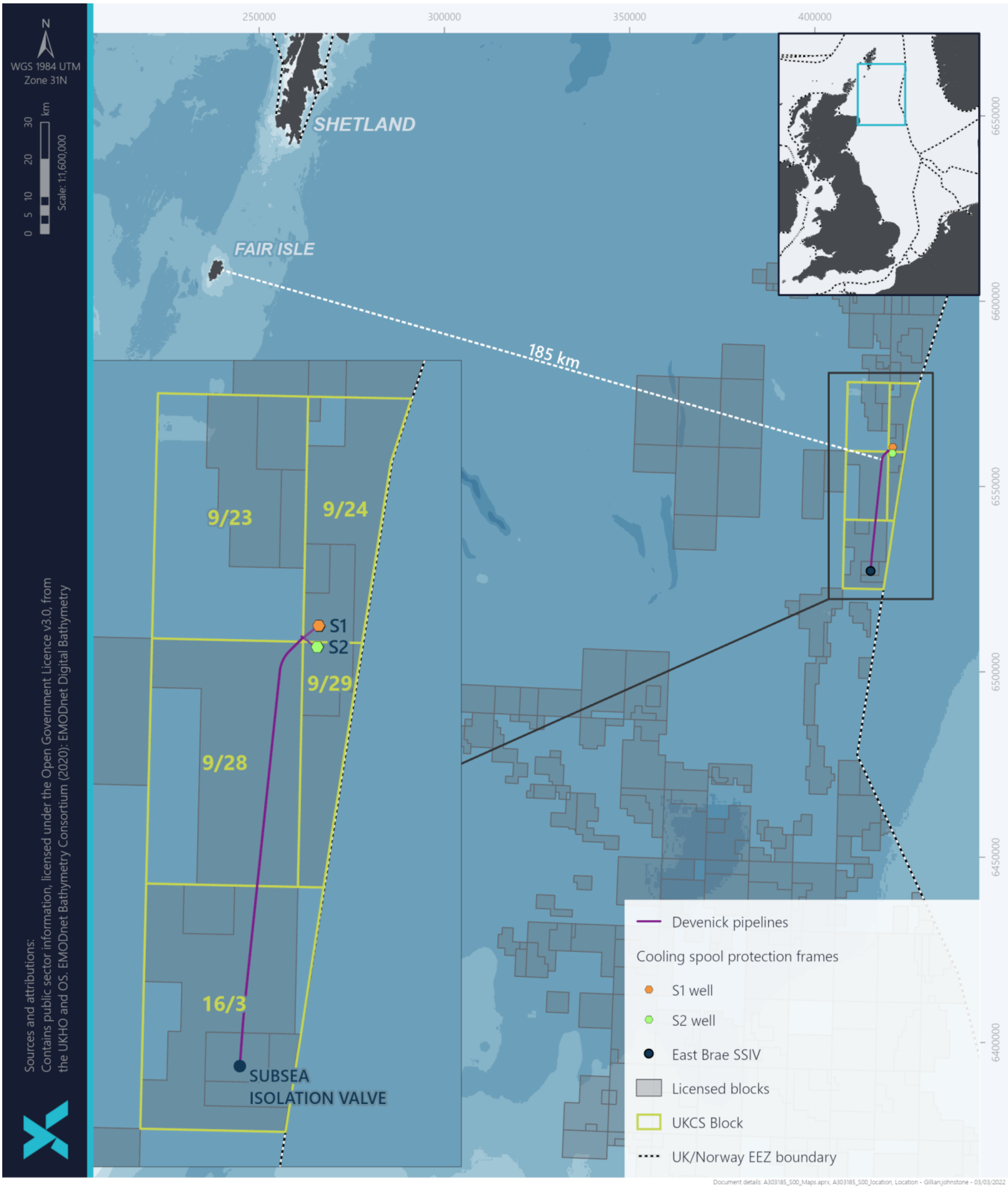


Figure A-1 Location of the Devenick subsea infrastructure

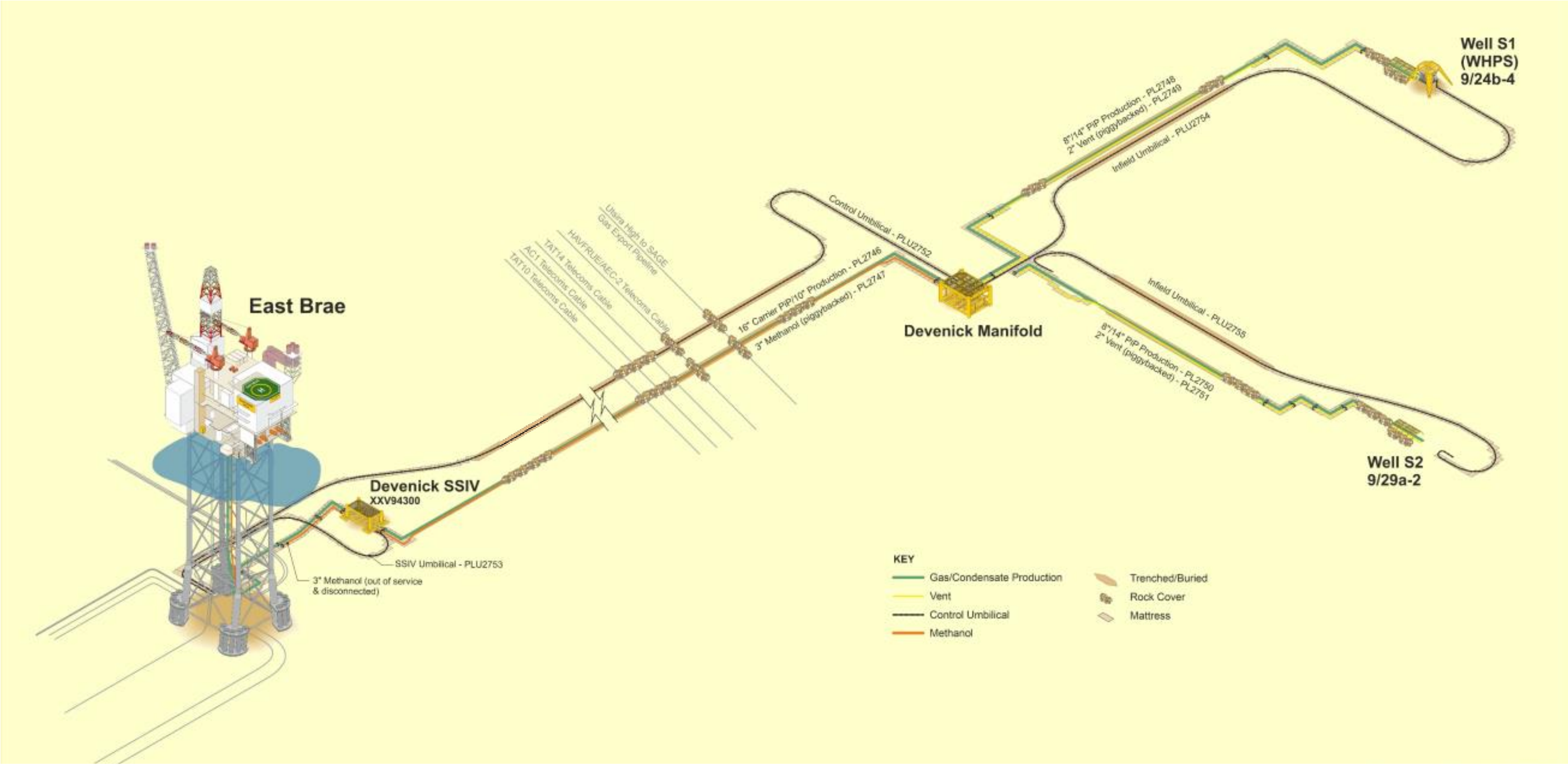


Figure A-2 Devenick infrastructure layout

Regulatory context

The decommissioning of offshore oil and gas infrastructure in the UKCS is principally governed by the Petroleum Act 1998, as amended by the Energy Act 2008, which sets out the requirements for a formal Decommissioning Programme (DP) and the approval process. The Department for Business, Energy and Industrial Strategy (BEIS) published Guidance Notes on Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1988 (BEIS, 2018). This Guidance describes a proportionate process that culminates in a streamlined EA Report to support the DP, which focuses on screening out of non-significant impacts and presents a detailed assessment of potentially significant impacts.

The Guidance (BEIS, 2018) also states that subsea installations (e.g., drilling templates, wellheads, and risers) must, where practicable, be completely removed for reuse or recycling or final disposal on land. With regards to pipelines (including flowlines and umbilicals), the Guidance (BEIS 2018) requires that these should be considered on a case-by-case basis, and highlights instances where pipelines could be decommissioned *in situ*. For example, pipelines that are adequately buried or trenched or which are expected to self-bury could be considered as candidates for *in situ* decommissioning. Where an Operator is considering decommissioning pipelines *in situ*, the decision-making process must be informed by 'Comparative Assessment' of the feasible decommissioning options. This Comparative Assessment takes account of safety, environmental, technical, societal and economic factors to arrive at a preferred decommissioning solution. Finally, the Guidance (BEIS, 2018) states that mattresses and grout bags installed to protect pipelines should be removed for disposal onshore, if their condition allows.

Proposed schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability of decommissioning services and contractual agreements. The potential window for Devenick decommissioning activities is between 2025 and 2030.

Options for decommissioning

TAQA used a Comparative Assessment process in line with the recommendations in relevant Guidance (BEIS, 2018) to determine the preferred decommissioning options for the Devenick pipelines and umbilicals.

Each decommissioning option was assessed against five criteria – safety, environment, technical, societal and economic. The CA outlined the decommissioning options available for the various types of pipelines. Recommended options for pipelines include the decommissioning *in situ* of any buried sections and associated rock cover. Any exposures and/or free-spans will be remediated with rock cover. Cut pipeline ends will also be remediated with rock (as a worst-case). Pipeline and umbilical lengths in close proximity (approximately 75 m) to the East Brae platform will be decommissioned *in situ*.

Surface-laid pipelines, subsea structures and stabilisation materials (including mattresses and grout bags) will be removed from the seabed. Rock covering the cooling spools will be re-located prior to the removal of the spools, and where possible, will be re-used to remediate any seabed depressions following the removal of the WHPS and the Devenick manifold foundation piles.

Environmental and socio-economic baseline

The key environmental and social sensitivities in the Devenick infrastructure area are summarised in Table A-1.

Table A-1 Key environmental and social sensitivities for the Devenick area

Sediment type and seabed features
The water depth around the Devenick infrastructure ranges from 115 m below Lowest Astronomical Tide (LAT) in the north to 130 m below LAT in the south. The annual mean wave height within the Devenick pipelines ranges from 2.49 m – 2.5 m, and current speeds are low. Survey work within the vicinity of the Devenick pipelines shows that the seabed sediments range from very fine sand in the north to very fine or coarse silt to the south, proximal to the East Brae Platform. This is consistent with mapped information which classifies this region of the North Sea as the EUNIS broadscale habitat A5.27 deep circalittoral sand and A5.37 "deep circalittoral mud". Numerous pockmarks were identified along the Harding to East Brae pipeline survey corridor, particularly to the south of the Braemar Pockmark SAC where they were observed in high density. They were also frequent in the southern half section of the eastern Harding to East Brae pipeline route, which is in close vicinity to the Devenick pipelines, with the largest pockmark measuring 100 m in diameter.
Sediment chemical composition
Hydrocarbon concentrations within the area surrounding the Devenick infrastructure are generally within expected background levels for the northern North Sea. However, the drill cuttings pile survey at East Brae revealed that the majority of samples within 250 m of the platform contained polyaromatic hydrocarbons and heavy metal concentrations which exceeded thresholds that represent the concentrations which are likely to be toxic to marine life. In addition, historical barium concentrations at the Devenick field and the Braemar field (3.5 km from the Devenick pipelines) exceeded background concentrations for the North Sea, likely attributed to historic cuttings discharge.
Seabed habitats and species
Invertebrate communities living within the sediments are dominated by polychaete and mollusc species, characteristic of background conditions in this part of the NNS. Seabed surveys indicated that species number and diversity was higher at the pockmarks present along the Devenick pipelines in comparison to the surrounding area. The polychaete *Paramphinome jeffreysii* was dominant across the surveys, indicating that the EUNIS biotope '*Paramphinome jeffreysii*, *Thyasira spp.* and *Amphiura filiformis* in offshore circalittoral sand or mud' (or similar) may be expected.
Fish and shellfish
The Devenick infrastructure lies within known spawning grounds for cod, saithe, Norway Pout and haddock, all at a low or undetermined intensity. The area is also a potential nursery ground for anglerfish, blue whiting, cod, European hake, haddock, herring, link, mackerel plaice, spotted ray, spurdog, whiting, Norway pout and sandeel. Plaice is the only species with a high intensity nursery ground. Published sensitivity maps indicate that the probability of aggregations of juvenile sole, plaice, blue whiting, horse mackerel, sprat, herring, cod, mackerel, anglerfish, hake, whiting, Norway pout and haddock in the area of Devenick decommissioning activities area is low.
Seabirds
Offshore in the NNS, the most numerous species present are likely to be northern fulmar, black-legged kittiwake and common guillemot. The Devenick infrastructure is located close to hotspots for little auk during the winter months, with low densities expected in the breeding season for the following species: northern fulmar, common guillemot, northern gannet, lesser black-backed gull, Atlantic puffin, black-legged kittiwake, herring gull, razorbill, great skua, common full and arctic skua. Seabird sensitivity to oil pollution in the region of the Devenick infrastructure is considered low from June to September / October and medium to extremely high between January and May. There are no data available for November and December.
Marine mammals
Harbour porpoise, Atlantic white-sided dolphin, white-beaked dolphin, minke whale and white-sided dolphin are the most abundant species recorded in the survey block covering the Devenick infrastructure. The harbour porpoise is the most frequently recorded cetacean in the vicinity of the Devenick

infrastructure, which is reflective of these being the most abundant and widely distributed cetaceans in the North Sea.

Both grey and harbour seal densities are known to be low 185 km offshore, and around the Devenick infrastructure, densities are predicted to be between 0 and 0.001% of the British Isles at-sea population per 25 km^2 for both species, which is considered low.

Conservation

There are no Nature Conservation Marine Protected Areas or Special Protection Areas within 40 km of the Devenick pipelines. However, the Braemar Pockmarks Special Area of Conservation lies approximately 1.5 km west of the pipelines (Figure 3.6). This designated site is protected for the Annex I habitat 'Submarine structures made by leaking gases'.

Higher densities (>10 individuals) of ocean quahog individuals (which are listed by OSPAR and as a Priority Marine Feature (PMF) in Scottish waters) were observed at the East Brae (28 adults) and Braemar Fields (71 adults). Low abundances of individual ocean quahog (<10 individuals) were also identified at Harding and Brae Bravo in surveys spanning from 1991 – 2019.

Sea-pens and other burrowing megafauna have been recorded in this region and identified during surveys at the pockmarks along the Devenick pipelines habitat assessment. This habitat is on the OSPAR list of threatened and/or declining habitats and species and is a PMF.

Fisheries and shipping
The Devenick infrastructure is located in International Council for the Exploration of the Sea (ICES) Rectangle 47F1 and 46F1. This region is primarily targeted for demersal species, however, shellfish and pelagic fish have also been targeted in ICES rectangle 46F1 in the last 5 years. Annual fishery landings by weight and value are considered low to moderate for demersal and pelagic fisheries in comparison to other areas of the North Sea. Fishing effort has remained low to moderate within this region for the last five fishing years and has decreased in ICES rectangle 47F1 and increased in ICES rectangle 46F1. Fishing effort is dominated by trawl fishing gears. Shipping density in the NNS in the vicinity of the proposed Devenick decommissioning activities is very low or low. Between 0 - 100 vessels transit through the area annually.
Other sea users
The proposed Devenick decommissioning operations are located in a well-developed area for oil and gas extraction. The closest piece of surface infrastructure is the East Brae platform where the Devencik pipelines and umbilicals terminate. The next closest piece of surface infrastructure is the Gudrun platform, 12.9 km south-east of the Devenick infrastructure. The pipeline also crosses two active and two disused telecommunications cables. There are no other cables or pipelines in the vicinity, no designated military practice and exercise areas, no offshore renewable or wind farm activity and no designated or protected wrecks nearby.

Impact assessment process

The environmental impact assessment has been informed by a number of different processes, including identification of potential environmental issues through project engineer and marine environmental specialist review during a desktop screening exercise, and consultation with key stakeholders (OPRED, Marine Scotland, JNCC and SFF).

An impact assessment exercise addressed the proposed decommissioning activities and any potential impacts these may pose. This discussion identified nine potential impact areas based on the chosen proposed removal method. Seven potential impacts were screened out of further assessment based on the low level of severity, or likelihood of significant impact occurring and two were carried forward for further assessment. An overview of the nine potential impacts is provided in Table A-2, together with justification statements for the screening decisions.

Table A-2 Environmental impact screening summary for the Devenick decommissioning

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Emissions to air	No	• Emissions generated by decommissioning activities are small relative to production. • Estimated CO_2 emissions to be generated by the selected decommissioning options are 5,215.72 te, equating to approx. 0.04% of total UKCS emissions (2018). • Large amount of this total arises from the re-manufacture of steel decommissioned *in situ* (1,593.09 te CO_2). Considering the above, atmospheric emissions do not warrant further assessment.	• Vessel management. • Minimal vessel use/ movement. • Vessel sharing where possible. • Engine maintenance.
Disturbance to the seabed	Yes	• Potential for disturbance to seabed during subsea decommissioning activities	See Section 5.2

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
		• Seabed impacts may range in duration from temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. • Potential impact of long-term discharges from degrading infrastructure on the receiving environment. On this basis, impacts to the seabed from project activities have been assessed further in Section 5.2	
Discharges to sea	No	• Discharges from vessels are typically well-controlled activities Considering the above, discharges to sea resulting from any vessel and subsea decommissioning activity will not be assessed further.	• MARPOL compliance. • Bilge management procedures. • Contractor management procedures.

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Physical presence of vessels in relation to other sea users	No	• Limited in duration • Similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities • Vessel activity will not occupy 'new' areas • Other sea users will be notified in advance of and subsequent to operations • The decommissioning of the Devenick infrastructure is estimated to require up to four vessels (plus a drill rig for well P&A), however these would not all be on location at the same time (max of two at any one time) Considering the above, temporary presence of vessels does not need further assessment.	• Minimal vessel use/movement • Notifications to Mariners
Physical presence of infrastructure decommissioned *in situ* in relation to other sea users	Yes	Considering the potential impact on the fishing industry of decommissioning the infrastructure *in situ*, the physical presence of infrastructure decommissioned *in situ* in relation to other sea users (namely commercial fisheries), has been fully assessed in Section 5.3.	See Section 5.3
Underwater noise emissions	No	• Aside from vessel noise and cutting activities, there will be no other noise generating activities. • Vessel presence and cutting activities will be limited in duration. • The project is not located within an area protected for marine mammals. • With industry-standard mitigation measures and adherence to JNCC guidance, EAs for offshore oil and gas decommissioning projects typically show no injury, or significant disturbance associated with these projects. On this basis, underwater noise assessment does not need assessed further.	• Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • Cutting activities will be minimised and carried out in isolation where possible.
Resource use	No	• Limited raw materials required (largely restricted to fuel use). • Estimated total energy usage for the activities is 67,306.88 GJ. • Some of the rock already used as protection material may be reused to mitigate seabed depressions, in which case some of the rock's embedded energy will be reused. • Material will be returned to shore as a result of project activities, expectation is to recycle c.95% of this returned material. Considering the above, resource use does not warrant further assessment.	• Adherence to the Waste Hierarchy • Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • Engine maintenance.

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Onshore impacts/ Waste	No	The waste to be brought to shore, which will be routine in nature (with the exception of one licenced, sealed source, which will be returned to shore and managed under the appropriate storage, transport and disposal permits/ routes) will be managed in line with TAQA's Waste Management Strategy and the Waste Hierarchy, as part of the project AWMP, using approved waste contractors and in liaison with the relevant Regulators. On this basis, no further assessment of waste is necessary.	• Overall 'Duty of Care' • Waste Management Strategy and Active waste tracking including close-out reporting • Adherence to the Waste Hierarchy • Selection of suitably licenced site and contractors • Communication with relevant Regulator(s) - e.g., SEPA established
Unplanned events	No	• Well P&A and pipeline flushing will be undertaken prior to decommissioning activities. • The East Brae OPEP (Reference 200033; TAQA, 2020) will be updated to cover the Devenick decommissioning activities. Any spills from vessels in transit and outside the 500 m zones are covered by a separate Shipboard Oil Pollution Emergency Plan (SOPEP). • Vessel fuel inventories are split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of a full inventory. • Dropped object procedures are industry-standard and there is only a very remote probability of any interaction with any live infrastructure. The *in situ* decommissioning of some infrastructure will also limit the potential for dropped objects or dislodged materials/objects. Considering the above, the potential impacts from accidental chemical/hydrocarbon releases or dropped objects during decommissioning activities do not warrant further assessment.	• OPEP in place for operations • SOPEP on all vessels • Navigational warnings in place • 500 m zones operational until seabed clearance certified • Contractor management and communication • Lifting operations management of risk • PON2 submission • Careful planning, management and implementation of activities

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Emissions to air	No	• Emissions generated by decommissioning activities are small relative to production. • Estimated CO_2 emissions to be generated by the selected decommissioning options are 5,215.72 te, equating to approx. 0.04% of total UKCS emissions (2018). • Large amount of this total arises from the re-manufacture of steel decommissioned *in situ* (1,593.09 te CO_2). Considering the above, atmospheric emissions do not warrant further assessment.	• Vessel management. • Minimal vessel use/ movement. • Vessel sharing where possible. • Engine maintenance.
Disturbance to the seabed	Yes	• Potential for disturbance to seabed during subsea decommissioning activities • Seabed impacts may range in duration from temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. • Potential impact of long-term discharges from degrading infrastructure on the receiving environment. On this basis, impacts to the seabed from project activities have been assessed further in Section 5.2	See Section 5.2
Discharges to sea	No	• Discharges from vessels are typically well-controlled activities Considering the above, discharges to sea resulting from any vessel and subsea decommissioning activity will not be assessed further.	• MARPOL compliance. • Bilge management procedures. • Contractor management procedures.

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Physical presence of vessels in relation to other sea users	No	• Limited in duration • Similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities • Vessel activity will not occupy 'new' areas • Other sea users will be notified in advance of and subsequent to operations • The decommissioning of the Devenick infrastructure is estimated to require up to four vessels (plus a drill rig for well P&A), however these would not all be on location at the same time (max of two at any one time) Considering the above, temporary presence of vessels does not need further assessment.	• Minimal vessel use/movement • Notifications to Mariners
Physical presence of infrastructure decommissioned *in situ* in relation to other sea users	Yes	Considering the potential impact on the fishing industry of decommissioning the infrastructure *in situ*, the physical presence of infrastructure decommissioned *in situ* in relation to other sea users (namely commercial fisheries), has been fully assessed in Section 5.3.	See Section 5.3
Underwater noise emissions	No	• Aside from vessel noise and cutting activities, there will be no other noise generating activities. • Vessel presence and cutting activities will be limited in duration. • The project is not located within an area protected for marine mammals. • With industry-standard mitigation measures and adherence to JNCC guidance, EAs for offshore oil and gas decommissioning projects typically show no injury, or significant disturbance associated with these projects. On this basis, underwater noise assessment does not need assessed further.	• Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • Cutting activities will be minimised and carried out in isolation where possible.
Resource use	No	• Limited raw materials required (largely restricted to fuel use). • Estimated total energy usage for the activities is 67,306.88 GJ. • Some of the rock already used as protection material may be reused to mitigate seabed depressions, in which case some of the rock's embedded energy will be reused. • Material will be returned to shore as a result of project activities, expectation is to recycle c.95% of this returned material. Considering the above, resource use does not warrant further assessment.	• Adherence to the Waste Hierarchy • Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • Engine maintenance.

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Onshore impacts/ Waste	No	The waste to be brought to shore, which will be routine in nature (with the exception of one licenced, sealed source, which will be returned to shore and managed under the appropriate storage, transport and disposal permits/ routes) will be managed in line with TAQA's Waste Management Strategy and the Waste Hierarchy, as part of the project AWMP, using approved waste contractors and in liaison with the relevant Regulators. On this basis, no further assessment of waste is necessary.	• Overall 'Duty of Care' • Waste Management Strategy and Active waste tracking including close-out reporting • Adherence to the Waste Hierarchy • Selection of suitably licenced site and contractors • Communication with relevant Regulator(s) - e.g., SEPA established
Unplanned events	No	• Well P&A and pipeline flushing will be undertaken prior to decommissioning activities. • The East Brae OPEP (Reference 200033; TAQA, 2020) will be updated to cover the Devenick decommissioning activities. Any spills from vessels in transit and outside the 500 m zones are covered by a separate Shipboard Oil Pollution Emergency Plan (SOPEP). • Vessel fuel inventories are split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of a full inventory. • Dropped object procedures are industry-standard and there is only a very remote probability of any interaction with any live infrastructure. The *in situ* decommissioning of some infrastructure will also limit the potential for dropped objects or dislodged materials/objects. Considering the above, the potential impacts from accidental chemical/hydrocarbon releases or dropped objects during decommissioning activities do not warrant further assessment.	• OPEP in place for operations • SOPEP on all vessels • Navigational warnings in place • 500 m zones operational until seabed clearance certified • Contractor management and communication • Lifting operations management of risk • PON2 submission • Careful planning, management and implementation of activities

Based on the initial screening, two aspects warrant further assessment within the EA as having potential environmental and/ or socioeconomic impacts. These are disturbance to the seabed and the physical presence of infrastructure decommissioned *in situ* in relation to other sea users. These two aspects are assessed further in Sections 5.2 and 5.3 of this EA respectively.

Environmental management

The project has limited activity associated with it beyond the main period of decommissioning. The focus of environmental performance management for the project is therefore to ensure that the activities that will take place during the limited period of decommissioning happen in a safe, compliant and acceptable manner. The primary mechanisms by which this will occur is through TAQA's certified Environmental Management System and Health, Safety, Security and Environment Policy. To support this, a project Health, Safety and Environment (HSE) Plan will outline how HSE issues will be managed and how policy will be implemented effectively. Performance will be measured to satisfy regulatory requirements, compliance with environmental consents and to identify progress on fulfilment of project objectives and commitments.

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

TAQA is committed to working towards the government policy of Net Zero in line with the OGA Stewardship Expectation 11 (OGA, 2021). This commitment includes decommissioning activities and is intended to drive increased energy efficiencies and minimise emissions. TAQA seeks to influence its joint venture partners and suppliers to ensure that everyone is striving to reduce and manage the emissions associated with Devenick decommissioning.

In terms of activities in the northern North Sea, the National Marine Plan has been adopted by the Scottish Government to help ensure sustainable development of the marine area. This Plan has been developed in line with UK, European Union (EU) and OSPAR legislation, directives and guidance. With regards to decommissioning, the National Marine Plan states that 'where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. As part of the conclusions to this assessment (Section 6), TAQA has given due consideration to the Scottish National Marine Plan during project decision making.

Conclusions

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

Having reviewed the project activities and taken into consideration: the remote offshore location of the Devenick Field; that the activities will have a small area of impact; that the benthos is likely to have a degree of natural resilience to sediment suspension; the availability of similar habitat within the context of the wider North Sea, as well as mitigation measures to limit impact, there is not expected to be a significant impact on the seabed environment or any European or nationally designated protected sites in proximity to the Devenick decommissioning activities.

The Devenick area experiences a low-moderate level of fishing activity. Trawling activity in the area, is mostly concentrated along pipelines without identified exposures. The average depth of burial for the pipelines ranges from 1.23 to 1.60 m. Depth of Burial (DoB) has increased over time since installation (Appendix A). All umbilicals are buried below the seabed and where historical exposures occurred; these have previously been remediated with spot rock cover (Appendix B). Pipelines which have existing exposures or free-spans along their lengths will be appropriately remediated during decommissioning removing any snagging risk to fisheries. Overall, there is not expected to be an impact on commercial fisheries from buried infrastructure decommissioned *in situ*.

1.0 INTRODUCTION

In accordance with the Petroleum Act 1998, TAQA Bratani Limited (TAQA), an established United Kingdom Continental Shelf (UKCS) operator and on behalf of the Section 29 notice holders, is applying to the Department for Business, Energy and Industrial Strategy (BEIS) to obtain approval for decommissioning the subsea infrastructure associated with the Devenick Field.

This Environmental Appraisal (EA) has been conducted to assess the potential environmental impacts that may result from undertaking the subsea decommissioning activities as part of the decommissioning of the Devenick pipelines and subsea infrastructure. This EA supports the combined Decommissioning Programmes (DPs) submitted to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), the offshore decommissioning regulator under BEIS. The DPs are submitted under Section 29 of the Petroleum Act 1998, and cover:

1. The Devenick subsea installations (S1 wellhead and xmas tree, Devenick manifold and cooling spool protection structures);
2. The associated pipelines and umbilicals and Subsea Isolation Valve (SSIV) structure; and
3. The retrospective recovery of the S2 wellhead and associated infrastructure (not included in the scope of this EA as subject to P&A).

1.1 Project overview

The Devenick Field and associated infrastructure lie in UKCS Blocks 16/3a, 16/3e, 9/24b, 9/24c, 9/28c and 9/29a in a water depth of approximately 115 - 130 m, approximately 185 km south east of Fairisle, 310 km north east of Aberdeen and approximately 4 km west of the UK/Norway median line. Production is exported to the East Brae platform in Block 16/03a. The Devenick pipelines run for approximately 33.8 km between the Devenick manifold and East Brae Platform.

The Devenick Field started production of gas condensate in 2012 as a subsea tieback to East Brae. A CoP application for the Devenick Field was submitted in July 2021 and accepted by the Oil and Gas Authority (OGA) in September 2021 with a CoP of no earlier than January 2022.

The decommissioning activities were prioritised in three phases according to risk, opportunity and support of ongoing production. Activities commenced with disconnection and permanent P&A of two of the Devenick Field wells (the S2 Well in Phase 1, followed by the E&A Well in Phase 2). Phases 1 and 2 are complete, this EA supports the Phase 3 work.

Phase 3 covers P&A of the S1 Well and decommissioning and dismantling of the remaining Devenick subsea infrastructure. These decommissioning activities may be integrated with the overall decommissioning programme for the wider Brae Area facilities to maximise synergies, optimise the use of resources and minimise disturbance of the environment.

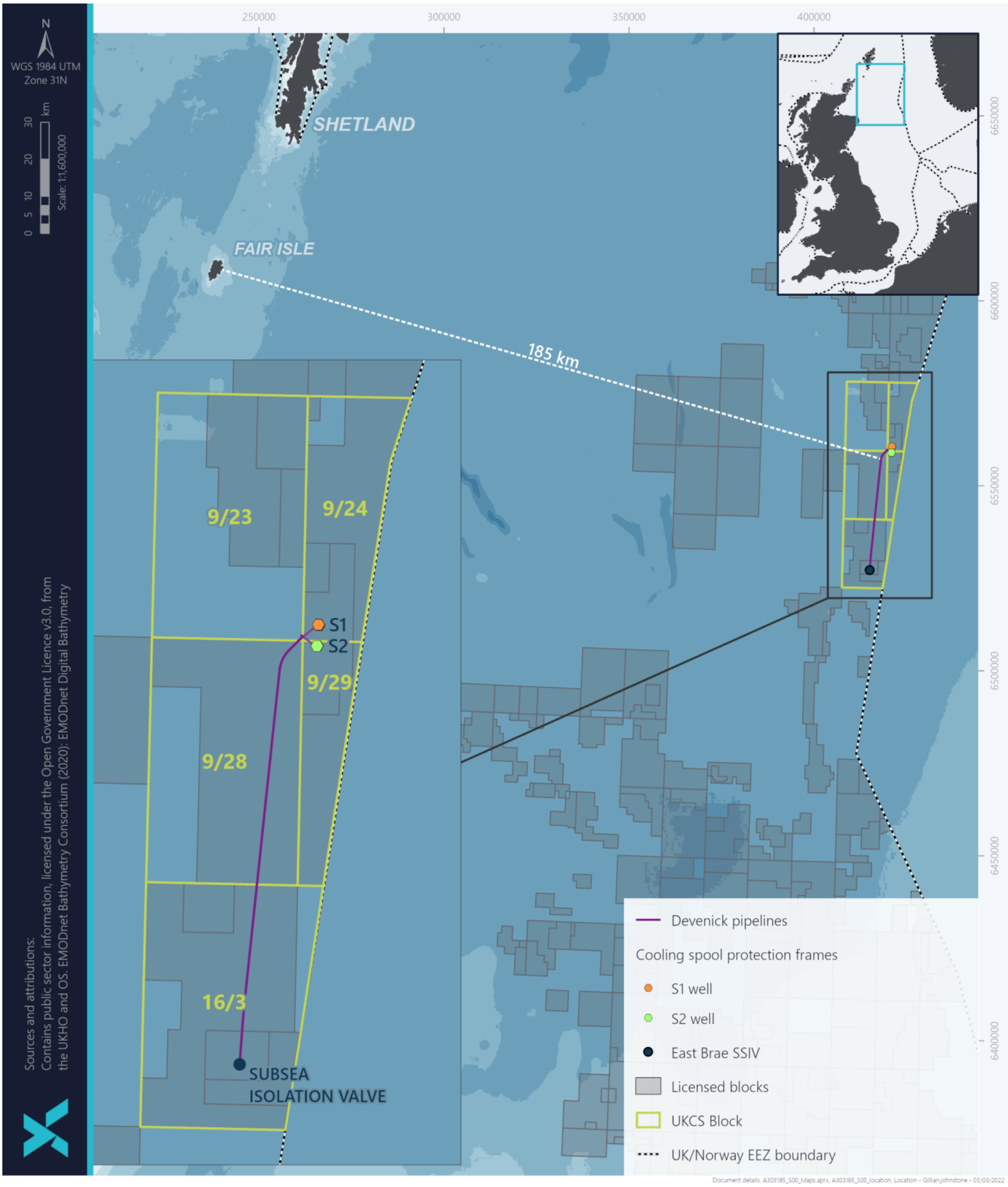


Figure 1.1 Location of the Devenick subsea infrastructure

1.2 Purpose of the environmental appraisal

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

1.3 Regulatory context

1.3.1 Legislation and guidance

The decommissioning of offshore oil and gas installations and pipelines on the UKCS is controlled through the Petroleum Act 1998 (as amended). Decommissioning is also regulated under the Marine and Coastal Act 2009 and Marine (Scotland) Act 2010. The UK's international obligations on decommissioning are primarily governed by the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (the Oslo Paris (OSPAR) Convention). The responsibility for ensuring compliance with the Petroleum Act 1998 rests with BEIS.

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

The latest guidance (BEIS, 2018) states that subsea installations (e.g., wellhead protection structures, manifolds) must, where practicable, be completely removed for reuse or recycling or final disposal on land. Any foundation piles used to secure such installations in place should be cut below natural seabed level at such a depth as to ensure that any remains are unlikely to become uncovered. With regards to pipelines (including flowlines and umbilicals), these should be considered on a case-by-case basis. The guidance does provide general advice regarding removal for two categories of pipelines:

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

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

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

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

In terms of activities in the NNS, the Scottish National Marine Plan has been adopted by the Scottish Government to help ensure sustainable development of the marine area and will be considered throughout this EA. This Plan has been developed in line with UK, European Union (EU) and OSPAR legislation, directives and guidance. With regards to decommissioning the Plan states that 'where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process. TAQA has given due consideration throughout this EA to the National Marine Plan during Project decision making and the interactions between the Project and Plan.

1.4 Scope and structure of this environmental appraisal report

This EA report describes, in a proportionate manner, the potential environmental impacts of the proposed activities associated with decommissioning of the Devenick subsea infrastructure demonstrates the extent to which these can be mitigated and controlled to an acceptable level. This is achieved in the following sections, which cover:

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

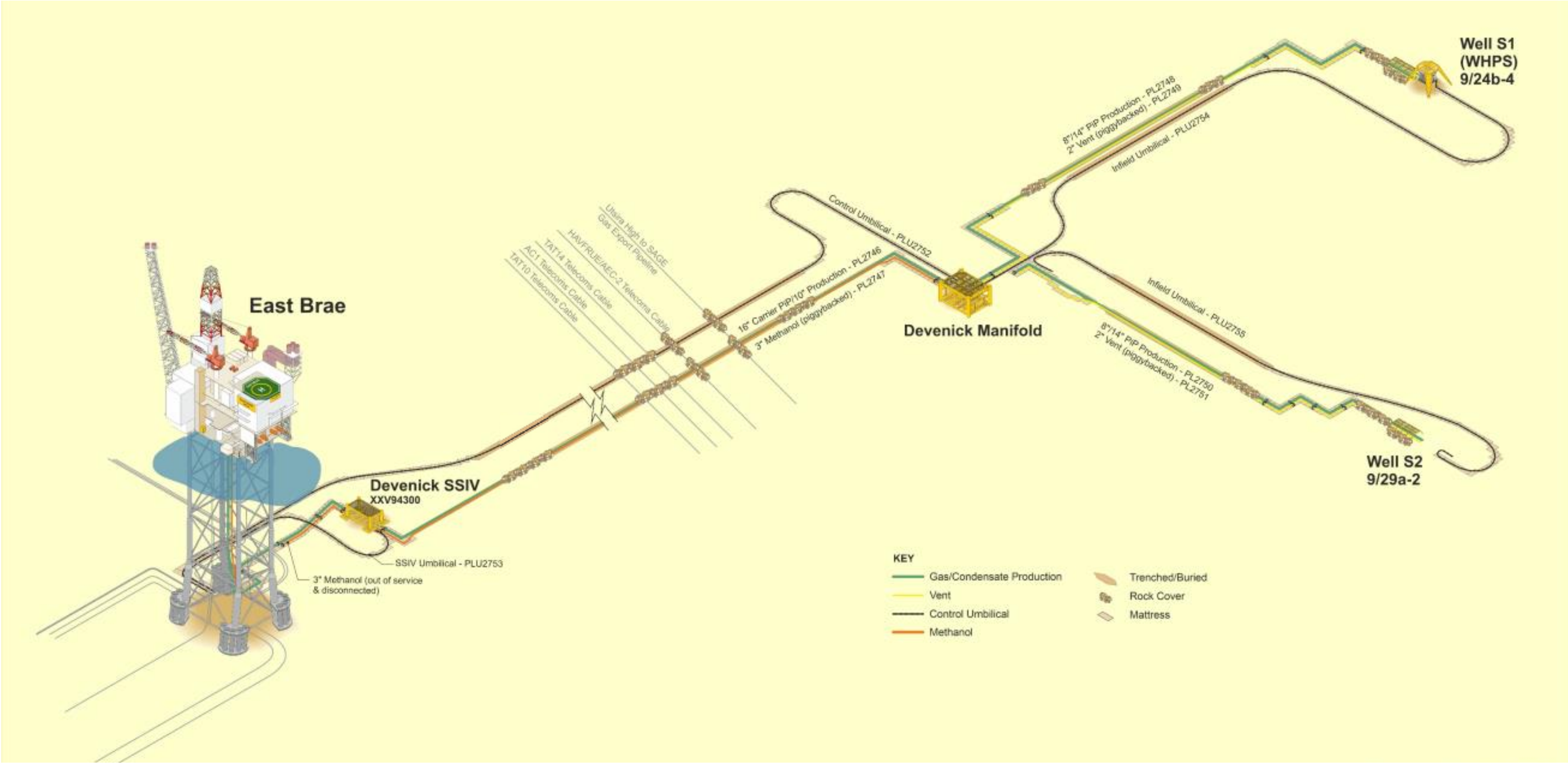


Figure 1.2 The Devenick pipelines and subsea infrastructure

2 PROJECT SCOPE

2.1 Description of the infrastructure being decommissioned

2.1.1 Well plug and abandonment

The remaining 9/24b-4 (S1) wellhead is due for plug and abandonment (P&A) at the commencement of decommissioning activities, as part of Phase 3, and will be subject to environmental permitting outwith the scope of the decommissioning activities described here. However, as per the BEIS (2018) Guidance, this EA also assesses the removal of the S1 wellhead protection structure (WHPS) as a subsea structure. The 9/29a-2Z (S2) well was plugged and abandoned, and the tree removed in 2015. The S2 wellhead was recovered to shore for recycling and disposal in 2017 under Phase 1 of the decommissioning plan.

2.1.2 Decommissioning campaign

The facilities included in the Devenick subsea decommissioning campaign and therefore the scope of this EA, include the infrastructure listed below. Information on the dimensions, weight and status of this infrastructure is included in Table 2.1 to Table 2.5.

Subsea structures (Table 2.1):

- Devenick manifold;
- 9/24b-4 (S1) WHPS;
- S1 and S2 cooling spool protection frames; and
- Devenick Subsea Isolation Valve (SSIV).

Pipelines and Umbilicals (Table 2.2):

- The production pipeline (PL2746), methanol pipeline (PL2747) and control umbilical (PLU2762) connecting the Devenick manifold and the East Brae platform;
- Pipelines and umbilicals connecting the S1 and S2 well locations to the Devenick manifold (PL2748, PL2749, and PLU2754 and PL2750, PL2751, and PLU 2755 respectively). The short surface laid sections of the S2 pipelines and umbilical at the well and the manifold were removed and recovered to shore for recycling and disposal in 2017;
- Cooling spools forming part of the production flowlines at the S1 and S2 well locations beneath the protection frames listed in Table 2.1; and
- The SSIV control umbilical, PLU2753.

Stabilisation materials:

- Concrete mattresses (Table 2.3);
- Grout bags (Table 2.4); and
- Rock cover (Table 2.5).

Table 2.1 Subsea installations

Item	No.	Size (m) [LxWxH]	Weight (te)	Location		Comments / Status
Devenick Manifold	1	14 x 8.5 x 6	242.0	WGS84 Decimal	59.169 N 1.600 E	Includes various equipment including valves, control modules, flowmeter, distribution units and control jumpers and is secured to the seabed by four foundation piles.
				WGS84 Decimal Minute	59 10' 09.225" N 01 36' 00.957" E	
Devenick SSIV	1	10.75 x 6.5 x 4.25	72.5	WGS84 Decimal	58.877 N 1.528 E	Located within the East Brae Platform 500m safety zone.
				WGS84 Decimal Minute	58 52' 38.803" N 01 31' 42.624" E	
S1 WHPS	1	14 x 14 x 7	120.0	WGS84 Decimal	59.177 N 1.619 E	Secured to the seabed by four steel foundation piles.
				WGS84 Decimal Minute	59 10' 36.681" N 01 37' 09.904" E	
Debris from S2 P&A activity	>1	Approx. 2 x 2 x 2	20	WGS84 Decimal	59.163 N 1.618 E	The removal of the S2 wellhead broke up the concrete that formed the cement plug, resulting in a number of concrete "boulders" on the seabed at the S2 well location.
				WGS84 Decimal Minute	59 09' 45.809" N 01 37' 04.710" E	
S1 Protection Frame Type A	1	15 x 5.2 x 2.5	40.0	WGS84 Decimal	59.177 N 1.620 E	Part of Section S1 Cooling Spool Protection Frame. This frame is protected by rock cover.
				WGS84 Decimal Minute	59 10' 37.006" N 01 37' 09.397" E	
S1 Protection Frame Type B	1	15 x 5.2 x 2.5	35.0	WGS84 Decimal	59.177 N 1.620 E	Part of Section S1 Cooling Spool Protection Frame. This frame is protected by rock cover.
				WGS84 Decimal Minute	59 10' 37.307" N 01 37' 08.818" E	
S1 Protection Frame Type C	1	15 x 5.2 x 2.5	32.5	WGS84 Decimal	59.177 N 1.620 E	Part of Section S1 Cooling Spool Protection Frame. This frame is protected by rock cover.
				WGS84 Decimal Minute	59 10' 37.654" N 01 37' 08.154" E	
S1 Protection Frame Type D	1	18 x 3.9 x 1.5	28.0	WGS84 Decimal	59.177 N 1.619 E	Part of Section S1 Cooling Spool Protection Frame. This frame is protected by rock cover
				WGS84 Decimal Minute	59 10' 38.032" N 01 37' 07.425" E	
S2 Protection Frame Type A	1	15 x 5.2 x 2.5	40.0	WGS84 Decimal	59.163 N 1.618 E	Part of Section S2 Cooling Spool Protection Frame. This frame is protected by rock cover
				WGS84 Decimal Minute	59 09' 45.809" N 01 37' 04.710" E	
S2 Protection Frame Type B	1	15 x 5.2 x 2.5	35.0	WGS84 Decimal	59.163 N 1.618 E	Part of Section S2 Cooling Spool Protection Frame. This frame is protected by rock cover
				WGS84 Decimal Minute	59 09' 45.802" N 01 37' 04.040" E	
S2 Protection Frame Type C	1	15 x 5.2 x 2.5	32.5	WGS84 Decimal	59.163 N 1.618 E	Part of Section S2 Cooling Spool Protection Frame. This frame is protected by rock cover
				WGS84 Decimal Minute	59 09' 46.502" N 01 37' 03.343" E	
S2 Protection Frame Type D	1	18 x 3.9 x 1.5	28.0	WGS84 Decimal	59.163 N 1.617 E	Part of Section S2 Cooling Spool Protection Frame. This frame is protected by rock cover
				WGS84 Decimal Minute	59 09' 46.880" N 01 37' 02.621" E	

Table 2.2 Pipelines and umbilicals

Description	PL No	Diameter	Length (km)	Component Parts	Product Conveyed	From – To	Burial Status	Pipeline Status	Current Content
Production Pipeline	PL 2746	10"/16"	33.817	PIP – 16" Carbon steel outer, 10" 13%Cr inner, insulation between	Hydrocarbon	Devenick Manifold – East Brae Platform	Trenched, backfilled with spot rock cover	Operational	Production Fluids & Chemicals
Methanol Pipeline	PL 2747	3"	33.804	Piggybacked to PL 2746	Methanol	East Brae Platform – Devenick Manifold	Trenched, backfilled with spot rock cover	Out of Service	Methanol
S1 Production Pipeline	PL 2748	8"/14"	1.490	PIP – 14" Carbon steel outer, 8" 13%Cr inner, insulation between	Hydrocarbon	Well S1 – Devenick Manifold	Trenched, backfilled with spot rock cover	Operational	Production Fluids & Chemicals
S1 Methanol 2" Service Line	PL 2749	2"	1.490	Piggybacked to PL 2748	Methanol	Well S1 – Devenick Manifold	Trenched, backfilled with spot rock cover	Operational	Methanol
S2 Production Pipeline	PL 2750	8"/14"	1.28	PIP – 14" Carbon steel outer, 8" 13%Cr inner, insulation between	Methanol	Well S2 – Devenick Manifold	Trenched, backfilled with spot rock cover	Out of Service	MEG (S2 Well never produced)
S2 2" Service Line	PL 2751	2"	1.28	Piggybacked to PL 2750	Methanol	Well S2 – Devenick Manifold	Trenched, backfilled with spot rock cover	Out of Service	Methanol
Control Umbilical	PLU 2752	105 mm	33.780	Composite Flexible	Chemicals & Power	East Brae Platform – Devenick Manifold	Trenched and backfilled, with spot rock cover & rock cover at crossings	Operational	Methanol; & Hydraulic fluid,
SSIV Control Umbilical	PLU 2753	71.3 mm	0.5	Composite Flexible	Chemicals & Power	East Brae Platform – Devenick SSIV	Surface laid on seabed	Operational	Methanol & Hydraulic fluid,
S1 Infield Control Umbilical	PLU 2754	98.6 mm	1.510	Composite Flexible	Chemicals & Power	Devenick Manifold – Subsea Umbilical Termination	Trenched, backfilled with spot rock cover	Operational	Methanol, Scale Inhibitor & Hydraulic fluid
S2 Infield Umbilical	PLU 2755	115 mm	1.390	Composite Flexible	Chemicals & Power	Devenick Manifold – Umbilical Termination Assembly	Trenched, backfilled with spot rock cover	Out of Service	Methanol, Scale Inhibitor & Hydraulic fluid

Table 2.3 Concrete mattresses

Location	Number	Total Weight (te)*	Exposed/Buried/Condition
Over PL2746 & Piggybacked PL2747 at East Brae Platform	67	314.9	Exposed on seabed
Over PL2746 & Piggybacked PL2747 at Manifold	29	136.3	
Over Control Umbilical PLU2752 at East Brae Platform	43	202.1	
Over Control Umbilical PLU2752 at Devenick Manifold	59	277.3	
Over SSIV Control Umbilical PLU2753 at East Brae Platform to Devenick SSIV structure	16	75.2	
PL2748 & piggybacked PL2749 at Manifold	31	145.7	
PL2748 & piggybacked PL2749 at Well S1	33	155.1	
S1 Well Control Umbilical PLU2754 at Manifold	17	79.9	
S1 Well Control Umbilical PLU2754 at Well S1	48	225.6	
PL2750 & piggybacked PL2751 at Manifold	24	112.8	
PL2750 & piggybacked PL2751 at Well S2	30	141.0	
S2 Well Control Umbilical PLU2755 at Manifold	20	94.0	
S2 Well Control Umbilical PLU2755 at Well S2	58	272.6	
TOTAL	**475**	**2,232.5**	

*Each mattress weights approximately 4.7 te. Approximate mattresses dimensions are 6 m (L) x 4 m (W).

Table 2.4 Grout bags

Location	Type	Number	Weight (te)*	Exposed/Buried/Condition
Over PL2746 at East Brae Platform	Salt Sack/Grout Gabion	80	2.0	Exposed on seabed
Over PL2746 at East Brae Platform	Grout Bags	30	0.75	
Over PL2747 at East Brae Platform	Grout Bags	10	0.25	
Over PL2746 at Manifold	Salt Sack/Grout Gabion	120	3.0	
PL2750 & piggybacked PL2751 at Manifold	Grout Bags	60	1.5	
PL2750 & piggybacked PL2751 at Manifold	Grout Bags	480	12	
	TOTAL	**780**	**19.5**	

*Each grout bag weighs 25kg. Each gabion includes 40 grout bags and as a whole, weighs 1 te.

Table 2.5 Rock placement (As-laid)

Location	Weight (te)	Exposed/Buried/Condition
Over PL2746 and Piggybacked PL2747	UHB* = 33,000, Crossings 16,300 Total 49,300	Exposed on seabed
Over Control Umbilical PLU2752	Crossings Total 4,800	
PL2748 & piggybacked PL2749	UHB Total 7,600	
PL2750 & piggybacked PL2751	UHB Total 7,600	
Over PL2746 and Piggybacked PL2747	UHB = 33,000, Crossings 16,300 Total 49,300	
Over Control Umbilical PLU2752	Crossings Total 4,800	
PL2748 & piggybacked PL2749	UHB Total 7,600	
PL2750 & piggybacked PL2751	UHB Total 7,600	
TOTAL	**69,300**	

*Upheaval Buckling protection (as laid)

2.2 Comparative assessment

Under the Petroleum Act 1998 and as described in the BEIS (2018) Guidance, a detailed Comparative Assessment (CA) is required to identify the recommended option for decommissioning the Devenick pipelines.

2.2.1 CA overview

The overall methodology for Devenick CA was as follows:

- Review the inventory of subsea facilities to identify generic segments into which the facilities may be classified;
- Carry out CA for each generic segment type to determine the preferred decommissioning option for that segment or group;
- Break the Devenick infrastructure down into constituent segments, classify each segment according to its generic type and match each segment to a decommissioning option;
- Finalise selection of options; and
- Perform formal write-up detailing process and outcomes obtained.

The pipeline segments identified during the CA are listed in Table 2.6

Table 2.6 Pipeline segments identified

Segment number	Segment type
A.1	Fabricated Steel Structures (forming part of pipelines)
B.1.1	Buried/Trenched Pipeline (Top of Pipe more than 600 mm below seabed)
B.1.2	Buried/Trenched Pipeline (Top of Pipe less than 600 mm below seabed)
B.2.1.1	Surface Laid Pipeline (Mattress/Grout Bag Protection)
B.2.1.2	Surface Laid Pipeline (Rock Cover Protection)
B.2.2	Surface Laid Pipeline (No protection)
C.1	Fishing Critical Span (Pipeline, cable or umbilical)
C.2	Integrity Critical Span (Pipeline, cable or umbilical)
C.3	Non-critical Span (Pipeline, cable or umbilical)
D.1	Buried/Trenched Cable (Top of Cable below seabed level)
D.2	Surface Laid Cable (Mattress/grout bag protection/stabilisation)
E.1	Buried/Trenched Umbilical (Top of Umbilical below seabed level)
E.2.1	Surface Laid Umbilical (Mattress / Grout bag protection/stabilisation)
E.2.2	Surface Laid Umbilical (Rock cover protection/stabilisation)
E.2.3	Surface Laid Umbilical (Rock cover protection/stabilisation)
F.1	Live Crossing (TAQA asset crossing a live third-party asset)
F.2	Dead Crossing (All lines in crossing are dead)

The Brae Area subsea infrastructure CA process follows a qualitative approach where segment decommissioning options were classified from ‘Most Preferred’ to ‘Least Preferred’. Options included full removal, partial removal and decommission *in situ* options for each segment. For some segments, only two options were identified. For other segments up to four options were identified.

For each segment, the options were classified from most preferred to least preferred irrespective of the number of options for that segment. The classification was performed as a balanced consideration of the five CA criteria derived from BEIS (2018) and OEUK (Offshore Energy UK [formally known as OGUK]) (2015) Guidance. The criteria and associated sub-criteria are listed in Table 2.7.

Table 2.7 Primary and sub-criteria for the CA process

Primary Criteria (weighting)	Sub-criteria
1 – Health and Safety	Operations Personnel
	Other Users
2 – Environmental impact	Energy Consumption / Emissions
	Impacts of Option
3 – Technical Feasibility	Technical Feasibility / Challenge
4 – Socio-economic impact	Commercial Impact on Fisheries
	Wider Community Impact
5 – Economic feasibility	Total Project Cost
	Long-term Costs

A CA workshop was undertaken to explain the CA process and obtain feedback from stakeholders as part of the overall Brae Area subsea facilities CA development (TAQA, 2022). The acceptability of decommissioning options was discussed and recorded and the most preferred decommissioning option for each segment was identified. An overview of the current burial status for each pipeline and umbilical is also included in Table 2.8. Depth of Burial profiles for each of the pipelines are provided in Appendix A and B.

Table 2.8 Most preferred decommissioning methods for Devenick pipelines and umbilicals

<table>
<tr><th>Equipment</th><th>Description</th><th>Segment Type / Selected Decommissioning Option</th></tr>
<tr><td>PL2746 Production Pipeline</td><td>The pipeline runs from the East Brae platform to the Devenick Manifold.
10” / 16” PiP, 33.8 km long. The pipeline is trenched and back filled with spot rock cover over most of its length.
The initial ≈ 340 m of the pipeline at the East Brae platform and final ≈ 150 m at the Devenick manifold are surface laid and mattress protected.
Where not surface laid, PL2746 remains buried below the seabed surface. The greatest depth of burial has been recorded at 2.9m and the average depth of burial is calculated to be 1.49m (Appendix A).</td><td rowspan="2">B.1.1: Buried/Trenched Pipeline (Top of Pipe more than 600mm below seabed)
Leave in place (make safe and remediate any exposed ends)

B.1.2: Buried/Trenched Pipeline (Top of Pipe less than 600mm below seabed)
The lengths of the Devenick pipelines that are buried at a shallower depth than 600mm will be assessed and remediated, with rock cover or retrenching following consultation with OPRED.

B.2.1.1: Surface Laid Pipeline (Mattress / Grout Bag Protection)
Pipeline not in close proximity to derogated sub-structure footings: Remove protection and pipeline to shore for reuse, recycling, or appropriate disposal.
Pipeline in close proximity to derogated sub-structure footings: Leave in situ.

B.2.2: Surface Laid Pipeline (No protection)
Pipeline not in close proximity to derogated sub-structure footings: Remove to shore for reuse, recycling, or appropriate disposal.
Pipeline in close proximity to derogated sub-structure footings: Leave in situ.</td></tr>
<tr><td>PL2747 Methanol Pipeline</td><td>The pipeline runs from the East Brae platform to the Devenick Manifold.
3” Pipeline piggybacked on PL2746, 33.8 km long. The pipeline is trenched and back filled over most of its length with spot rock cover.
The initial ≈ 340 m of the pipeline at the East Brae platform and final ≈ 150 m at the Devenick manifold are surface laid and mattress protected.
This piggybacked pipeline is trenched and buried over 0.6 m beneath the seabed surface (Appendix A)</td></tr>
</table>

<table>
<tr><th>Equipment</th><th>Description</th><th>Segment Type / Selected Decommissioning Option</th></tr>
<tr><td>PL2748 S1 Production Pipeline</td><td>The pipeline runs from the Devenick Manifold to the S1 well.
8” / 14” PiP, 1.49 km long. The pipeline is trenched and back filled cover over most of its length with spot rock.
The initial ≈ 110 m of the pipeline at the manifold and the final ≈ 170 m of the pipeline between the trench transition and cooling spool protection structures at the S1 well are surface laid and mattress protected.
Where not surface laid, the main body of PL2748 remains buried below the seabed surface. The greatest depth of burial has been recorded at 2.05m and the average depth of burial is calculated to be 1.23m (Appendix A).</td><td rowspan="2">B.1.1: Buried/Trenched Pipeline (Top of Pipe more than 600mm below seabed)
Leave in place (make safe any exposed ends).

B.1.2: Buried/Trenched Pipeline (Top of Pipe less than 600mm below seabed)
The lengths of the Devenick pipelines that are buried at a shallower depth than 600mm will be assessed and remediated. Remediation will probably be rock cover, as a rock cover vessel will be present for decommissioning and rock cover is a more efficient means of mitigating these short lengths of shallow buried pipeline that retrenching them. However other appropriate remediation measures may be adopted if this is the case remediation measures will be discussed and agreed with OPRED before implementation.

B.2.1.1: Surface Laid Pipeline (Mattress / Grout Bag Protection)
Pipeline not in close proximity to derogated sub-structure footings: Remove protection and pipeline to shore for reuse, recycling, or appropriate disposal. Pipeline in close proximity to derogated sub-structure footings: Leave in situ.

B.2.2: Surface Laid Pipeline (No protection)
Pipeline not in close proximity to derogated sub-structure footings: Remove to shore for reuse, recycling, or appropriate disposal.</td></tr>
<tr><td>PL2749 S1 Methanol Pipeline</td><td>The pipeline runs from the Devenick Manifold to the S1 well.
2” Pipeline piggybacked on PL 2748, 1.49 km long. The pipeline is trenched and back filled over most of its length with spot rock cover.
The initial ≈ 110 m of the pipeline at the manifold and the final ≈ 170 m of the pipeline between the trench transition and cooling spool protection structures at the S1 well are surface laid and mattress protected.
The trenched and buried portions of the pipeline are over 0.6 m beneath the seabed (Appendix A).</td></tr>
</table>

<table>
<tr><th>Equipment</th><th>Description</th><th>Segment Type / Selected Decommissioning Option</th></tr>
<tr><td>PL2750 S2 Production Pipeline</td><td>The pipeline runs from the Devenick Manifold to the S2 well.

8” / 14” Pip, 1.28 km long. The pipeline is trenched and back filled cover over most of its length with spot rock.

The initial ≈ 130 m of the pipeline at the manifold and the final ≈ 175 m of the pipeline between the trench transition and cooling spool protection structures at the S2 well site are surface laid and mattress protected.

Where not surface laid, the main body of PL2750 remains buried below the seabed surface. The greatest depth of burial has been recorded at 3.25 m and the average depth of burial is calculated to be 1.6m (Appendix A).</td><td rowspan="2">B.1.1: Buried/Trenched Pipeline (Top of Pipe more than 600mm below seabed)
Leave in place (make safe any exposed ends).

B.1.2: Buried/Trenched Pipeline (Top of Pipe less than 600mm below seabed)
The lengths of the Devenick pipelines that are buried at a shallower depth than 600mm will be assessed and remediated. Remediation will probably be rock cover, as a rock cover vessel will be present for decommissioning and rock cover is a more efficient means of mitigating these short lengths of shallow buried pipeline that retrenching them. However other appropriate remediation measures may be adopted. If this is the case remediation measures will be discussed and agreed with OPRED before implementation.

B.2.1.1: Surface Laid Pipeline (Mattress / Grout Bag Protection)
Pipeline not in close proximity to derogated sub-structure footings: Remove protection and pipeline to shore for reuse, recycling, or appropriate disposal.

B.2.2: Surface Laid Pipeline (No protection)
Pipeline not in close proximity to derogated sub-structure footings: Remove to shore for reuse, recycling, or appropriate disposal.</td></tr>
<tr><td>PL2751 S2 Vent Pipeline</td><td>2” Pipeline piggybacked on PL 2750, 1.28 km long. The pipeline is trenched and back filled over most of its length with spot rock cover.

The pipeline runs from the Devenick Manifold to the S2 Well site.

The initial ≈ 130 m of the pipeline at the manifold and final ≈ 175 m of the pipeline between the trench transition and cooling spool protection structures at the S2 well site is surface laid and mattress protected.</td></tr>
</table>

Equipment	Description	Segment Type / Selected Decommissioning Option
PLU2752 Control Umbilical	The umbilical runs from the East Brae platform to the Devenick Manifold. 105 mm composite flexible umbilical, 33.78 km long. The umbilical is trenched and back filled over most of its length (Appendix B) with spot rock cover. The initial ≈ 225 m of the umbilical at the East Brae platform and final ≈ 170 m at the Devenick manifold are surface laid and mattress protected.	**E.1: Buried/Trenched Umbilical (Top of umbilical below seabed)** Leave in place (make safe any exposed ends). **E.2.1: Surface Laid Umbilical (Mattress / Grout Bag Protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove protection and umbilical to shore for reuse, recycling, or appropriate disposal. Umbilical in close proximity to derogated sub-structure footings: Leave *in situ*. **E.2.3: Surface Laid Umbilical (No protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove to shore for reuse, recycling, or appropriate disposal. Umbilical in close proximity to derogated sub-structure footings: Leave *in situ*.
PLU2754 S1 Infield Control Umbilical	The umbilical runs from the Devenick Manifold to the S1 well. 98.6 mm composite flexible umbilical, 1.51 km long. The umbilical is trenched and back filled over most of its length with spot rock cover (Appendix B). The initial ≈ 170 m length of the umbilical at the manifold and final ≈ 260 m length of the umbilical at the S1 wellsite are surface laid and mattress protected.	**E.1: Buried/Trenched Umbilical (Top of umbilical below seabed)** Leave in place (make safe any exposed ends). **E.2.1: Surface Laid Umbilical (Mattress / Grout Bag Protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove protection and umbilical to shore for reuse, recycling, or appropriate disposal. **E.2.3: Surface Laid Umbilical (No protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove to shore for reuse, recycling, or appropriate disposal.

Equipment	Description	Segment Type / Selected Decommissioning Option
PLU2755 S2 Infield Control Umbilical	The umbilical runs from the Devenick Manifold to the S2 well. 115 mm composite flexible umbilical, 1.39 km long. The umbilical is trenched and back filled (Appendix B) over most of its length with spot rock cover. The initial ≈ 180 m length of the umbilical at the manifold and final ≈ 235 m length of the umbilical at the S2 wellsite are surface laid and mattress protected. Note: Some surface laid portions of the umbilical at the Manifold and the S2 wellhead removed to shore in 2015 for appropriate recycling or disposal.	**E.1: Buried/Trenched Umbilical (Top of umbilical below seabed)** Leave in place (make safe any exposed ends). **E.2.1: Surface Laid Umbilical (Mattress / Grout Bag Protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove protection and umbilical to shore for reuse, recycling, or appropriate disposal. Umbilical in close proximity to derogated sub-structure footings: Leave *in situ*. **E.2.3: Surface Laid Umbilical (No protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove to shore for reuse, recycling, or appropriate disposal.
Live Crossings: PL2746, PL2747 and PLU2752 crossings with AC1 and Havfrue / AEC-2 telecoms cables and Utsira High Gas Pipeline	The Devenick lines PL2746, PL2747 and PLU2752 cross over the live AC1 telecoms cable, approximately 17.5 km south of the Devenick Manifold, and are crossed by the Utsira High gas pipeline and Havfrue / AEC-2 telecoms cable approximately 3.6 km and 4.5 km south of the manifold respectively. At the AC1 crossing the Devenick lines are surface laid and rock covered. At the Utsira High pipeline and Havfrue / AEC-2 telecoms cable crossings, the Devenick lines are trenched and buried and rock covered.	**Segment type: F.1: Live Crossing.** Leave until the third-party facility is decommissioned and then decommission as a dead crossing. In this instance PL2746, PL2747, and PLU 2752 will remain *in situ*.
Live Crossings: PL2746, PL2747 and PLU2752 crossings with Devenick pipelines and umbilicals.	The Devenick lines PL2746, PL2747 and PLU2752 cross the Braemar pipelines PL1969 and PLU1970 inside the East Brae 500m zone in close proximity to the jacket footings.	**Segment type: F.1: Live Crossing.** Leave until the third-party facility is decommissioned and then decommission as a dead crossing. (At the time of Devenick Decommissioning the Braemar facilities will also be decommissioned. This will then be considered a Dead Crossing. If derogation is obtained to leave the East Brae footings in place, then these crossings, which are in close proximity to the footings will also be left *in situ*).

Equipment	Description	Segment Type / Selected Decommissioning Option
Dead Crossings PL2746, PL2747 and PLU2752 crossings with AT10 and AT14 telecommunications cables.	The Devenick lines PL2746, PL2747 and PLU2752 cross the TAT10 and TAT14 telecommunications cables, which are no longer in use, approximately 22 km and 11.5 km south of the Devenick manifold respectively. These crossings are rock covered.	**Segment type: F.2: Dead Crossing.** Treat crossing components as per the preferred options for the individual components of the crossing, e.g., treat surface laid pipeline as surface laid pipeline, etc. In this instance PL2746, PL2747, and PLU 2752 will remain *in situ*.
Spans in Devenick pipelines and umbilicals	There are short spans on some Devenick pipelines. These are monitored by survey.	**Segment Type: C.1: Fishing Critical Span (Pipeline, cable or umbilical)** **Segment Type: C.2: Integrity Critical Span (Pipeline, cable or umbilical)** **Segment Type: C.3: Non-critical Span (Pipeline, cable or umbilical)** All spans will either be removed as part of the surface laid pipelines or umbilicals in which they occur, or rock covered, in the case where they occur in trenched, buried and rock covered lines.
Devenick SSIV Structure	The SSIV structure is in the East Brae platform 500m zone. The structure measures 10.75 m x 6.5 m x 4.25 m. The structure is not piled.	**A.1: Fabricated Steel Structures (forming part of pipelines)** Remove to shore for appropriate reuse, recycling, or appropriate disposal.
PLU2753 SSIV Control Umbilical	The umbilical runs from the Devenick Manifold to the S1 well. 71.3 mm composite flexible umbilical, 0.5 km long. The umbilical is surface laid on the seabed and mattress protected.	**E.2.1: Surface Laid Umbilical (Mattress / Grout Bag Protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove protection and umbilical to shore for reuse, recycling, or appropriate disposal. Umbilical in close proximity to derogated sub-structure footings: Leave *in situ.* **E.2.3: Surface Laid Umbilical (No protection)** Umbilical not in close proximity to derogated sub-structure footings: Remove to shore for reuse, recycling, or appropriate disposal. Umbilical in close proximity to derogated sub-structure footings: Leave *in situ.*

2.2.2 Subsea installation selected decommissioning options

The Guidance (BEIS, 2018) states that subsea installations must, where practicable, be completely removed for reuse or recycling or final disposal on land. Any piles used to secure such installations in place should be cut below natural seabed level at such a depth as to ensure that any remains are unlikely to become uncovered. Table 2.9 outlines the selected decommissioning options for the Devenick subsea installations.

Table 2.9 Decommissioning options for Devenick subsea installations

Equipment	Description	Selected Decommissioning Option
S1 Wellhead / Xmas Tree	This equipment includes the wellhead, guide base, guideposts and Xmas tree.	Plug and abandon in accordance with Oil and Gas UK guidance. Remove equipment to shore for reuse, recycling, or appropriate disposal.
S1 WHPS	S1 WHPS is secured to the seabed by four steel foundation piles.	Remove to shore for reuse, recycling, or appropriate disposal.
S1 Protection Frame Type A	Part of 4 Section S1 Cooling Spool Protection Frame.	Move rock. Recover cooling spool protection structures (and cooling spools) to shore for reuse, recycling, or appropriate disposal.
S1 Protection Frame Type B	Part of 4 Section S1 Cooling Spool Protection Frame.	
S1 Protection Frame Type C	Part of 4 Section S1 Cooling Spool Protection Frame.	
S1 Protection Frame Type D	Part of 4 Section S1 Cooling Spool Protection Frame.	
S1 Protection Frame Rock Cover	Rock cover distributed over 63m total length of S1 protection frames	
S2 Wellhead / Xmas Tree	Removed in 2015/ 2017. Equipment taken onshore for recycling or disposal.	
S2 Protection Frame Type A	Part of 4 Section S2 Cooling Spool Protection Frame.	Move rock. Recover cooling spool protection structures (and cooling spools) to shore for reuse, recycling, or appropriate disposal.
S2 Protection Frame Type B	Part of 4 Section S2 Cooling Spool Protection Frame.	
S2 Protection Frame Type C	Part of 4 Section S2 Cooling Spool Protection Frame.	
S2 Protection Frame Type D	Part of 4 Section S2 Cooling Spool Protection Frame.	
S2 Protection Frame Rock Cover	Rock cover distributed over 63m total length of S2 protection frames	
E&A Wellhead / Xmas Tree	Removed in 2017. Equipment taken onshore for recycling or disposal.	
Devenick Manifold	Manifold structure, which includes various equipment, e.g., valves, subsea control modules, multi-phase flowmeter (including a licensed source), distribution units and control jumpers. The manifold comingles the production from the S1 and S2 wells into the production pipeline PL 2746, and distributes control signals, methanol etc. to the wells. The Manifold Structure is secured to the seabed by four steel foundation piles.	Cut piles 3 m below the seabed and remove the manifold and cut off piles to shore for reuse, recycling, or appropriate disposal.

2.3 Decommissioning activities

2.3.1 Vessels

The vessel requirements for the decommissioning activities are not yet confirmed and will be subject to market availability, contractual agreements and alignment with other decommissioning projects. It is anticipated that any vessel time will be split across various types of vessels which will participate in a variety of activities including equipment removal, rock placement and post-decommissioning monitoring. The main decommissioning vessel is likely to be either a Dive Support Vessel (DSV), ROV support vessel or construction vessel. For the purposes of covering all scenarios, time has also been accounted for a guard vessel (in the instance that the DSV has to leave site when the condition of the Devenick subsea equipment presents a hazard to other sea users), a rock vessel, in the instance that rock remediation is required and survey vessels to support any non-intrusive post-decommissioning survey activities. Further to this, a Mobile Offshore Drilling Unit (MODU) to be used for well P&A activities at the S1 well. Currently it is envisaged that all vessels undertaking the decommissioning and removal works will be dynamically positioned vessels and there will be no requirement for anchoring activities.

2.3.2 Subsea infrastructure decommissioning

Subsea infrastructure decommissioning will include dredging and cutting activities to remove the Devenick manifold, Devenick SSIV, S1 WHPS and pipeline cooling spool protection frames which are presented in Table 2.1. The Devenick manifold and the S1 WHPS are both piled to the seabed with four foundation piles each. To facilitate removal of the piled structures it is the intent to cut each of the foundation piles 3 m below the seabed using an internal cutter to avoid having to carry out substantial seabed excavation at the four pile locations. The preference is to make the cuts using abrasive water jet technology and an inert garnet cutting medium. Such jet cutters are routinely used subsea for cutting piles and provide an efficient method with little impact to the environment.

At each foundation pile location, the cutting operation will comprise the following steps;

- Removal of the locking pin securing the structure to that pile, to give access to the inside of the pile;
- Running an internal clean out tool to remove any soil infill, etc. from within the pile, and then removing the tool;
- Running a jet cutter into the pile to the required cutting depth; and
- Making the pile cut and withdrawing the cutting tool.

Following removal of the subsea structure, the cut off portions of the piles will then be recovered. Deployment of the cleaning and jet cutting tools and recovery of the structure and pile cut offs will be by means of ROVs and vessel cranes.

2.3.3 Decommissioning of pipelines and umbilicals

There are a few options for the removal of the surface laid portions of the pipelines and umbilicals from the seabed including:

- Cut surface laid sections into discrete lengths and recover each section using subsea grab or similar; and
- Cut surface laid sections into discrete lengths and recover multiple sections using subsea basket to vessel.

The cutting equipment used to cut the pipeline ends, the pipeline tie-in spools and the umbilicals will typically be either a diamond wire cutter or hydraulic shears. In terms of environmental impact and the time taken to complete the cutting operation(s), there is little difference between the two methods, especially given the relatively small diameters of the pipelines and umbilicals.

2.3.4 Removal of protection material

Where rock is overlying the cooling spool protection structures, this will be relocated on the seabed to enable the removal of the protection structures and the spools themselves. Concrete mattresses and grout bags will be removed from the seabed to the DSV.

2.3.5 Remediation

Where exposures and free spans have been identified along the length of the pipelines and umbilicals to be decommissioned *in situ*, rock cover will be used to remediate these where removal is not possible due to the short length of the exposed or spanning section. As detailed in Appendix C, there are 21 exposures along six of the Devenick pipelines and umbilicals, totalling a length of 68.6 m. There are also eight free spans along six of the Devenick pipelines and umbilicals with a total length of 16 m. Rock cover will be laid within a 10 m wide corridor. The total weight of rock that will be used for remediation of spans and exposure is estimated to be 846 tonnes (i.e., 10 tonnes per m length).

Rock cover will also be used to remediate any cut pipeline ends, with a worst-case of 25 te (100 m^2) of rock per pipeline end. Rock berm profiles will be within a 10 m-wide corridor and will be designed with a 1:3 slope to be overtrawlable. Rock will be laid precisely using a fall pipe vessel and the relevant permits and consents will be applied for in advance of operations.

The removal of the foundation piles associated with subsea structures may leave depressions in the seabed. Where possible, TAQA will use the rock removed from the cooling spool protection structures to remediate the depressions at the S1 well location. It may be necessary to import additional rock cover to mitigate any further depressions.

2.3.6 Post-decommissioning surveys

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

The survey methods will be discussed and finalised with OPRED prior to survey commencement to ensure the survey meets the requirements for clear seabed verification. Non-intrusive verification techniques will be considered in the first instance. These may include techniques which do not make contact with the seabed, such as Side Scan Sonar (SSS) and Remotely Operated Vehicle (ROV) surveys. Any oil field debris identified shall be recovered and recycled / disposed of accordingly.

2.3.7 Ongoing inspections & evaluation

With any materials decommissioned *in situ*, the Operator has a liability to monitor and mitigate any impacts from these materials. As the buried pipelines, umbilicals and associated remediation will likely be decommissioned *in situ*, they will be the subject to on-going inspections when the Devenick decommissioning activities are concluded. After the initial post-decommissioning site survey reports have been sent to OPRED and reviewed, a post-decommissioning inspection regime will be agreed with OPRED by TAQA.

2.3.8 Proposed schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability, contractual agreements and alignment with other decommissioning projects. The window for the decommissioning of the Devenick subsea infrastructure is 2025 – 2030.

2.4 Summary of materials inventory

The approximate amounts of key materials that make-up the Devenick subsea facilities have been evaluated. A focused review of the inventories of materials will be conducted during the detailed engineering phase of decommissioning. A summary of the bulk material inventory for the Devenick subsea facilities is presented in Table 2.10 and Figure 2.1 and a summary of the bulk material inventory for the Devenick pipelines is presented in Table 2.11 and Figure 2.2

Table 2.10 Materials Inventory: Devenick Subsea Facilities Inventory

Material	Estimated weight to be recovered to shore (te)	Proposed fate			Estimated total weight to be decommissioned *in situ* (te)	Total weight (te)
		Reuse (te)	Recycling (te)	Onshore Disposal (te)		
Carbon Steel	426.63	0	426.63	0	0	426.63
Aluminium	3.34	0	3.34	0	0	3.34
Plastic**	5.42	0	5.42	0	0	5.42
Paint	3.34	0	0	3.34	0	3.34
Inconel	2.09	0	2.09	0	0	2.09
Duplex	100.13	0	100.13	0	0	100.13
Alloy	130.17	0	130.17	0	0	130.17
Other	0.83	0	0	0.83	0	0.83
Rock Cover***	0	0	0	0	3,300.47	3,300.47
Hazardous material****	<1	0	<1	0	0	<1
Total	**671.95**	**0**	**667.78**	**4.17**	**3,300.47**	**3,972**

**The proportion of plastics that will be recycled versus disposed of to landfill depends on the condition of the plastics when they are recovered.

*** Rock cover will be largely left *in situ*. The rock cover on the cooling spool protection structures at the S1 and S2 well sites may be used to remediate any seabed depressions left by removal of foundation piles at the S1 and S2 well sites and Devenick manifold.

**** The hazardous material consists of approximately 1 kg of Barium Ba^{133} 10 mCi from a sealed source. If possible, this will be recycled.

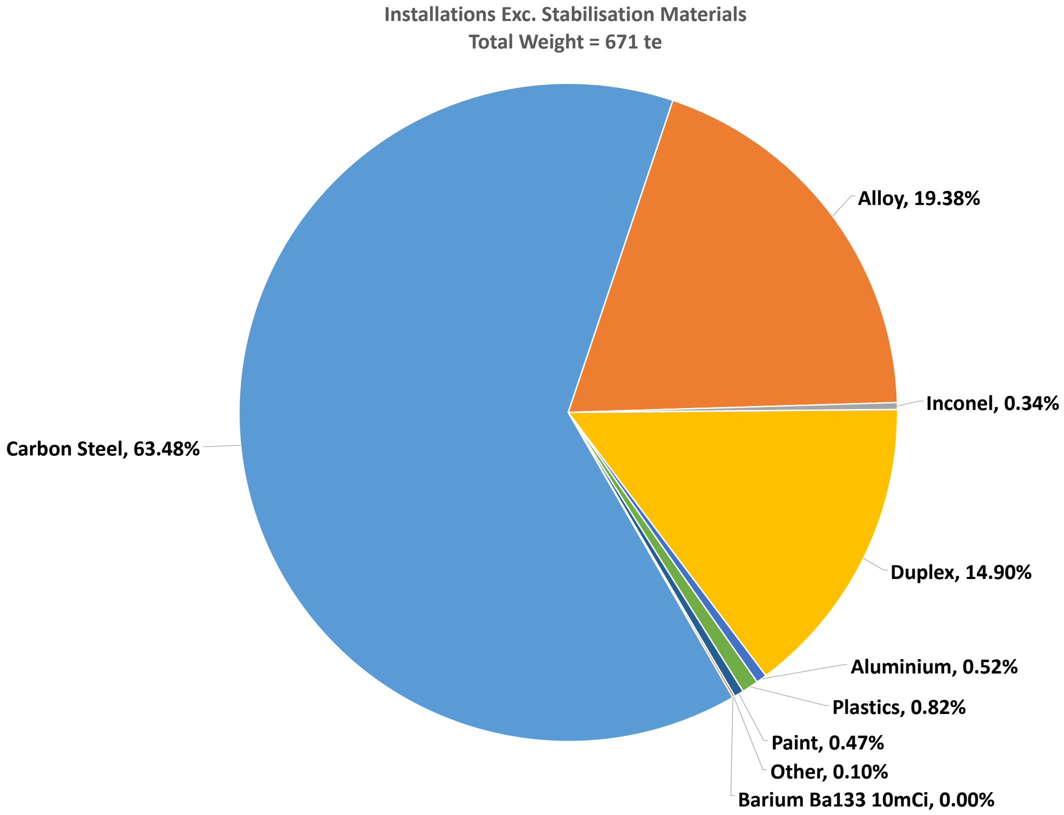


Figure 2.1 Subsea Installations Inventory – Excluding Stabilisation Material

Table 2.11 Materials Inventory: Devenick Pipelines, etc., Inventory Including Stabilisation Materials

Materia	Estimated weight to be recovered to shore (te)	Proposed fate			Estimated total weight to be decommissioned *in situ* (te)	Total weight (te)
		Reuse (te)	Recycling (te)	Onshore Disposal (te)		
Carbon Steel	5	0	5	0	8,337	8,342
Duplex	3.4	0	3.4	0	5,564	5,567
Other	0.25	0	0	0.25	428.7	430
Aerogel	0.01	0	0	0.01	33.99	34
Concrete Mattresses*	2,233	0	0	2,233	0	2,234
Grout Bags*	19.5	0	0	19.5	0	19.5
Rock Cover**	0	0	0	0	69,297	69,297
Total	**2,281.7**	**0**	**8.4**	**2,273.3**	**83,660.7**	**85,924**

*A proportion of the mattress and grout bags that make up the total concrete weight may be decommissioned *in situ,* depending on the state of these upon recovery. Should the safe removal of these materials become an issue, TAQA will discuss any alternative approaches with OPRED in the first instance.

** Rock cover will be largely left *in situ.* The rock cover on the cooling spool protection structures at the S1 and S2 well sites may be used to remediate any seabed depressions left by removal of foundation piles at the S1 and S2 wellsites and Devenick manifold.

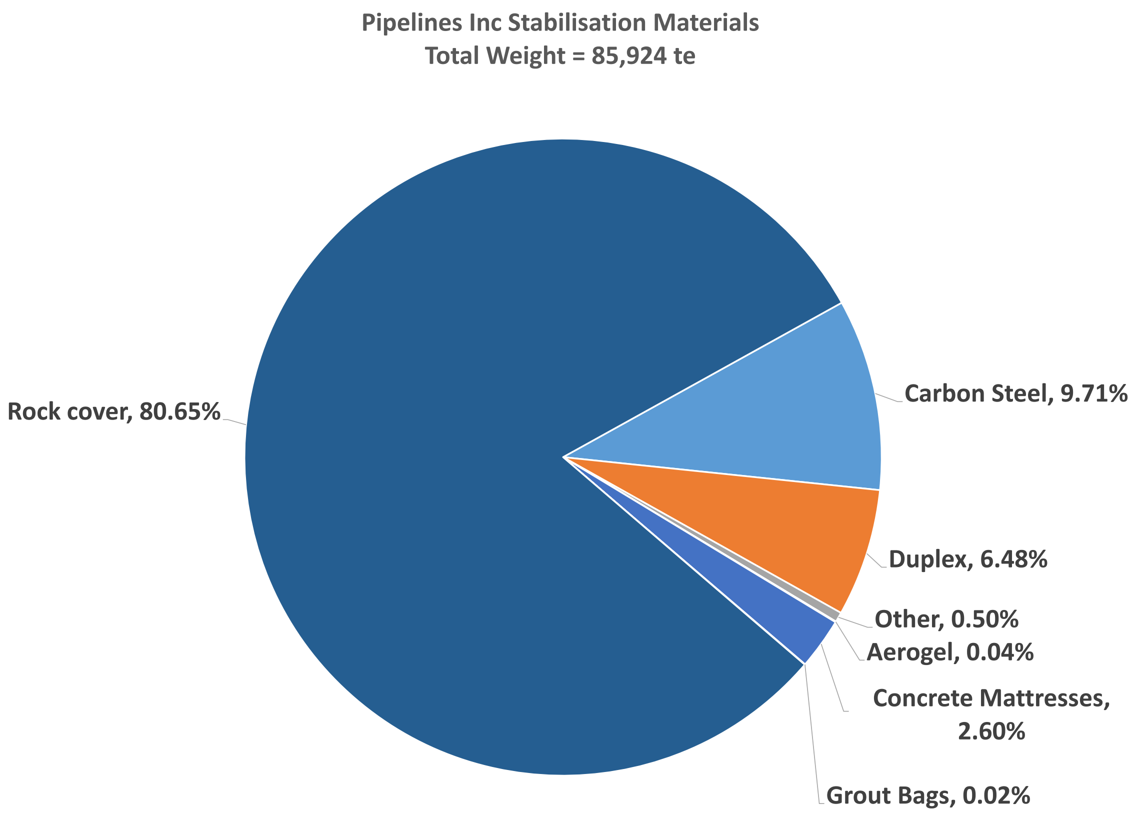


Figure 2.2 Pipelines, etc., Inventory - Including Stabilisation Materials

2.5 Waste management

TAQA will comply with the Duty of Care requirements under the UK Waste Regulations and The Environmental Protection (Duty of Care) (Scotland) Regulations 2014. The hierarchy of waste management will also be followed at all stages of disposal (see Figure 2.3) and industry best practice will be applied (Decom North Sea, 2018 Managing Offshore Decommissioning Waste, November 2018).

All waste will be managed in compliance with relevant waste legislation by a licenced and/or permitted waste management contractor. The selected contractor will be assessed for competence through due diligence and duty of care audits.

Most of the material recovered during the Devenick subsea decommissioning activities will be non-hazardous, including steel, non-ferrous metals, plastic and concrete as outlined in Section 2.4. The hazardous material consists of approximately 1 kg of Barium Ba^{133} 10 mCi within a sealed source and if possible, this will be recycled.

Preventing waste is ultimately the best option, achieved through reducing consumption and using resources more efficiently. However, this is followed by re-use and recycling of goods (Figure 2.3). If all re-use opportunities have been taken by TAQA, the next preferable option is for recycling of materials.

Figure 2.3 Waste hierarchy model

The Material Inventory has also classified each material according to the European Waste Catalogue Codes (EWC) as required for disposal of wastes within the EU and a further categorisation of hazardous/special or non-hazardous/non-special wastes. The EWC is a standardised way of describing waste and was established by the European Commission. The use of EWC codes to describe waste is a requirement of the Duty of Care for waste which requires the holder of waste to take all reasonable steps to ensure that waste is described in a way that permits its safe handling and management.

Until a waste management contractor has been selected and disposal routes identified, the final disposal options for waste materials are unknown. The project aspiration is that all ferrous and non-ferrous metals, concrete and plastics will be recycled where possible. Less than 5% of the material will be reused, c.95% of material will be recycled and the small quantities of residual material will be sent for disposal. There may be instances where infrastructure returned to shore is contaminated (marine growth, hydrocarbons, paints etc), in this situation TAQA will make every effort to clean such infrastructure to enable it to be recycled. In cases where this is not possible, and the infrastructure cannot be recycled, the quantity of material is not expected to result in substantial landfill use.

As part of TAQA's standard processes, all sites and waste carriers will have appropriate environmental and operating licences and/or permits to carry out this work and will be closely managed within TAQA's contractor assurance processes.

NORM is not anticipated but should NORM be encountered, TAQA will ensure the disposal site is suitably licenced to accept the waste arising from the decommissioning of the subsea infrastructure.

An Active Waste Management Plan (AWMP) including an inventory of hazardous waste will be compiled to aid the segregation and recycling of waste.

TAQA is committed to working towards the government policy of Net Zero in line with the OGA Stewardship Expectation 11 (OGA, 2021). This commitment includes decommissioning activities and is intended to drive increased energy efficiencies and minimise emissions. TAQA seeks to influence our joint venture partners and suppliers to ensure that everyone is striving to reduce and manage associated emissions.

2.6 Environmental management strategy

TAQA has an established and independently verified Environmental Management System (EMS) which operates in accordance with the requirements of ISO14001:2015. The scope of the TAQA EMS includes all activities, onshore and offshore, in relation to the exploration for and production of hydrocarbons in defined license areas of the UK sector of the North Sea. This scope encompasses the Devenick subsea infrastructure, all under the control of the TAQA Aberdeen office. The EMS meets the requirements of OSPAR Recommendation 2003/5 which promotes the use and implementation of EMSs by the offshore industry.

TAQA, is committed to managing all environmental impacts associated with its activities. Continuous improvement in environmental performance is sought through effective project planning and implementation, emissions reduction, waste minimisation and waste management; this mindset has fed into the development of the mitigation measures developed for the Project; these include both industry-standard and project-specific measures. A signed copy of TAQA’s Health, Safety, Security and Environment Policy is presented in Appendix D.

3 ENVIRONMENTAL AND SOCIETAL BASELINE

The Devenick seabed infrastructure is located in UKCS Blocks 16/3a, 16/3e, 9/24b, 9/24c, 9/28c and 9/29a in the North Sea and lies in a water depth of approximately 115 m below lowest astronomical tide (LAT) in the north to approximately 130m below LAT in the south. The Devenick pipelines run for approximately 33.5 km between the Devenick manifold and East Brae platform.

As part of the EA process, it is important that the main physical, biological and societal sensitivities of the receiving environment are well understood. This environmental baseline describes the main characteristics of the offshore environment around the Devenick infrastructure and highlights the key sensitivities. This section draws on several information sources including published papers, relevant strategic environmental assessments (SEAs) and site-specific investigations.

Where any data gaps exist, these will be addressed by a pre-decommissioning environmental baseline survey, which will be conducted in Q4 2022. The results of this survey will be shared with OPRED.

3.1 Physical environment

3.1.1 Bathymetry

The water depth around the Devenick infrastructure ranges from approximately 115 m below lowest astronomical tide (LAT) in the north to 130 m in the south. The infrastructure is not located on any large-scale features of functional significance such as shelf deeps, shelf banks and mounds, seamounts, or continental slopes (NMPI, 2021), although there are a number of pockmark features along the pipeline route.

3.1.2 Currents, waves and tides

The annual mean wave height in the NNS region follows a gradient increasing from the southern point in the Fladen/Witch Ground to the northern area of the East Shetland Basin. In the south, the mean wave height ranges from 2.11 - 2.40 m whilst in the north it ranges from 2.41 - 3.30 m (NMPI, 2021). McBreen *et al*. (2011) shows wave energy at the seabed is 'low' (less than 0.21 N/m^2) within the Devenick Decommissioning area. The annual mean wave height at Devenick ranges from 2.49 m - 2.5 m and the annual mean wave power ranges from 31.95 – 32.09 kW/m (NMPI, 2021).

The anti-clockwise movement of water through the North Sea and around the NNS region originate from the influx of Atlantic water, via the Fair Isle Channel and around the north of Shetland and the main outflow northwards along the Norwegian coast (DECC, 2016). Against this background of tidal flow, the direction of residual water movement in the NNS is generally to the south or east (DTI, 2001; DECC, 2016). The peak flow for mean spring tide ranges between low velocities of 0.1 m/s in open (DECC, 2016). The mean residual current through the Devenick Decommissioning area is approximately 0.05 to 0.1 m/s (Wolf *et al*., 2016).

The NNS is seasonally stratified and the strength of the thermocline is determined by solar energy, tidal and wave forces (DECC, 2016). Distinct density stratification occurs in the NNS region in summer at around 50 m depth and the thermocline becomes increasingly distinct towards deeper water in the north of the region (DECC, 2016). This stratification breaks down in September as the frequency and severity of storms increases causing mixing in the water column (DECC, 2009).

3.1.3 Meteorology

The prevailing winds in the NNS are from the south west and north north-east. Wind strengths in winter are typically in the range of Beaufort scale force 4-6 (6-11 m/s) with higher winds of force 8-

12 (17-32 m/s) being much less frequent. Winds of force 5 (8 m/s) and greater are recorded 60-65% of the time in winter and 22-27% of the time during the summer months (DECC, 2016).

3.1.4 Seabed environment

In the NNS, and indeed across the North Sea, seabed sediments generally comprise a veneer of unconsolidated terrigenous and biogenic deposits, generally much less than 1 m thick. Sediments in the area of the Devenick infrastructure are predominantly sand and muddy sand, although the deeper areas within the Fladen Ground consist of mud or sandy mud off the edge of the continental shelf to the north of the region, the slope is characterised by areas of mixed and coarse sediments, while the floor of the Faroe-Shetland Channel is classified as mud (JNCC, 2017; DECC, 2016).

A survey gap analysis study commissioned by TAQA, has assessed all available survey reports covering the Devenick development and wider Brae area (Xodus, 2021). The full coverage of the pipeline and field surveys conducted in the area, including sampling station locations, are shown in Figure 3.1. These surveys have all indicated similar species and sediment compositions which provide evidence of a relatively uniform nature of the seabed habitats and communities in the vicinity of the Devenick decommissioning area and in the wider region.

Under the European Nature Information System (EUNIS) habitat classification, the predicted broad-scale seabed type around the Devenick infrastructure is A5.27 “deep circalittoral sand” and A5.37 “deep circalittoral mud”. The sediment type along the majority of the main Devenick pipeline and umbilical route consists of very fine sand with a transition into very fine or coarse silt towards the East Brae Platform, which broadly corresponds to the predicted EUNIS habitat for the region transitioning from “deep circalittoral sand” to “deep circalittoral mud”. These two habitat types fall within the broad habitat Priority Marine Feature (PMF) “offshore sands and gravels” and “offshore deep muds”, respectively (Tyler-Walters *et al*., 2016) (NMPI, 2021). Seabed sediments in the wider area are generally coarser (sand makes up a greater proportion) than those found around the Devenick infrastructure and East Brae platform.

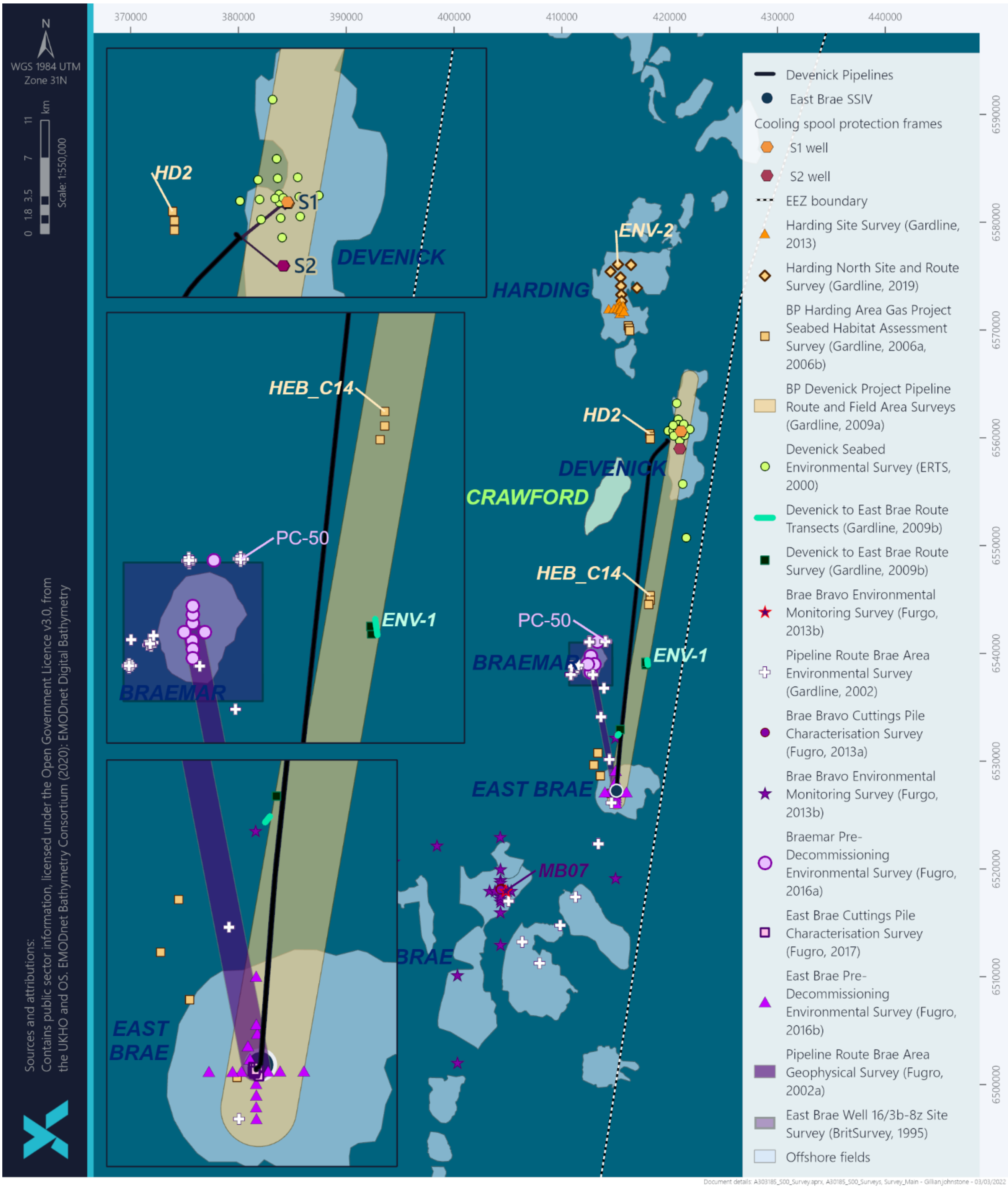
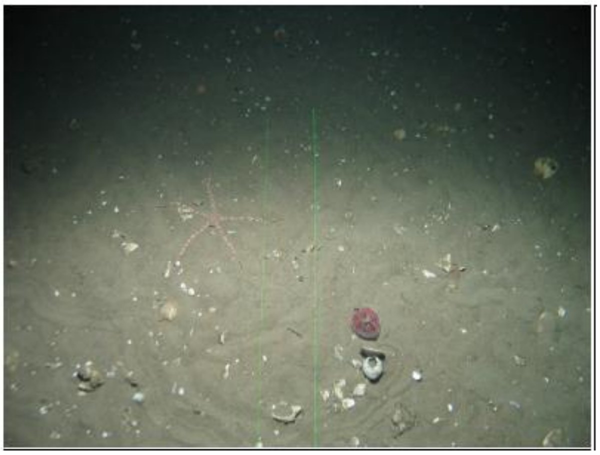


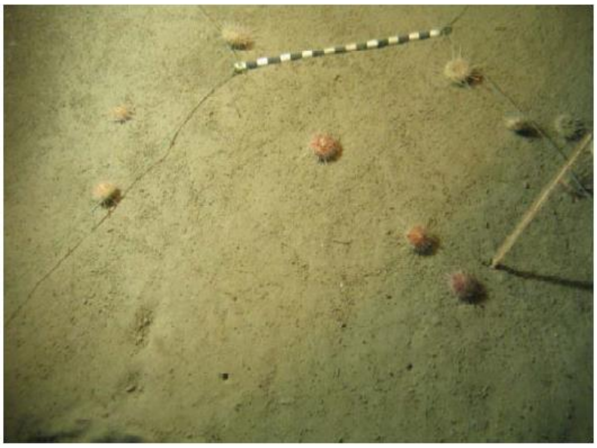
Figure 3.1 Location of environmental surveys around the Devenick infrastructure

ENV2 (from Gardline, 2019)

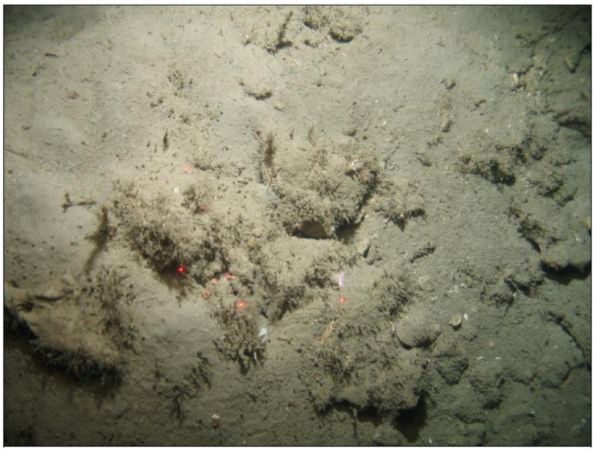


HD2 (from Gardline, 2006a, 2006b)

HEB_C14 (from Gardline, 2006a, 2006b)



ENV1 (from Gardline, 2009a, 2009b)



PC-50 (from Gardline, 2002)

MB07 (from Fugro, 2013b)

Figure 3.2 Seabed imagery taken along the Devenick pipelines or in nearby fields (corresponding to locations labelled in)

3.1.4.1 Physical characteristics

Sediments at the Devenick Field comprise well-sorted, medium dense silty sand. The thickness of the surface sediment layer increasing towards the south, eventually reaching more than 10 m in depth (Gardline, 2009a; ERTSL, 2000). Gardline (2006a; 2006b and 2009a) and Fugro (2016b) reported that the seabed sediments along the majority of the Devenick to East Brae pipeline route are comprised mainly of silty fine sand. These are generally less than 1 m thick, with occasional areas of shells and exposures of underlying sediments close to East Brae.

Figure 3.2 shows images taken along the Devenick to East Brae route and at the nearby fields.

Based on the available survey data, the sediment type along the majority of the Devenick pipeline route are expected to consist of very fine sand with a transition into very fine or coarse silt towards the East Brae Field. This broadly corresponds to the predicted EUNIS habitat for the region transitioning from “deep circalittoral sand” to “deep circalittoral mud”. These two habitat types fall within the broad habitat Priority Marine Feature (PMF) “offshore sands and gravels” and “offshore deep muds”, respectively (Tyler-Walters *et al*., 2016). However, these habitats are both widely distributed across the UKCS and it is therefore unlikely that this location will be regarded as being of particular conservation significance.

3.1.4.2 Chemical characteristics

The site-specific seabed survey conducted at Devenick (ERTSL, 2000) reported the levels of hydrocarbon and heavy metal concentrations as being generally at background levels for the North Sea. Sediment hydrocarbons were typical of distributions found in marine sediments remote from main centres of anthropogenic activity (ERTSL, 2000). Total hydrocarbon (THC) concentrations measured in the Devenick development surface sediments ranged from 2.0 to 4.1 µg/g (ERTSL, 2000). The North Sea Quality Status Report suggests that typical THC levels (i.e. “background”) in sediments remote from anthropogenic activities range from 0.2 to 5 µgg (ERTSL, 2000). The total barium concentrations in the sediments were all less than 500 µg/g over the Devenick Field stations sampled, which was considered as background at the time, however it is higher than what is now considered as background concentrations for the North Sea (348 µg/g; UKOOA, 2001) and can likely be attributed to historic drill cuttings discharge.

The East Brae pre-decommissioning survey showed that concentrations of metals in the sediments were relatively constant throughout the East Brae survey area (Fugro, 2016b). Comparison of the metals concentrations with the background data indicated that the survey data were of no obvious environmental concern and could be generally ascribed as within the range of natural background concentrations. Total barium levels for the sediment samples ranged from 470 µg/g to 2,820 µg/g at station (mean 953 µg/g). Mean total barium levels in 2015 were very similar to those measured in 2000 (ERT, 2000). Total hydrocarbon levels for the sampling stations ranged from 4.7 µg/g to 15.2 µg/g (mean 7.7 µg/g), mostly below the average background calculated from environmental survey data collected between 1975 and 1995 in the central North Sea area of 9.5 µg/g (UKOOA, 2001).

However, the drill cuttings pile survey at East Brae revealed that the majority of samples for polyaromatic hydrocarbons and heavy metals (arsenic, barium, copper, mercury and zinc) exceeded their effect range low (ERL). The ERL is a threshold defined by the United States National Oceanic and Atmospheric Administration (NOAA) above which sediment contaminants are likely to be present at levels toxic to marine life. However, beyond 250 m of the platform except for barium and mercury, they did not exceed the ERL. The survey of the drill cuttings pile at East Brae and the surrounding area concluded that THCs were elevated in comparison to historical survey data but were comparable to other cutting piles in the North Sea (Fugro, 2017).

At Harding, located 13 km from the Devenick pipelines, THC concentrations ranged from 5.5 µg/g to 11.9 µg/g with a mean of 8.3 µg/g which remains close to the background levels for the North Sea of 9.5 µg/g. Overall, the targets recording comparatively higher THC concentrations were located in areas of predominantly fine sand. Concentrations of Ba ranged from 244 µg/g to 385 µg/g with a mean of 300 µg/g. Ba concentrations at most targets were below the mean value for the North Sea (348 µg/g). As with hydrocarbons, comparatively higher Ba concentrations corresponded with the location of these targets in in areas of predominantly fine sand. Two of these stations were also closest in proximity (<700 m) to historical wells (Gardline, 2019d). The previous survey at Harding, undertaken in 2013, revealed that with the exception of the most contaminated station (located 160 m south of the platform) where differences were most obvious, subtle effects of contaminants associated with drilling activity at the Harding platform were detectable (Gardline, 2013).

The THC measured in the surface sediments at the Braemar field, located 3.5 km from the Devenick pipelines ranged from 1.9 µg/g to 10.8 µg/g with a mean value of 5.1 µg/g (Fugro, 2016a). THC levels were mostly below, or similar to, the average background in the central North Sea area of 9.5 µg/g (UKOOA, 2001). The barium concentrations at Braemar ranged from <50 µg/g to 1,050 µg/g with a mean of 660 µg/g. This is higher than the background levels for the central North Sea of 348 µg/g (UKOOA, 2001), indicating some deposition and dispersal of drilling muds around the Braemar subsea template.

For Brae Bravo, located 14 km from the Devenick pipelines, total barium concentrations were found to range from 85 µg/g to 1,130 µg/g with a mean of 288 µg/g, which is comparable to levels found over 5 km from an active platform in the central North Sea indicating that at the time of the survey, there had been little or no deposition of drilling muds around the Brae Bravo platform. The THC at Brae Bravo were similar to the average background concentrations for the central North Sea (Fugro, 2013b).

The hydrocarbon and heavy metal concentrations are broadly similar across the surveyed region and are typical of sediments generally considered as ‘background’ for the central North Sea region, influenced by historic and existing oil and gas activities. Areas that contained elevated heavy metal concentrations are most likely influenced by their proximity to drill cuttings piles and current and historic drill centres. It is expected that contaminant concentrations of the sediments closer to the Devenick well and East Brae platform will be elevated, however, this is not considered to be higher than other platforms/drill centres in the North Sea. Along the area of the pipeline at a further distance from oil and gas platforms and wells, the contaminant concentrations are expected to be reduced.

3.2 Biological environment

3.2.1 Plankton

Planktonic assemblages exist in large water bodies and are transported simultaneously with tides and currents as they flow around the North Sea. Plankton forms the basis of marine ecosystem food webs and therefore directly influences the movement and distribution of other marine species.

In both the northern and central areas of the North Sea, the phytoplankton community is dominated by dinoflagellates of the genus *Ceratium* and diatoms such as *Thalassiosira spp*. and *Chaetoceros spp*. In recent years the dinoflagellate *Alexandrium tamarense* and the diatom *Pseudo-nitzschia* (known to cause amnesic shellfish poisoning) has been observed in the area (DECC, 2016). Densities of phytoplankton fluctuate during the year, with sunlight intensity and nutrient availability driving its abundance and productivity together with water column stratification (Johns & Reid, 2001; DECC, 2016). In the 10-year period between 1997 and 2007, two main blooms are seen to occur in the NNS: one in May, and a second in August before levels decrease through the winter months when light and temperature are less abundant (SAHFOS, 2015).

Zooplankton species richness is greater in the northern and central areas of the North Sea, than in the south and displays greater seasonality. Zooplankton in this area is dominated by calanoid copepods, in particular *Calanus* and *Acartia spp*. and *Euphausiids* and decapod larvae are also important to the zooplankton community in this region (DECC, 2016).

Calanus finmarchicus has historically dominated the zooplankton of the North Sea and is used as an indicator of zooplankton abundance. Analysis of data provided by the Continuous Plankton Reader (CPR) surveys in the 10-year period between 1997 and 2007 shows a sharper spring increase in *C. finmarchicus* biomass in May in the NNS compared to more southerly areas. This peak in numbers is 70% greater than seen in the central North Sea and 88% greater than the southern North Sea over the same period (SAHFOS, 2015). The increase is likely a reflection of the increased availability of nutrients and food (including phytoplankton) in spring. Overall abundance of *C. finmarchicus* has declined dramatically over the last 60 years, which has been attributed to changes in seawater temperature and salinity (Beare *et al*., 2002; FRS, 2004). *C. finmarchicus* has largely been replaced by boreal and temperate Atlantic and neritic (coastal water) species in particular, and a relative increase in the populations of *C. helgolandicus* has occurred (DECC, 2009; Edwards *et al*., 2010; Baxter *et al*., 2011).

3.2.2 Benthos

The biota living near, on or in the seabed is collectively termed benthos. The diversity and biomass of the benthos is dependent on several factors including substrata (e.g. sediment, rock), water depth, salinity, the local hydrodynamics and degree of organic enrichment (DECC, 2016). The species composition and diversity of the benthos or macrofauna found within sediments is commonly used as a biological indicator of sediment disturbance or contamination.

Polychaetes accounted for around 50% of the individuals encountered in sediments at Devenick in 2000. The relatively high proportion of polychaetes accounting for such a large percentage of the total individuals in this survey was due to the dominance of *Paramphinome jeffreysii* at all of the stations sampled. Other consistently common taxa recorded across the survey area included the polychaetes *Spiophanes bombyx*, *Spiophanes kroyeri, Levensenia gracilis, Apistobranchus tullbergi, Minuspio cirrifera* and *Pholoe assimilis*, the brittle star *Amphiura filiformis*, *Nemertea* spp and the bivalve mollusc *Thyasira pygmaea*. Other mollusc species belonging to the genus Thyasira (*T. croulinensis* and *T. succisa*) were numerically abundant but at fewer stations. The microbenthic community within the vicinity of Devenick was assessed as being generally diverse for this area of the North Sea. The OSPAR-listed bivalve species *Arctica islandica* was found in benthic samples, however most were juveniles, with a small number of adults (ERTSL, 2000).

During the Gardline (2009a and 2009b) surveys, camera investigations revealed fauna and burrowing megafauna at all pockmarks along the Devenick to East Brae Route. Species typically associated with North Sea pockmarks, such as juvenile cod family fish, starfish, anthozoans (seapens, anemones), hagfish, crustaceans (crabs and Norway lobster), hydroids, sponges, molluscs and worms were observed. Comparison with the seabed surrounding the pockmarks suggests that similar species were present throughout the Devenick pipeline survey area, although slightly higher numbers and greater diversity was observed within the pockmarks.

Macrofaunal analysis of 15 samples collected around the East Brae platform in 2015 revealed that the polychaete *Paramphinome jeffreysii* was the dominant taxa at all stations across the survey area. The species accounted for 49% of the polychaetes identified and 39% of the total individuals recorded. The bivalve molluscs *Adontorhina similis* and *Axinulus croulinensis* and the polychaete *Pterolysippe vanelli* were also found in the top 10 across the entire survey area. Other common taxa across the survey area included the polychaetes *Pholoe assimilis*, *Spiophanes kroyeri*, *Lumbrineris cingulata/aniara* and *Notomastus* sp.. The brittlestar *Amphiura filiformis* was present across the survey area but in relatively low numbers. The macrofaunal community over the East Brae survey area was deemed being broadly typical of the upper central North Sea (Fugro, 2016b). The bivalve *Arctica islandica* was identified in low abundances across the survey area, with mainly juvenile specimens observed. The general biotope around the East Brae platform are considered to be variations on SS.SMU.OMu.PjefThyAfil, *Paramphinome jeffreysii*, *Thyasira* spp and *Amphiura filiformis* in offshore circalittoral sandy mud (EUNIS habitat A5.376). This biotope is part of the offshore deep-sea muds habitats that are currently listed as a PMF and a priority habitat under the UK Biodiversity Action Plan (BAP). However, these mud habitats occur widely across this part of the upper central area of the North Sea.

In the Braemar to East Brae pipeline survey conducted in 2002, the most common species included *Paramphinome jeffreysii,* which was dominant in all samples. Other common species included the polychaete *Paradoneis eliasoni*, the cumacean *Brachidiastylis resima*, Echinocardium, *Pholoe inornata*, *Glycera cf. mimica*, *Levinsenia gracilis*, *Apistobranchus tullbergi*, *Spiophanes kroyeri*, *Galathowenia oculata* and *Eclysippe vanelli*, the pelecypods *Thyasira croulinensis* and *T. pygmaea*, and juveniles of a species of Echinoidea.

Further north at the Harding Field, located 13 km from the Devenick pipelines, polychaete annelids accounted for 52% of the species recorded, crustaceans 9% and molluscs 14%. The large percentage of polychaete records was attributable to the dominance of *Paramphinome jeffreysii*, followed by *Spiophanes bombyx.* Other abundant species included *Cerianthus lloydii, Harpinia antennaria, Retusa umbilicata*, and *Phoronis* (Gardline, 2013). At the Harding site survey, conducted in 2019, seabed imagery revealed burrows to be a prominent feature in areas of sandy sediment along with the presence of the sea pens *Pennatula phosphorea* and *Virgularia* sp. An individual *Virgularia* sp. was also observed within a grab sample along with four *Virgularia mirabilis* individuals recorded from macrofauna analysis. Following assessment, sea pens and burrows were classified within a range which encompassed ‘frequent’ within their calculated abundance categories at Stations ENV1, ENV7 and ENV8. Therefore, these stations could be regarded as showing similarity to the ‘sea pen and burrowing megafauna communities’ habitat as defined by OSPAR (2010) and listed as a threatened and/or declining habitat (OSPAR, 2008). Additionally, observations of the bivalve mollusc *Arctica islandica* occurred within grab samples, with five adults and seven juvenile individuals confirmed from macrofaunal analysis at six of the twelve targets; *A. islandica* was not observed from seabed imagery. The bivalve *A. islandica* is on the OSPAR (2008) list of threatened and/or declining species and habitats and is listed as a low or limited mobility species as a Scottish PMF.

Thirteen stations were sampled during the environmental monitoring survey at Brae Bravo (14 km from the Devenick pipelines) in 2013. A further six stations were surveyed from the wider Brae Field. Similarly to the surveys conducted at Devenick, the polychaete *Paramphinome jeffreysii* was the dominant taxa at all stations. This species alone accounted 68% of the polychaetes identified and 55% of the total taxa found. Other common taxa across the survey area included the polychaete *Spiophanes bombyx* which was either the second or third most dominant taxa at the majority of stations. The polychaetes (Galathowenia oculata, Tharyx killariensis and *Pholoe assimilis*), the opistobranch mollusc *Philine* spp and the burrowing anemone *Cerianthus lloydii* were all found within the top ten taxa at the majority of stations. across the entire survey area. A very small number of adult *A. islandica* were found, most specimens were juveniles, which aligned with the results from the surveys conducted at Devenick and around East Brae (Fugro, 2013b).

The results of the surveys at Devenick are similar to others conducted in the region; for example, visible macrofauna observed along the Harding (approximately 13 km north west) to Devenick study route during the Gardline (2006a, 2006b) survey include hermit crabs, sea stars, hagfish and small urchins. Benthic communities at Devenick can, therefore, be described as typical of the region. Additionally, a number of echinoderms have been recorded in the wider region, including the brittlestar *Amphiura filiformis* and the burrowing heart urchin *Echinocardium flavescens*.

At the Crawford Field (located 3 km from the Devenick pipelines), the two most abundant species recorded in 1991 were *Capitella capitata* and *Paramphinome jeffreysii.* Other species found in high numbers and also found at Devenick and East Brae include *Spiophanes kroeyeri*, *Thyasira* spp. (juvenile), and *Amphiura filiformis,* When surveyed in 1994, similar species composition was found, with *Thyasira* spp. and *Paramphinome jeffreysii* being the most abundant species (M-Scan, 1991).

The surrounding benthic survey data are highly similar and represent typical benthic assemblages for offshore habitats in the North Sea. Given the dominance of *P. jeffreysii* across almost all surveys in the region surrounding the Devenick infrastructure, it is expected that the surrounding benthos will also be some variation of the EUNIS biotope *Paramphinome jeffreysii, Thyasira spp*. and *Amphiura filiformis* in offshore circalittoral sand or mud.

3.2.3 Potential sensitive habitats and species

A review of the data from the surveys compiled in the gap analysis (Xodus, 2021), indicated the presence of several potentially sensitive habitats and species, including:

- 'Submarine structures made by leaking gases' Annex I Habitat
- Ocean quahog *Arctica islandica* – OSPAR list of threatened and/or declining species and habitats (Region II - Greater North Sea)
- 'Seapens and burrowing megafauna in circalittoral mud' – OSPAR list of threatened and/or declining species and habitats (Region II - Greater North Sea), a component of which is the Scottish Priority Marine Feature (PMF) habitat 'Burrowed mud'

These habitats are listed by one or more International Conventions, European Directives or UK Legislation (including devolved UK administrations).

'Submarine structures made by leaking gases' encompass hard substrates which support a unique community of organisms that are able to survive on the methane and hydrogen sulphide gasses associated with these ecosystems. There are two main types of submarine structures known to occur in the UK: bubbling reefs and submarine structures associated with pockmarks. Pockmarks are generally connected to the release of methane, which reacts with the surrounding seawater forming carbonate blocks.

Numerous pockmarks were identified along the Harding to East Brae pipeline survey corridor, particularly to the south of the Braemar Pockmark SAC (Figure 3.6) where they were observed in high density (Gardline, 2006). They were also frequent in the southern half section of the eastern Harding to East Brae pipeline route, which is in close vicinity to the Devenick pipelines, with the largest pockmark measuring 100 m in diameter. Though slightly greater diversity of benthic species was observed within the pockmarks, no sizable carbonate structures were observed.

Possible small carbonate structures and/or bacterial mats were seen during camera investigations at five stations along the Devenick to East Brae route, mostly in the southern section of the pipeline route. The presence of bacterial mats (assumed to be Beggiotoa sp) is a good visual guide to the presence of some active seepage. Consequently, it was concluded that the surveyed area, particularly in the south, was an active pockmark area with potential presence of the Annex I 'submarine structures created by leaking gases' habitat (Gardline, 2006).

Low abundances of *A. islandica* (<10 individuals) were identified at Crawford, Harding and Brae Bravo, Devenick (M-Scan, 1991; Auris, 1994; ERTSL, 2000; Fugro, 2013b; Gardline, 2019d). At East Brae 29 adults were identified during a survey (Fugro, 2016b). These abundances do not constitute an aggregation. Higher numbers of records at the Braemar Field (71 adults in Fugro, 2016a), aligning with the nearest public record of *A. islandica* to the Devenick pipelines located 3.8 km away, near the Braemar Pockmark SAC (NMPI, 2021). Therefore, it is expected that small numbers of *A. islandica* will be present along the Devenick pipelines. However, the area is not expected to be of high importance for this species.

Another feature of conservation concern potentially present in the area is the OSPAR (2008) listed habitat 'seapens and burrowing megafauna communities'. This habitat has been recorded <1 km from the Devenick pipelines and is one of the constituent habitats of the PMF 'burrowed mud', which does not cover the pipeline area (Tyler-Walters *et al*., 2016; NMPI, 2021). Faunal burrows, burrowing megafauna such as seapens (*Virgularia mirabilis* and *Pennatula phosphorea*) and Norway lobster were evident at all pockmarks investigated in the Devenick pipelines habitat assessment (Gardline, 2009a). Therefore, this habitat could be present along the pipeline route, however, the area is not considered to support a particularly wide coverage of this habitat relative to the wider area.

No other benthic habitat or species features of conservation interest have been noted along the Devenick pipelines including those listed on the Annex I of the EC Habitats Directive, the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, the OSPAR list of threatened and/or declining species, or the Scottish PMF list (NMPI, 2021).

3.2.4 Fish and shellfish

A number of commercially important fish and shellfish species occur in the vicinity of the proposed decommissioning operations. Fish and shellfish populations may be vulnerable to impacts from offshore installations such as hydrocarbon pollution and exposure to aqueous effluents, especially during the egg and juvenile stages of their lifecycles (Bakke *et al*., 2013).

The proposed decommissioning project for the Devenick infrastructure is located in International Council for the Exploration of the Sea (ICES) rectangle 46F1 and 47F1, in an area of spawning and nursery grounds for several commercially important species. Information on spawning and nursery periods for these different species, including peak spawning times are detailed in Table 3.1.

Table 3.1 Fisheries sensitivities within the 46F1 and 47F1 ICES rectangle (Coull *et al*., 1998 and Ellis *et al*., 2012)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anglerfish	N	N	N	N	N	N	N	N	N	N	N	N
Blue Whiting	N	N	N	N	N	N	N	N	N	N	N	N
Cod	SN	S*N	S*N	SN	N	N	N	N	N	N	N	N
European hake	N	N	N	N	N	N	N	N	N	N	N	N
Haddock	N	S*N	S*N	S*N	SN	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	N	N	N	N	N
Ling	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	S*N	S*N	S*N	SN	N	N	N	N
Nephrops	SN	SN	SN	S*N	S*N	S*N	SN	SN	SN	SN	SN	SN
Norway Pout	SN	S*N	S*N	SN	N	N	N	N	N	N	N	N
Saithe	S*	S*	S	S								
Sandeel	N	N	N	N	N	N	N	N	N	N	N	N
Spotted ray	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	N	N	N	N	N	N	N	N	N	N	N	N

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

Spawning areas for most species are not rigidly fixed and fish may spawn either earlier or later from year to year. In addition, the mapped spawning areas represent the widest known distribution given current knowledge and should not be seen as rigid unchanging descriptions of presence or absence (Coull *et al*, 1998). Whilst most species spawn into the water column of moving water masses over extensive areas, benthic spawners (e.g. sandeel) have very specific habitat requirements, and therefore their spawning grounds are relatively limited and potentially vulnerable to seabed disturbance and change.

The Devenick infrastructure is within an area of low intensity or undetermined intensity spawning ground for cod (*Gadus morhua*), saithe (*Pollachius virens*), Norway pout (*Trisopterus esmarkii*) and haddock (*Melanogrammus aeglefinus*) (Ellis *et al*., 2012; Coull *et al*.,1998) (Figure 3.3).

The Devenick infrastructure is also within a potential nursery ground for anglerfish (*Lophius piscatorius*), blue whiting (*Micromesistius poutassou*), cod, European hake (*Merluccius merluccius*), haddock, herring (*Clupea harengus*), ling (*Molva molva*), mackerel (*Scomber scombrus*), plaice (*Pleuronectes platessa*), spotted ray (*Raja montagui*), spurdog (*Squalus acanthias*), whiting (*Merlangius merlangus*), Norway pout and sandeel (*Ammodytes* sp.). Plaice is the only species with a high intensity nursery ground in the Devenick decommissioning area while other species have a lower nursery intensity (Coull *et al*, 1998; Ellis *et al*., 2012).

Haddock, saithe, Norway pout and cod are known to produce pelagic eggs. Herring and sandeels are both benthic spawners but none of these are reported to spawn within Block 9/24, 9/23, 9/28 or 16/3, where the Devenick infrastructure is located (Coull *et al*, 1998; Ellis *et al*., 2012).

Fisheries sensitivity maps produced by Aires *et al*., (2014) for Marine Scotland Science detail the likelihood of aggregations of fish species in the first year of their life (i.e. group 0 or juvenile fish). The probability of 0 group fish aggregations to occur in the vicinity to the Devenick infrastructure is <0.009 for sole, plaice, blue whiting, horse mackerel, sprat, herring and cod. The probability is slightly higher, albeit still considered low, for mackerel (0.01), anglerfish (0.33), hake (0.06) and whiting (0.07). Higher probabilities are present for Norway pout (0.10), and haddock (0.20), although still low in comparison to other North Sea areas (Coull *et al*., 1998).

The following species listed above are also listed as Scottish PMF and are considered as of natural heritage importance: anglerfish, blue whiting, herring, ling, mackerel, Norway pout, saithe, spurdog, herring, and cod (SNH, 2014).

Blue whiting, herring, mackerel, Norway pout, saithe, spotted ray, spurdog and whiting are also on the IUCN Red List (although listed as species of 'least concern') (IUCN, 2018). Herring, cod, whiting, hake, blue whiting, ling, plaice, mackerel, Norway pout and spurdog are on the Scottish Biodiversity List which identifies species of most importance for biodiversity conservation in Scotland (NatureScot, 2020). Cod is reported as 'vulnerable' on the IUCN Red List and haddock is reported as ‘Vulnerable’ in a global perspective, but of ‘least concern’ at a European perspective (IUCN, 2018; NatureScot, 2020). Cod, spotted ray and spurdog are on the OSPAR (2008) List of Threatened and/or Declining Species and Habitats.

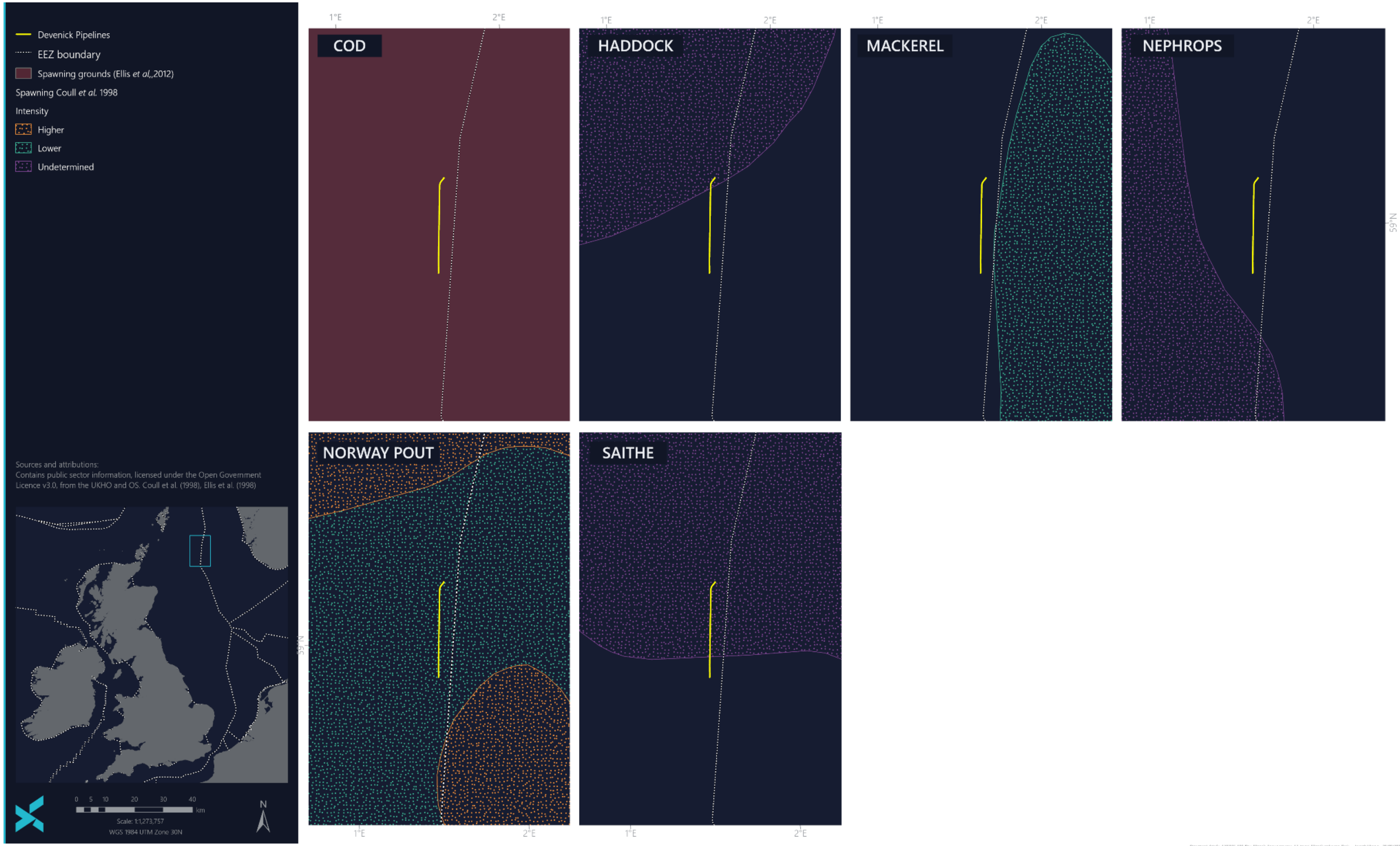


Figure 3.3 Potential fish spawning grounds in the vicinity of the Devenick infrastructure (Coull *et al.*, 1998; Ellis *et al.*, 2012)

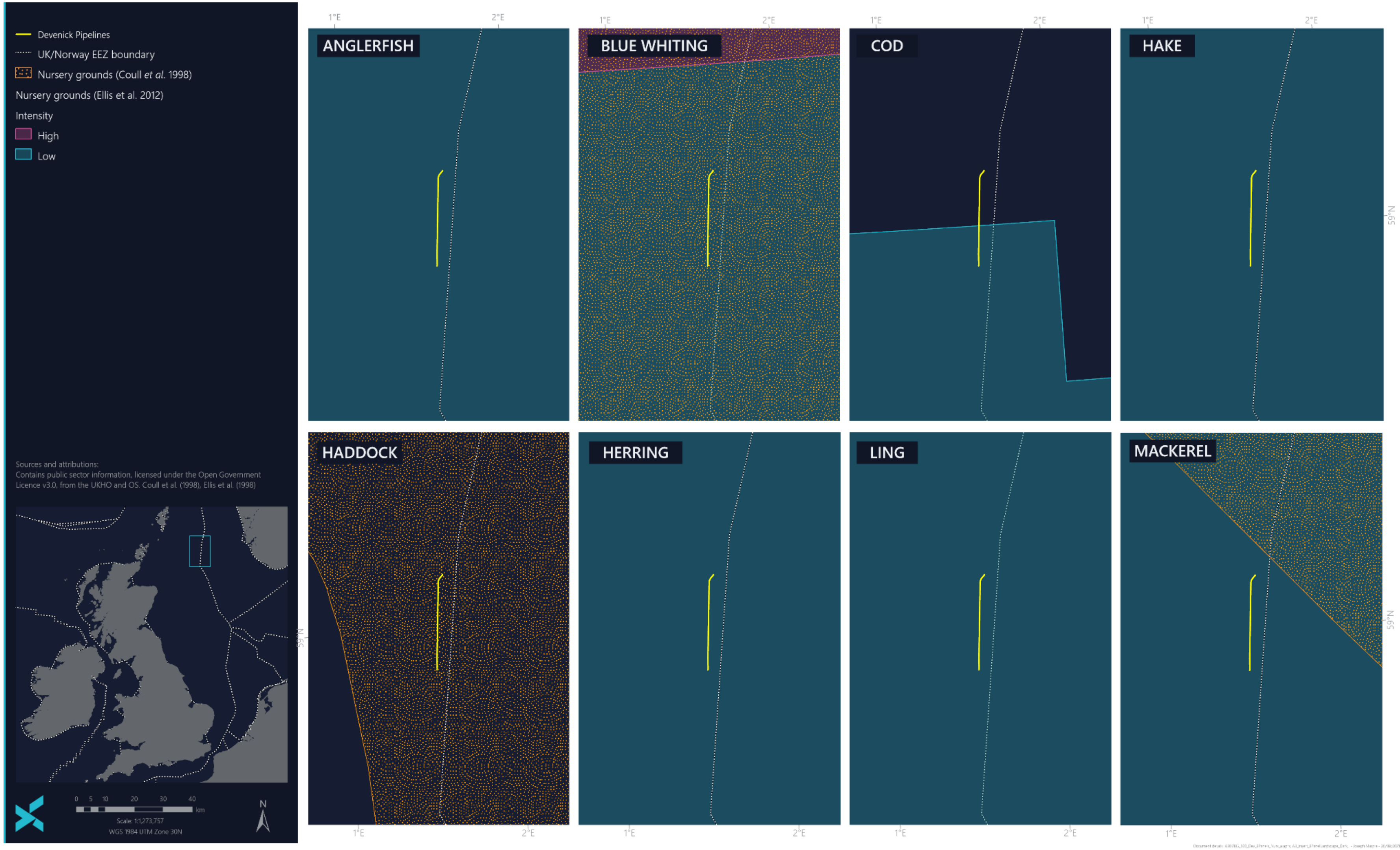


Figure 3.4 Potential fish nursery habitats in the vicinity of the Devenick infrastructure, adapted from Aires *et al.* (2014) (1 of 2)

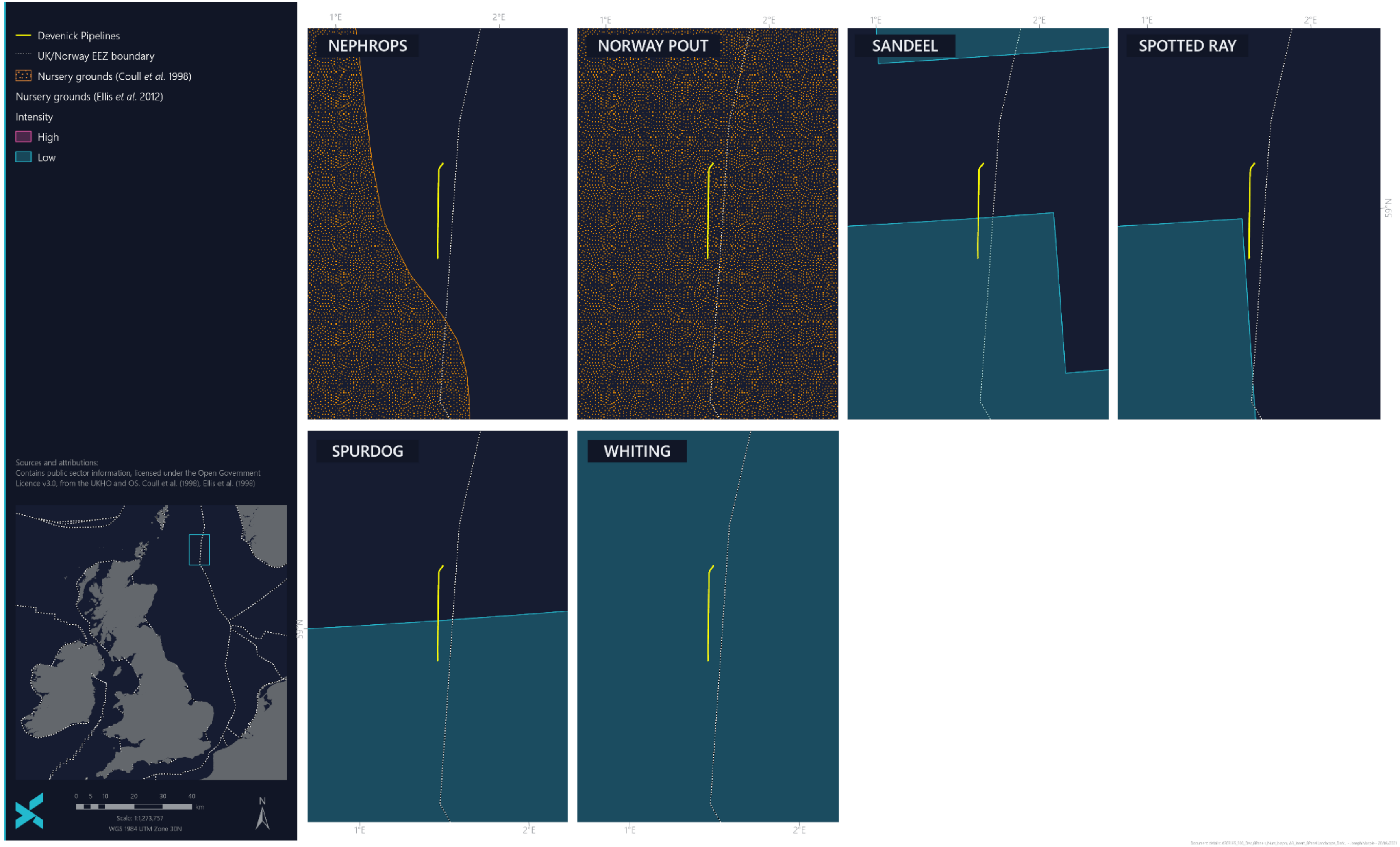


Figure 3.5 Potential fish nursery habitats in the vicinity of the Devenick infrastructure, adapted from Aires *et al.* (2014) (2 of 2)

3.2.5 Seabirds

Much of the North Sea and its surrounding coastline is an internationally important breeding and feeding habitat for seabirds. In the Devenick area, the most numerous species present are likely to be northern fulmar *Fulmarus glacialis*, black-legged kittiwake *Rissa tridactyla* and common guillemot *Uria aalge* (DECC, 2009; DECC, 2016). Seabirds are not normally affected by routine offshore oil and gas operations. In the unlikely event of an oil release, however, birds are vulnerable to oiling from surface pollution, which could cause direct toxicity through ingestion, and hypothermia as a result the birds' inability to waterproof their feathers. Birds are most vulnerable in the moulting season when they become flightless and spend a large amount of time on the water surface.

After the breeding season ends in June, large numbers of moulting auks (common guillemot, razorbill *Alca torda* and Atlantic puffin *Fratercula arctica*) disperse from their coastal colonies and into the offshore waters from July onwards. At this time these high numbers of birds are particularly vulnerable to oil pollution. In addition to auks, black-legged kittiwake, northern gannet *Morus bassanus*, and northern fulmar, are present in sizable numbers during the post breeding season.

Kober *et al*. (2010) have identified hotspots for a number of breeding seabirds in UK waters. The Devenick decommissioning area is located within or in the vicinity of a wider area of aggregation (or hotspots) for little auk during the winter (outwith the breeding season), with densities up to 1.3 – 2.8 individuals/km^2). However, the densities of breeding birds in the Devenick area are low during the breeding season, and include the following species: northern fulmar (5 -10 individuals/km^2), common guillemot (0.1 – 3.7 individuals/km^2), northern gannet (0.1 – 0.8 individuals/km^2), lesser black-backed gull (0.1 - 0.8 individuals/km^2), Atlantic puffin (0.1 – 1.3 individuals/km^2), black-legged kittiwake (0.1 – 1.5 individuals/km^2), herring gull (0.1 – 0.3 individuals/km^2), razorbill (0.1 – 0.3 individuals/km^2), great skua (0.03 – 0.07 individuals/km^2), common gull (0.01 – 0.02 individuals/km^2) and Arctic skua (0.001 – 0.018 individuals/km^2).

The offshore presence of these species during the breeding season is confirmed by the maximum foraging distances from colonies reported by Thaxter *et al*. (2012). Of the most abundant species in the Devenick area listed above, the northern fulmar has been recorded up to 580 km from colonies, the common guillemot up to 135 km, the northern gannet up to 590 km, the lesser black-backed gull up to 181 km and the Atlantic puffin up to 200 km (Thaxter *et al*., 2012).

The Seabird Oil Sensitivity Index (SOSI) (Webb *et al*., 2016) identifies sea areas where seabirds are likely to be most sensitive to oil pollution. It is an updated version of the Oil Vulnerability Index (JNCC, 1999) as it uses survey data collected between 1995 and 2015 and includes an improved method to calculate a single measure of seabird sensitivity to oil pollution. Overall, seabird sensitivity to oil pollution in the region of the Devenick infrastructure is considered low (score of 5) from June to September/October. No data were available for the months of November and December. Seabird sensitivity is considered high to extremely high from January to May (with the exception of March; Table 3.2).

Table 3.2 Seabird oil sensitivity in Blocks 9/24, 9/23, 9/28 and 16/3 and surrounding blocks (Webb *et al*., 2016)

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9/17	5*	5	5*	5*	5	5	5	5	5*	N	N	N
9/18	5*	5	5*	N	5*	5	5	5	5*	N	N	N
9/19	5*	5	5*	N	5*	5	5	5	5*	N	N	N
9/22	5*	5	5	5*	5	5	5	5	5*	N	N	N
9/23	3*	3	5	5*	5*	5	5	5	5*	N	N	N
9/24	4*	4	5	1*	1	5	5	5	5*	N	N	N
9/27	5*	5	5	5*	5	5	5	5	5	5*	N	N
9/28	2*	2	5	1*	1	5	5	5	5	5*	N	N
9/29	2*	2	5	2*	2	5	5	5	5	5*	N	N
16/2	5*	5	5	5*	5	5	5	5	5	5*	N	N
16/3	2*	2	5	1*	1	5	5	5	5	5*	N	N
16/7	5*	5	5	5*	1*	5*	5	5	5	5*	N	N
16/8	5*	5	5	5*	1	5*	5	5	5	5*	N	N
Key	1 = Extremely high		2 = Very high		3 = High		4 = Medium		5 = Low		N = No data	
* in light of coverage gaps, an indirect assessment of SOSI has been made												

3.2.6 Marine mammals

3.2.6.1 Cetaceans

The area around the Devenick infrastructure has a moderate to high diversity and density of cetaceans, with a general trend of increasing diversity and abundance with increasing latitude. Harbour porpoise *Phocoena phocoena* and white-beaked dolphin *Lagenorhynchus albirostris* are the most widespread and frequently encountered species, occurring regularly throughout most of the year. Minke whales *Balaenoptera acutorostrata* are regularly recorded as frequent seasonal visitors. Coastal waters of the Moray Firth and east coast of Scotland support an important population of bottlenose dolphins *Tursiops truncatus*, while killer whales *Orcinus orca* are sighted with increasing frequency towards the north of the area. Atlantic white-sided dolphin *Lagenorhynchus acutus*, Risso's dolphin *Grampus griseus* and long-finned pilot whale *Globicephala melas* can be considered occasional visitors, particularly in the north of the area (DECC, 2016).

Harbour porpoise, Atlantic white-sided dolphin, killer whale, white-beaked dolphin and minke whale have been recorded in the vicinity of the Devenick Field (Reid *et. al*, 2003). The harbour porpoise has been recorded at medium densities (approximately 1 – 10 individuals cited per hour in the months May and September). The minke whale was also recorded at medium densities in July (Reid *et al*., 2003). These species are commonly recorded around the UKCS within these months. White-beaked dolphin densities appear to be high between June and September in the vicinity of the Devenick field, according to Reid et al., (2003). Atlantic white-sided dolphin and killer whale records are generally low around the UKCS. Although their presence is recorded, it is expected that these species will occur at low densities in the vicinity of the Devenick infrastructure.

In 2016, the third series of Small Cetaceans in European Atlantic waters and the North Sea (SCANS-III) was conducted in European Atlantic waters. This involved a large-scale ship and aerial survey to study the distribution and abundance of cetaceans. Harbour porpoise, white-beaked dolphin, minke whale and white-sided dolphin were the most abundant species recorded in the survey block (T) covering the Devenick Decommissioning area, with specific densities listed in Table 3.3. (Hammond *et al*., 2017). Other species recorded within this survey block were Risso's dolphin, fin whale and Gervais beaked whale however there was not sufficient data for these species to provide abundance estimates (Hammond *et al*., 2017).

Table 3.3 Densities of cetaceans in the Devenick decommissioning area (Hammond *et al*., 2017)

Species	Density of cetaceans in the survey block T (animals per km^2)
Harbour porpoise	0.402
White-beaked dolphin	0.037
Minke whale	0.032
Atlantic white-sided dolphin	0.021

3.2.6.2 Seals

Two species of seal live and breed in the UK, namely the grey and harbour seal, both of which are protected under Annex II of the EU Habitats Directive and are listed as Scottish PMFs (SNH, 2016; Jones *et al*., 2015; DECC, 2016).

Approximately 38% of the world's grey seals breed in the UK with 88% of these breeding at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. Birth rates have grown since the 1960s, although according to data from the Special Committee on Seals (SCOS) population growth is levelling off (SCOS, 2014). Approximately 36% of the world's population breed in the UK and approximately 32% of harbour seals are found in the UK (SCOS, 2020). Following significant population declines due to disease in 1988 and 2002, harbour seal numbers on the English east coast have been rising since 2006 and have remained relatively constant (SCOS, 2020). Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles (SCOS, 2017).

Grey and harbour seals will feed both in inshore and offshore waters depending on the distribution of their prey, which changes both seasonally and yearly. Both species tend to be concentrated close to shore, particularly during the pupping and moulting season. Seal tracking studies from the Moray Firth have indicated that the foraging movements of harbour seals are generally restricted to within a 40–50 km range of their haul-out sites (SCOS, 2020). The movements of grey seals can involve larger distances of several hundred kilometres, although most forage within 100 km of their haul out (SCOS, 2020).

As the Devenick infrastructure is located approximately 185 km offshore, grey and harbour seals may be encountered from time to time, but it is not likely that they use the area with any regularity or in great numbers, and this is especially the case for harbour seals. This is confirmed by the grey and harbour seal distribution maps published by the Sea Mammal Research Unit (SMRU) (Carter et al., 2020). These report the presence of grey and harbour seals in the Devenick Field area as between 0 – 0.001% of the British Isles at-sea population per 25 km^2 for both species (Carter *et al*., 2020).

3.3 Conservation

3.3.1 Offshore conservation

There are no Nature Conservation Marine Protected areas (NCMPAs) or Special Protection areas (SPAs) within 40 km of the Devenick infrastructure. However, the Braemar Pockmarks Special

Area of Conservation (SAC) lies approximately 1.5 km west of the Devenick pipeline route (Figure 3.6). The closest NCMPA is the Central Fladen NCMPA, approximately 80 km west of the pipelines. The closest Special Protection Area (SPA) is Sumburgh Head SPA, approximately 175 km west.

The Braemar Pockmarks SAC is designated for the Annex I habitat ‘Submarine structures made by leaking gases’. The 48 pockmarks identified within this designated site are characterised as shallow seabed depressions of > 20 m in diameter (largest is 200 m) which are created by fluid expulsions into the water column. Six of the pockmarks qualify as the Annex I habitat ‘Submarine structures made by leaking gases’ and contain methane-derived authigenic carbonate (MDAC). This habitat supports specialist organisms and other marine fauna (JNCC, 2018).

The seabed in Blocks 9/28 and 6/13 contains records of burrowed mud habitat (designated as Scottish PMF), which consist of finer sediments that support burrowing crustaceans (Tyler-Walters *et al.*, 2016). More specifically, this area of seabed overlaps with records of the mud burrowing amphipod (*Maera loveni*) and records of the ‘Seapens and burrowing megafauna in circalittoral fine mud’ habitat. The latter of these habitats is also listed on the OSPAR (2008) list of threatened and/or declining habitats and species as ‘Seapens and burrowing megafauna communities’. As described in Section 3.2.3, faunal burrows and burrowing megafauna were recorded in the pockmarks investigated in the Devenick pipelines habitats assessments, meaning this habitat could be present. However, the area is not considered to support a particularly wide coverage of this habitat relative to the wider area.

Blocks 9/28 and 16/3 also overlap with the PMF ‘Offshore deep-sea muds’ (Tyler-Walters *et al.,* 2016). This habitat is widespread in the north and west of Scotland and is associated with a high diversity of fauna such as brittlestars, sea cucumbers and sea urchins (Tyler-Walters *et al*., 2016). Additionally, all of the blocks within the Devenick decommissioning area overlap with the habitat ‘subtidal sand and gravels’, a seabed type designated as PMF in Scottish waters (Tyler-Walters *et al*., 2016). ‘Subtidal sands and gravels’ also support internationally important commercial fisheries e.g. scallops, flatfish, sandeels, and are important nursery grounds for juvenile commercial fish species such as sandeels, flatfish, bass, skates, rays and sharks. However, the distribution of this feature is relatively wide in the North Sea (Tyler-Walters *et al*., 2016).

Apart from the nearby Braemar Pockmarks SAC (Figure 3-6), the recorded presence of ocean quahogs in survey sediment samples, the potential presence of sea pen communities in the area, and the PMF habitats listed above, there are no records of seabed features of conservation interest in the vicinity of the Devenick decommissioning area, including those listed on the Annex I of the EC Habitats Directive, or any other Scottish PMF (NMPI, 2021).

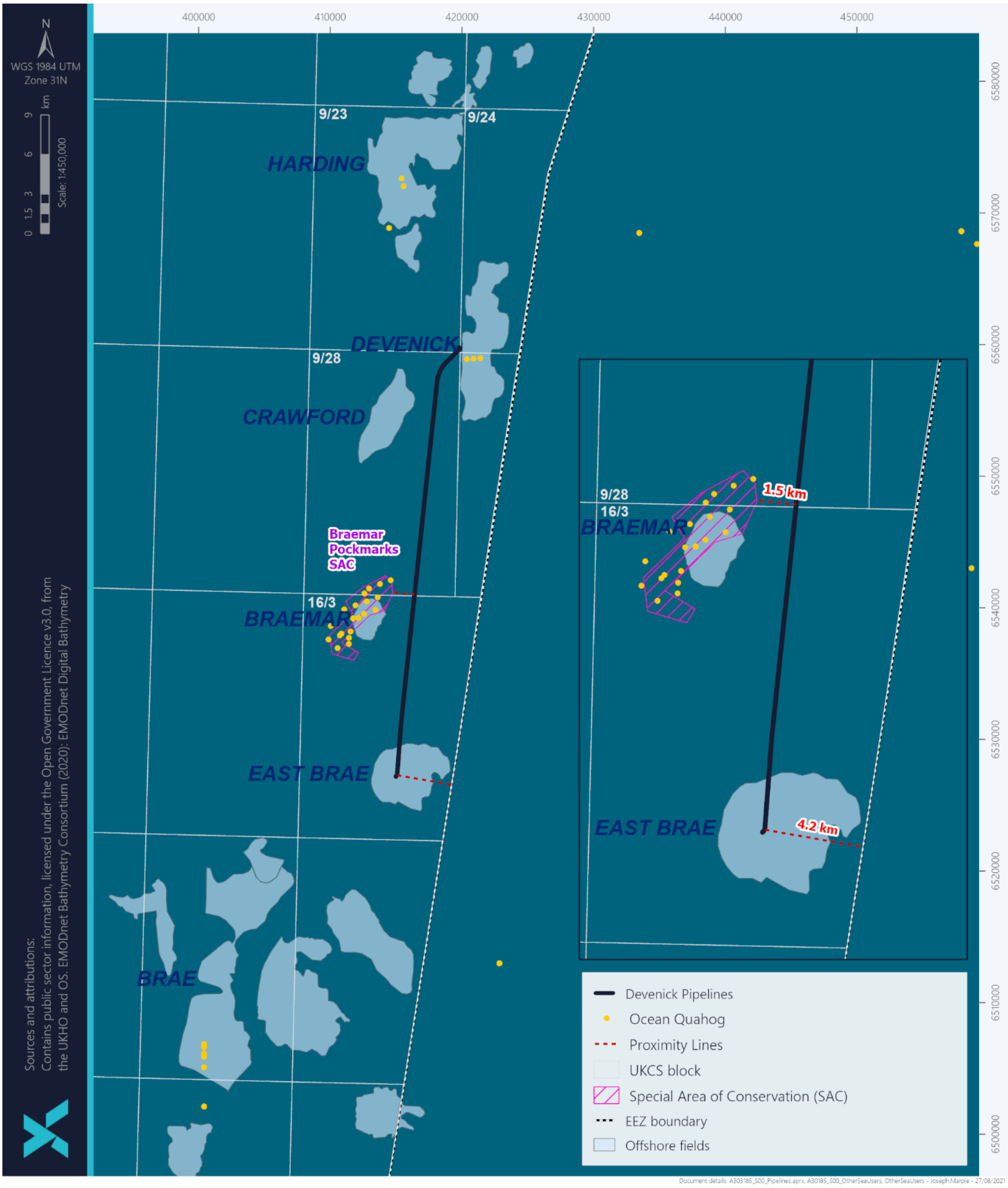


Figure 3.6 Location of the Devenick infrastructure relative to protected areas

3.3.2 Protected species

Four species listed under Annex II of the EU Habitats Directive are found in UK waters; harbour porpoise, minke whale, grey seal and harbour seal. Grey and harbour seals are unlikely to be observed near the Devenick decommissioning area with any regularity as both species have very low densities as was previously described. The harbour porpoise and minke whale are the two

Annex II species which could be present near the Devenick decommissioning area. However, due to their mobile nature, these species are likely to move away and not be adversely affected by the proposed decommissioning activities. All species of cetacean recorded within the proposed operations area are listed as EPSs.

As described in Section 3.2.3, *A. islandica* (<10 individuals) were identified during site-specific surveys, however, the abundances do not constitute an aggregation. Higher numbers of records at the Braemar Field (71 adults in Fugro, 2016a), aligning with the nearest public record of *A. islandica* to the Devenick pipelines located 3.8 km away, near the Braemar Pockmark SAC (NMPI, 2021). Therefore, it is expected that small numbers of *A. islandica* will be present around the Devenick infrastructure. However, the area is not expected to be of high importance for this species. This species is listed as PMF in Scottish waters (Tyler-Walters, 2016) and is on the OSPAR List of Threatened and/or Declining Species (OSPAR, 2008). However, the distribution of *A. islandica* is relatively widespread in the North Sea (OSPAR, 2009).

As described in Sections 3.2.3 and 3.3.1, there is also the potential for the OSPAR (2008) listed habitat 'seapens and burrowing megafauna communities' to be present within the Devenick decommissioning area. This habitat is listed under the PMF 'burrowed mud', which overlaps with the UKCS blocks within which the Devenick decommissioning area resides but does not overlap with the infrastructure directly (Tyler-Walters, 2016) (NMPI, 2021).

3.3.3 Onshore conservation

The Devenick field is located approximately 185 km from the northeast coast of Scotland. Due to this distance, no impacts to onshore conservation sites are expected from routine operations at the Devenick decommissioning project.

3.3.4 National marine plan

The National Marine Plan (NMP) covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles). The aim of the NMP is to help ensure the sustainable development of the marine area through informing and guiding regulation, management, use and protection of the Marine Plan areas. The proposed operations described in this EA have been assessed against the Marine Plan General Planning Principles, specifically GEN 1, 4, 5, 9, 12, 14 and 21 (Section 0 to Section 0) and OIL AND GAS 2, 3 and 6 (Section 0 to Section 0).

Assessment of compliance against relevant policies has already been achieved through the impact assessment in Section 1.0 in support of this EA. The proposed operations do not compromise any of the marine plan objectives and policies. TAQA will comply with all policies associated with the NMP, with particular attention being paid to the following policies:

GEN 1 – General planning principle

Development and use of the marine area should be consistent with the Marine Plan, ensuring activities are undertaken in a sustainable manner that protects and enhances Scotland's natural and historic marine environment. TAQA will ensure that any potential impacts associated with the selected Devenick decommissioning operations will be kept to a minimum as discussed in Section 1.0.

GEN 4 – Co-existence

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

GEN 5 – Climate change

Marine planners and decision makers should seek to facilitate a transition to a low carbon economy. They should consider ways to reduce emissions of carbon and other greenhouse gasses. TAQA will ensure that any potential impacts associated with the selected Devenick subsea decommissioning operations will be kept to a minimum as discussed in Section 1.0.

GEN 9 – Natural heritage

Development and use of the marine environment must:

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

TAQA will ensure that any potential impacts to protected species and sites associated with the selected Devenick subsea decommissioning operations will be kept to a minimum, as discussed in Section 1.0.

GEN 12 – Water quality and resource

Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives that apply. TAQA will ensure that any potential impacts to water quality associated with the selected Devenick subsea decommissioning operations will be kept to a minimum, as discussed in Section 1.0.

GEN 14 – Air quality

Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits. Some development and use may result in increased emissions to air, including particulate matter and gasses. Impacts on relevant statutory air quality limits must be taken into account and mitigation measures adopted, if necessary, to allow an activity to proceed within these limits. TAQA will ensure that any potential impacts to air quality with the selected Devenick subsea decommissioning operations will be kept to a minimum, as discussed in Section 1.0.

GEN 21 – Cumulative impacts

Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation and where necessary, in collaboration with other operators working in the vicinity of the Devenick infrastructure. TAQA will ensure that any potential cumulative impacts to air and water quality and biological communities with the selected Devenick subsea decommissioning operations will be kept to a minimum, as discussed in Section 1.0.

OIL AND GAS 2 – Decommissioning end-points

Where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process. TAQA will ensure that any material returned to shore as a result of the Devenick subsea decommissioning activities adheres to the waste hierarchy (Figure 2.3) as discussed in Section 2.5.

OIL AND GAS 3 – Minimising environmental and socio-economic impacts

Supporting marine and coastal infrastructure for oil and gas developments, including for storage, should utilise the minimum space needed for activity and should take into account environmental and socio-economic constraints. TAQA will ensure that the onshore resources required for Devenick subsea decommissioning activities will be minimised, as discussed in Section 5.0.

OIL AND GAS 6 – Risk reduction

Consenting and licensing authorities should be satisfied that adequate risk reduction measures are in place, and that operators should have sufficient emergency response and contingency strategies in place that are compatible with the National Contingency Plan and the Offshore Safety Directive. TAQA have the relevant risk reduction measures in place for the deconstruction of the Devenick subsea infrastructure, as discussed in Section 1.0.

3.4 Socio-economic environment

3.4.1 Commercial fisheries

To provide the fullest picture of fisheries within the area, and the associated landings and effort trends, data from 2015 to 2019 are considered (see Table 3.4 and Table 3.5). The Devenick infrastructure is located in ICES rectangle 47F1 and 46F1, which in general are targeted primarily for demersal species in terms of both landed weights and value (Figure 3.7).

In ICES rectangle 47F1, demersal fish accounted for 97% to 99% of the total landed value and >90% of the total landed weight between 2015 and 2018 (see Table 3.4). In these same years shellfish and pelagic species accounted for <3% of the value and <10% of the landed weight. In 2019, the distribution of catch by landings weight and value was still predominantly attributed to demersal fish, accounting for 82% of the landed value and 58% of the landed weight, however, a greater proportion of landings were attributed to pelagic fish in this year, compared with 2015 – 2018, accounting for 17% of the landed value and 42% of the landed weight (Scottish Government, 2020).

The landings value and weight in ICES rectangle 46F1 were more evenly split between demersal, pelagic and shellfish, although the dominant species type varied by year. In 2015, landings weight and value were fairly evenly split between pelagic, demersal fish and shellfish, although there was a slight dominance of demersal and pelagic fish. Demersal fish accounted for 43% of the landed value and 31% of the landed weight, whereas pelagic fish accounted for 22% of the landed value and 60% of the landed weight. Shellfish accounted for 35% of the landed value, but this was associated with only 9% of the landed weight. In 2016, pelagic fish were dominant, accounting for 59% of landed value and 77% of landed weight. Demersal fish accounted for 25% of the landed value and 22% of the landed weight. Pelagic fish landings decreased in 2017 and 2018 and demersal fish dominated in terms of landed weights and values. Landed value for demersal fish was 87% in 2017 and 62% in 2018 with landed weights being 94% in 2017 and 78% in 2018. Shellfish landings accounted for the remainder of landed weights and values, with no landings for pelagic fish being recorded in these years. In 2019, the incidence of shellfish catch increased, accounting for 51% of the landed value and 32% of the landed weight. Demersal fish accounted for 46% of the landed value and 54% of the landed weight in this year, and pelagic fish accounted for 3% of landed value and 14% of landed weight (Scottish Government, 2020).

In 2019, the three most valuable species in ICES rectangle 47F1 were cod, haddock and herring. These three species also made the largest contribution to landed weight in 2019. The three most valuable species in 2019 for ICES rectangle 46F1 were *Nephrops*, monkfish or anglerfish and haddock. The three species that had the highest contribution to landed weights were *Nephrops*, haddock and herring (Scottish Government, 2020).

The average landed value and weights of demersal fish in ICES rectangles 47F1 was generally consistent with surrounding ICES rectangles, such as 48F0, 48F1 and 47F0. Landed weights 46F1 were more similar to ICES rectangles 46F0, 45F0 and 45F1 (Figure 3.7). Generally, the landings values and weights of demersal fish are higher in the ICES rectangles further north, with an increase in shellfish landings in ICES rectangles to the south of the Devenick pipelines.

To put the landings into context, catches amounting to 529,109 te with a value of £767,721,935 were landed across the UK in 2019. Therefore, ICES rectangles 47F1 and 46F1 present a relatively low contribution to the UK total, comprising 0.46% and 0.23% of value landed and providing a 0.49% and 0.17% contribution to the total value of the UK commercial fisheries in 2019 for ICES rectangle 47F1 and 46F1, respectively (Scottish Government, 2020).

Table 3.5 presents the fishing effort in ICES rectangles 47F1 and 46F1 between 2015-2019. Fishing intensity is considered low for demersal fisheries in comparison with other areas of the North Sea and marked as disclosive for pelagic fisheries (Kafas *et al*., 2012). Fishing effort was comparatively higher in ICES rectangle 47F1 between 2015 and 2017 compared to ICES rectangle 46F1, however, fishing effort in ICES rectangle 46F1 exceeded that of 47F1 in 2018 and 2019. This is likely caused by an increase in fishing effort in ICES rectangle 46F1 between 2015 and 2019 which coincided with a decrease in fishing effort in ICES rectangle 47F1 in this time frame. In 2019, fishing effort amounted to 329 days in ICES rectangle 47F1 and 403 days in ICES rectangle 46F1. Fishing effort in ICES rectangles 47F1 and 46F1 has been observed throughout the year (Scottish Government, 2020).

Trawls were the dominant gear types used in ICES rectangles 47F1 and 46F1. Seine nets were also operated across all years in both ICES rectangles (although to a lesser extent in ICES rectangle 46F1) and traps were operated in a single year (2019) in ICES rectangle 46F1 (recorded as disclosive effort) (Figure 3.8) (Scottish Government, 2020). Figure 3.9 shows fishing intensity (derived from Vessel Monitoring System (VMS) data) in the NNS according to fishing method (Marine Scotland, 2020). Although this dataset differs in certain respects from that issued by the Scottish Government (2020), it broadly corroborates the overall picture that the fishing effort in the Devenick decommissioning area is low to moderate compared to other area of the North Sea. Figure 3.9 indicates that bottom trawling activity does occur across the pipelines, although to a lesser extent than in ICES rectangles further south (e.g., 45F0 and 45F1). Figure 3.9 also indicates that the majority of the bottom trawling that occurs within the vicinity of the Devenick pipelines does not target *Nephrops* or other crustaceans. However, it is important to note that the recent increase in shellfish landed weights and values in ICES rectangle 46F1 could indicate that *Nephrops* trawling fishing effort may have increased in ICES rectangle 46F1 within the last two years.

Table 3.4 Live weight and value of fish and shellfish from ICES rectangles 47F1 and 46F1 from 2015-2019 (Scottish Government, 2020)

Species type	2019				2018				2017				2016				2015			
	Live weight (te)		Value (£)		Live weight (te)		Value (£)		Live weight (te)		Value (£)		Live weight (te)		Value (£)		Live weight (te)		Value (£)	
	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1
Demersal	1,503	484	2,957,606	798,685	1,618	482	2,747,790	848,582	2,007	834	3,589,962	1,528,901	1,658	562	2,494,306	837,895	2,166	275	3,108,550	397,479
Pelagic	1,078	128	614,522	58,249	0	0	543	124	0	0	33	43	97	1,952	45,479	1,417,757	233	531	89,581	201,599
Shellfish	4	290	14,345	886,090	10	138	38,473	512,988	10	57	42,880	236,408	4	34	14,349	156,764	3	75	10,049	320,771
Total	**2,585**	**903**	**3,586,474**	**1,743,024**	**1,628**	**620**	**2,786,806**	**1,361,694**	**2,017**	**890**	**3,632,874**	**1,765,352**	**1,759**	**2548**	**2,554,134**	**2,412,415**	**2,402**	**882**	**3,208,180**	**919,850**

Table 3.5 Number of fishing days per month (all gear) in ICES rectangles 47F1 and 46F1 from 2015-2019 (Scottish Government, 2020)

Year	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Total	
	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1	47F1	46F1
2015	D	60	36	D	35	9	25	D	78	3	33	9	35	D	65	D	39	D	32	D	25	64	13	34	416	179
2016	35	D	49	99	17	34	30	D	61	15	43	D	38	10	46	17	19	D	8	8	25	9	19	D	389	192
2017	42	14	22	16	27	46	24	4	64	14	54	7	44	12	30	29	11	13	D	42	14	7	25	12	358	218
2018	64	10	23	39	20	D	19	19	42	139	27	D	30	7	20	D	12	34	7	57	17	16	41	10	321	332
2019	37	D	47	200	36	36	28	115	18	D	9	D	41	26	30	D	17	D	24	20	30	6	11	D	329	403

Note: Monthly fishing effort by UK vessels landing into Scotland: Blank = no data, D = Disclosive data (indicating very low effort) [1], green = 0 – 100 days fished, yellow = 101 – 200, orange =201-300, red = ≥301

[1] The term 'disclosive' is used when fewer than five vessels have been recorded fishing in an area, meaning that detailed data cannot be shown in order to preserve data privacy. It therefore indicates very low levels of effort within the area.

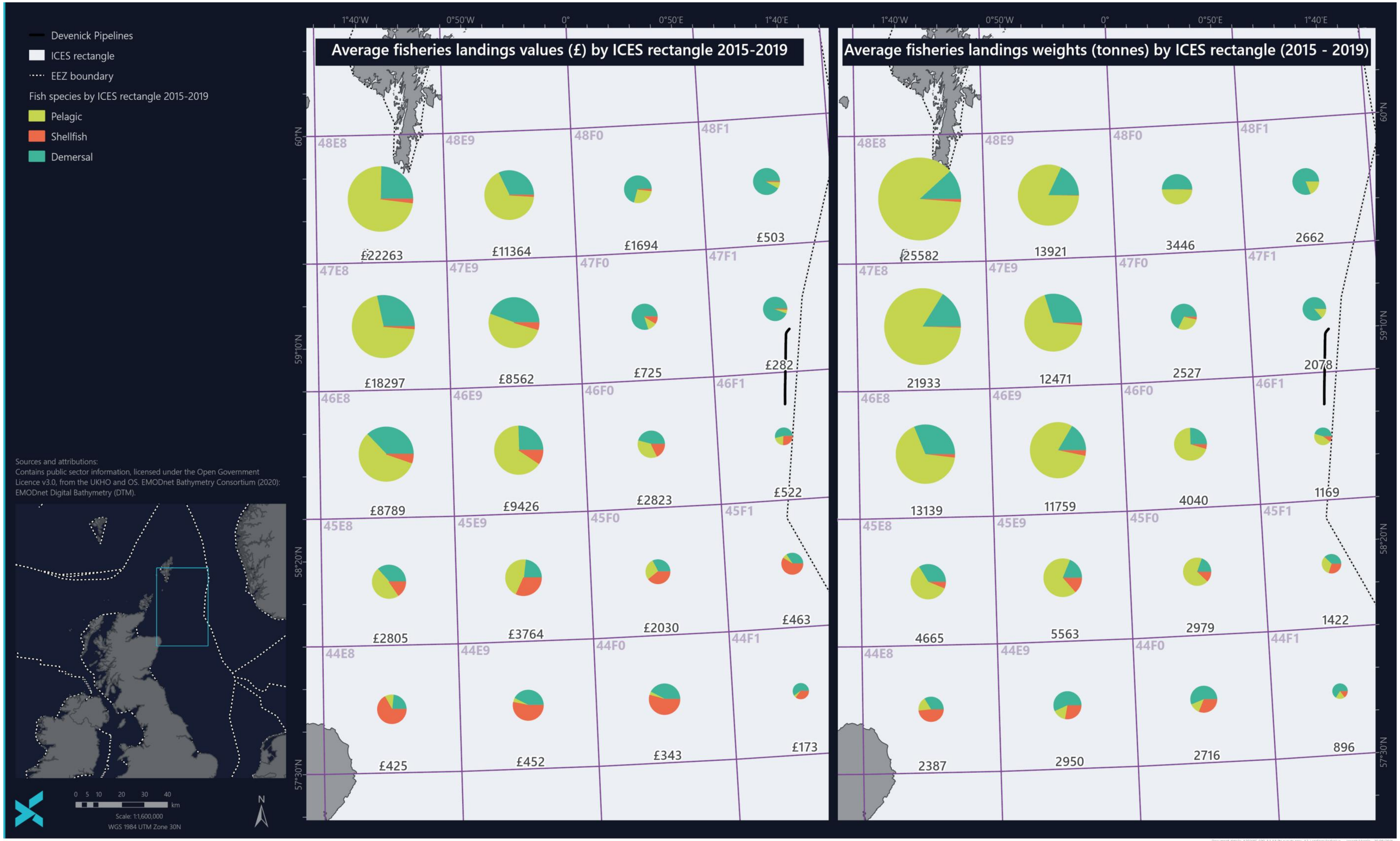


Figure 3.7 Average landings (tonnes) and values (£) of demersal, pelagic and shellfish fisheries in the vicinity of the Devenick infrastructure, by ICES rectangle (2015-2019)

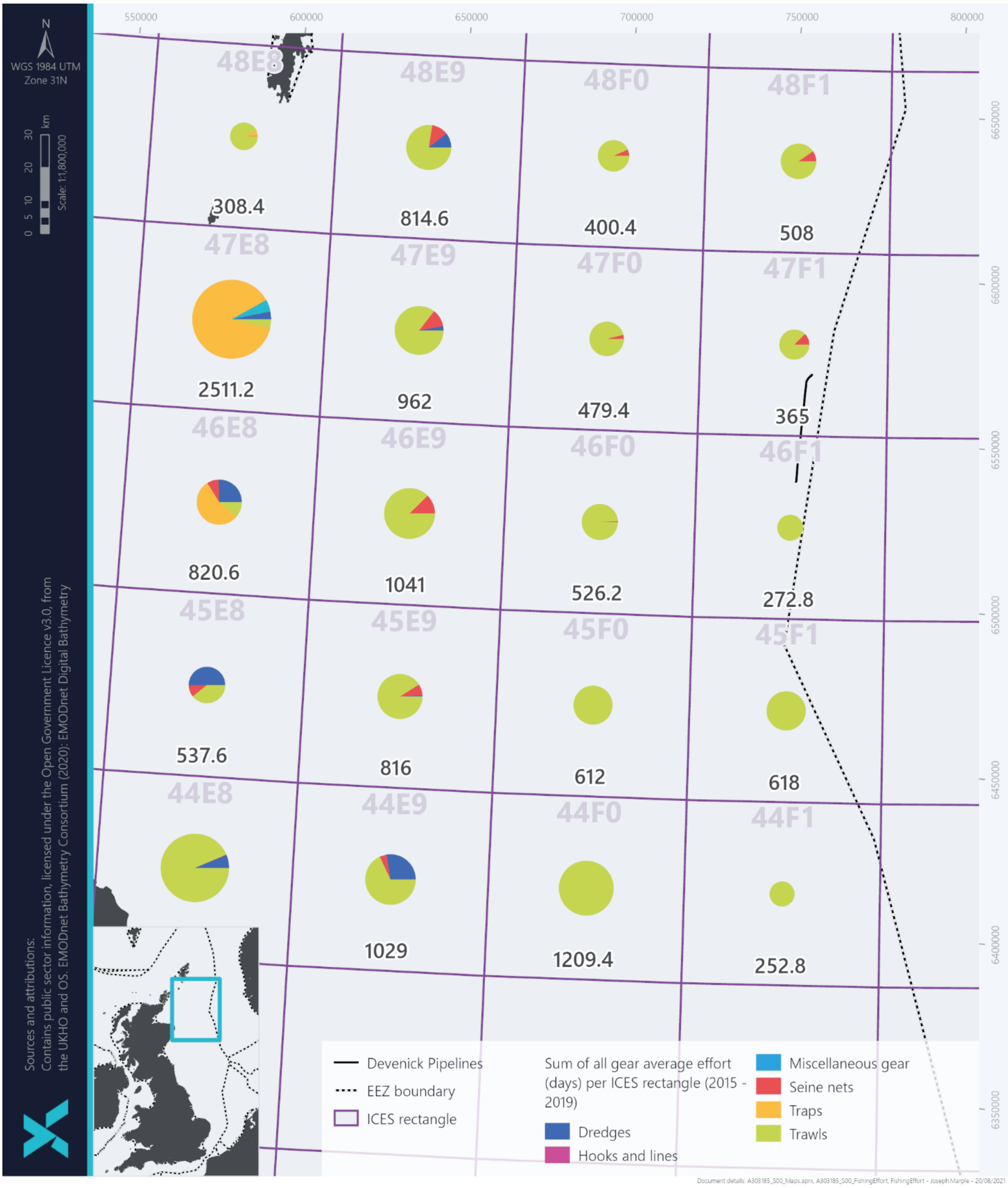


Figure 3.8 Fishing effort (minutes per year) in the vicinity of the Devenick infrastructure, by ICES rectangles 47F1 and 46F1 (2015-2019)

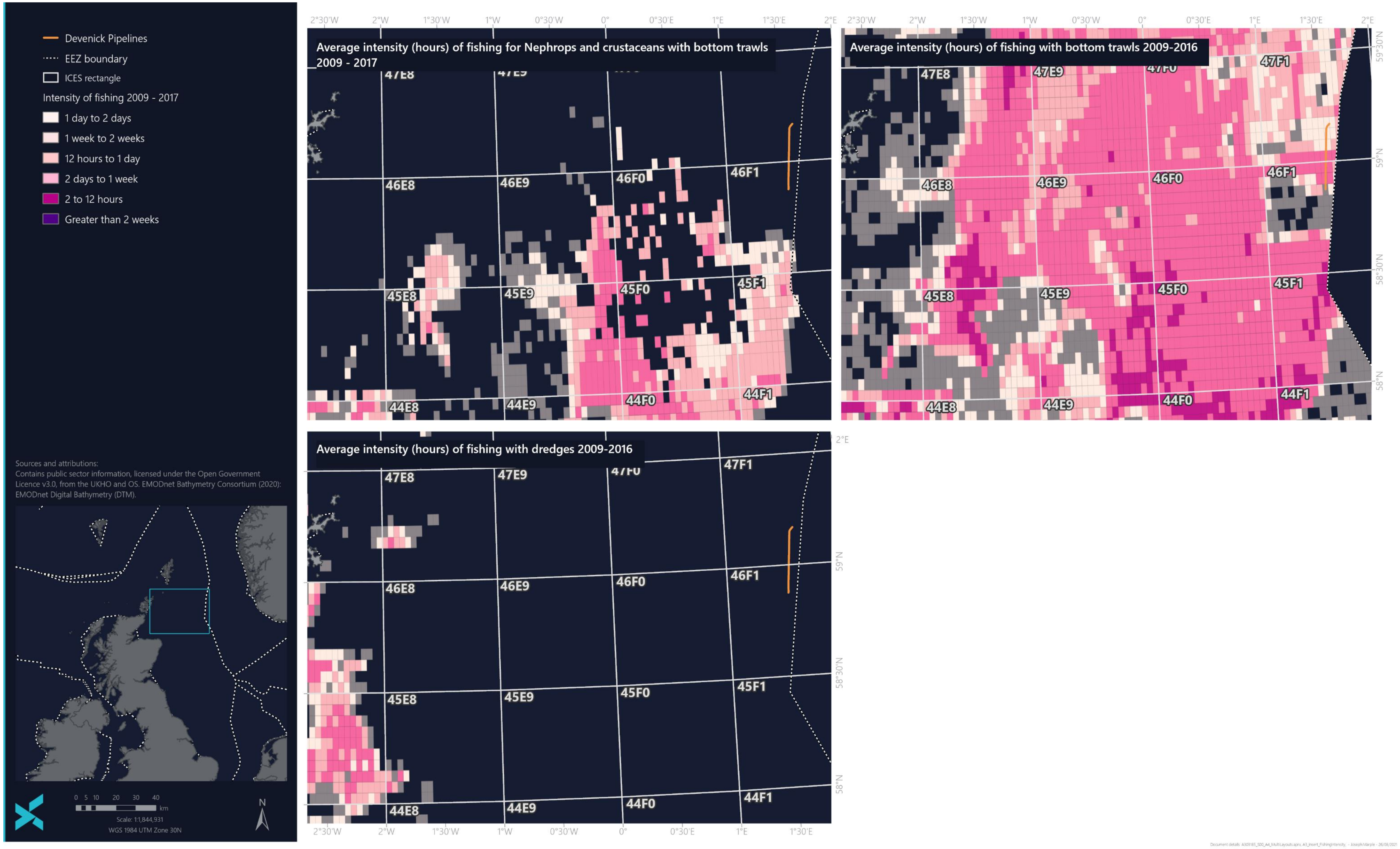


Figure 3.9 Average intensity (hours) of fishing for Nephrops and crustaceans by bottom trawls, fishing with bottom trawls and fishing with dredges in the vicinity of the Devenick infrastructure (2009-2016) (note that data for Nephrops bottom trawling extends out to 2017)

3.4.2 Shipping

The North Sea contains some of the world's busiest shipping routes, with significant traffic generated by vessels trading between ports at either side of the North Sea and the Baltic. North Sea oil and gas fields generate moderate vessel traffic in the form of support vessels, principally operating from Peterhead, Aberdeen, Montrose and Dundee in the north and Great Yarmouth and Lowestoft in the south (DECC, 2016).

The level of shipping activity is considered low or very low in Blocks 9/24, 9/23, 9/28 and 16/3 (OGA, 2016). The average weekly density of vessels (all combined) using automatic identification systems (AIS) data between 2012 and 2017 is less than five transits in the Devenick decommissioning area, which is very low compared to other areas in the North Sea (NMPI, 2021). Satellite data based on the Automatic Identification System dataset from 2017, plotted in Figure 3.10 show a range of vessels transit through Blocks 9/24, 9/23, 9/28 and 16/3 (MMO, 2017).

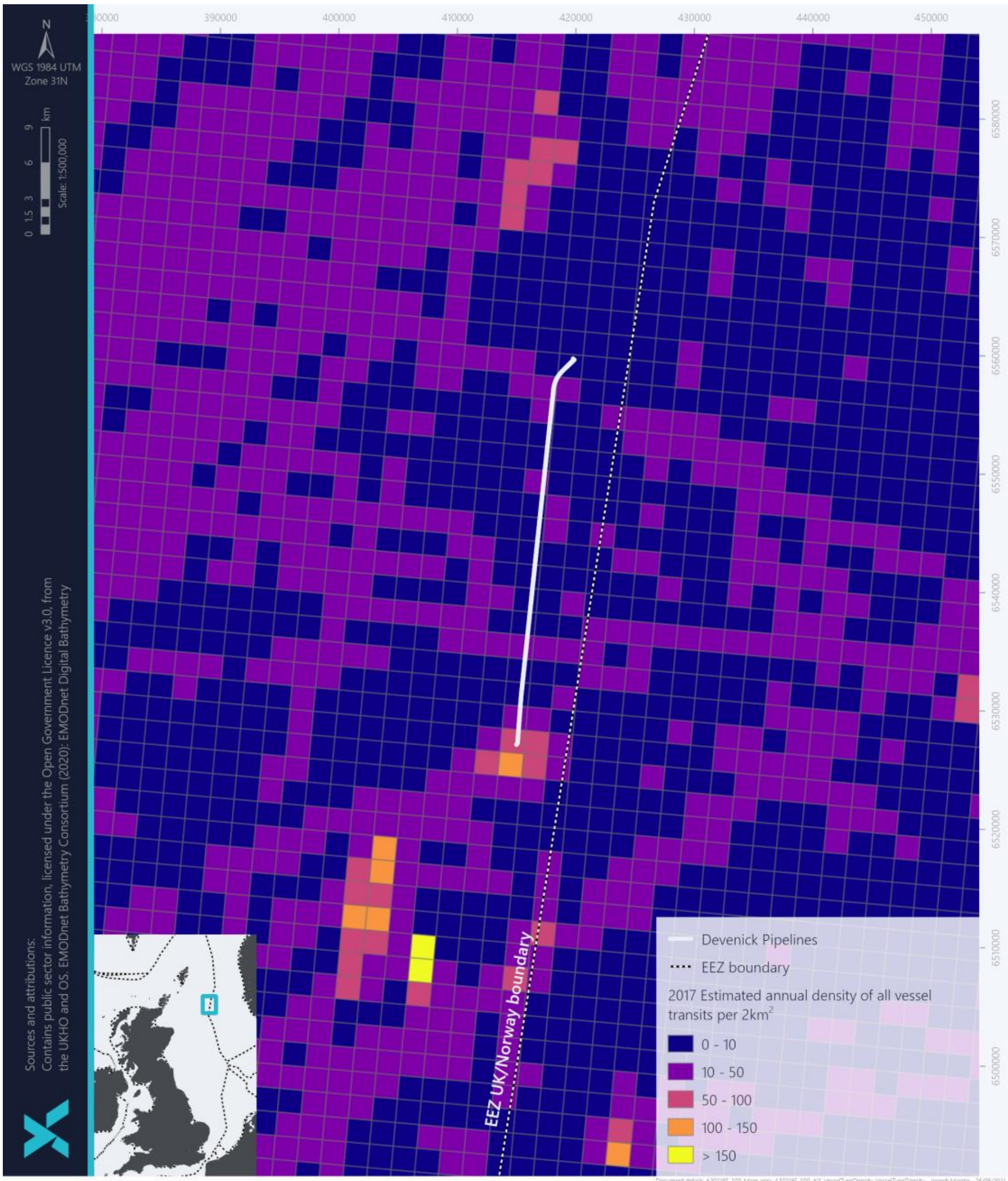


Figure 3.10 Density of vessel transits around the Devenick infrastructure in 2017 (MMO, 2017)

3.4.3 Oil and gas activity

There are a number of installations and pipelines located within the vicinity of the Devenick decommissioning area, as outlined in Figure 3.11. Table 3.6 provides the distances in the vicinity (<40 km) of the Devenick infrastructure.

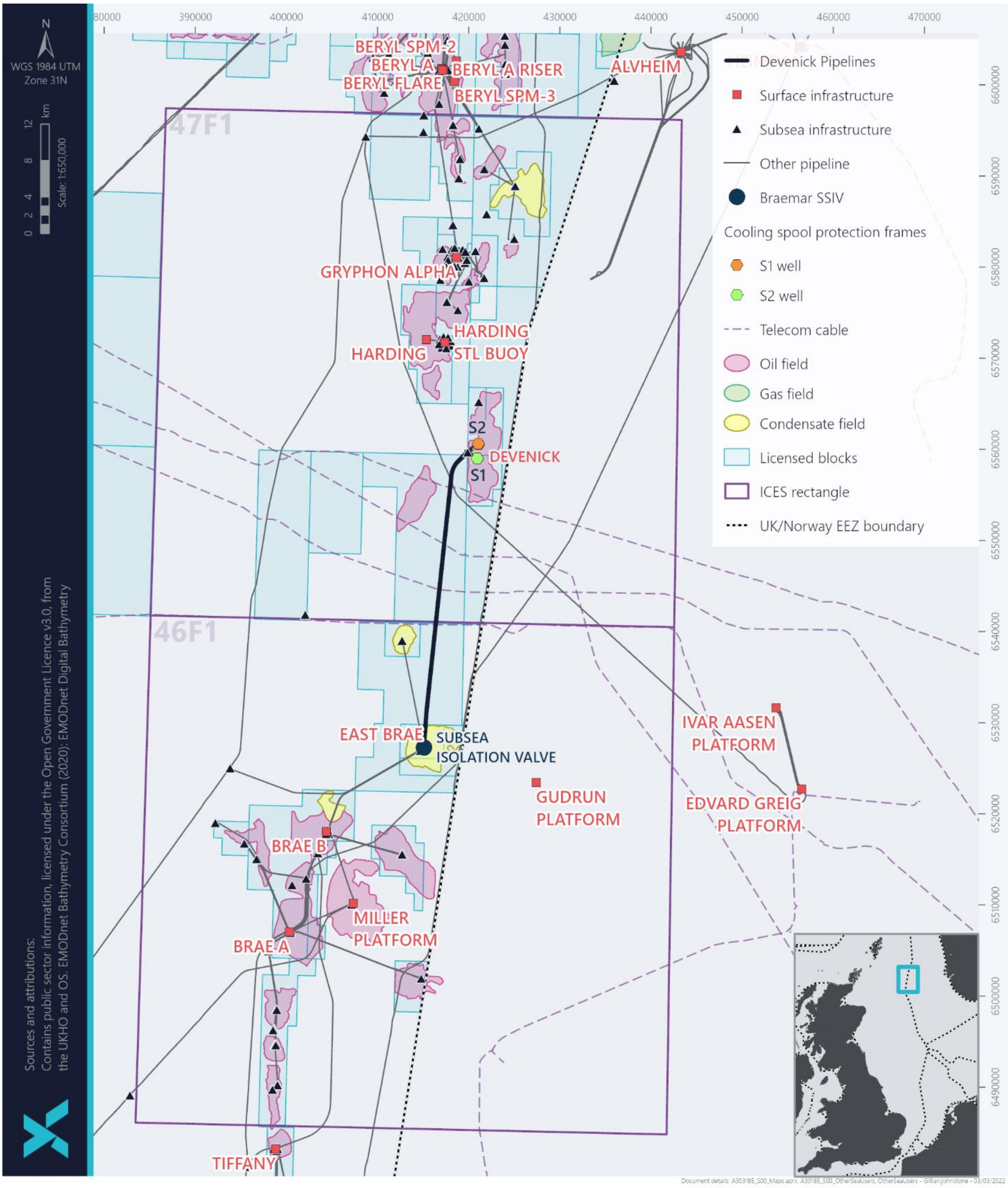


Figure 3.11 Infrastructure in the vicinity of the Devenick infrastructure

Table 3.6 Installations located within 40 km of the Devenick infrastructure

Installation	Distance from Devenick infrastructure (km)	Direction from Devenick infrastructure	Status
Ivar AASEN Platform	38.1	South east	Active
Brae Alpha	24.9	South west	Active
Braemar	22.0	South-south west	Active
Gryphon Alpha	21.3	North-north west	Active
Maclure	21.0	North	Active
Miller	18.6	South west	Decommissioned
Tullich	16.0	North-north west	Active
Brae Bravo	13.9	South west	Not in use
Harding	13.0	North-north west	Active
Gudrun Platform	12.9	South east	Active
East Brae	0	South	Active

The Utsira High gas pipeline (operated by Gassco) also crosses the Devenick pipeline approximately 3.7 km from the Devenick S1 well location (Figure 3.11). The Utsira High gas pipeline is a 94 km gas pipeline running from the Edvard Grieg and Ivar Aasen Fields on the Norwegian continental shelf to the Scottish Area Gas Evacuation (SAGE) transport system on the UKCS. The gas is transported via SAGE to the receiving terminal in St. Fergus, Scotland.

3.4.4 Military activities

There are no charted Military Practice and Exercise Areas (PEXAs) the vicinity of the Project area (NMPI, 2021).

3.4.5 Renewable energy

There are no planned or operating renewable energy sites in close vicinity (<40 km) of the Devenick infrastructure.

3.4.6 Telecommunication cables

The Devenick pipelines cross two active telecommunications cables; these are the Atlantic Crossing 1, operated by Century Link and HAVFRUE / AEC-2 (which crosses over the Devenick pipelines), operated by Aqua Comms. The Devenick pipelines also cross the disused Tat 14 cable, owned by Telia Carrier and the disused Tat 10B cable, owned by Deutsche Telekom AG.

3.4.7 Wrecks

Three 'non-dangerous wrecks' are located within Block 16/3, as identified by the UK Hydrographic Office (UKHO). The wrecks are located 0.2 km south east, 1.4 km south west and 5 km north west of the Devenick infrastructure. The identity of the wrecks is unknown.

4 IMPACT ASSESSMENT APPROACH

This EA is designed to:

- Identify potential impacts to environmental and societal receptors from the proposed decommissioning activities;
- Evaluate the potential significance of any identified impacts in terms of the threat that they pose to these receptors; and
- Assign measures to manage the risks in line with industry Best Available Technique (BAT) and Best Environmental Practise (BEP); and address concerns or issues raised by stakeholders through consultation.

The impact assessment was undertaken using the following approach:

- The potential environmental issues arising from subsea decommissioning activities were identified through a combination of the expert judgement of project engineers and marine environmental specialists, and from previous consultation on the wider area with OPRED, Marine Scotland, JNCC and SFF. The potential environmental issues were grouped under the following key receptor risk groups:
    - Emissions to air;
    - Disturbance to the seabed;
    - Discharges to sea;
    - Physical presence;
    - Underwater noise;
    - Resource use;
    - Onshore activities/ waste; and
    - Unplanned events.
- An initial screening based on a high-level consideration of these aspects against the evaluation criteria was then undertaken which screened aspects in or out of further detailed assessment. Justification statements were compiled detailing the rationale for screening out any aspects from further assessment (Section 5.1).
- For aspects which were considered potentially significant, their significance of potential impacts against impact criteria definitions was evaluated (Sections 5.2 and 5.3); and
- For any potentially significant impact, any potential mitigation and/or control measures to be used to further reduce any impact to ‘as low as reasonably practicable’ (ALARP) were captured.

4.1 Stakeholder engagement

Consultation for the Devenick subsea decommissioning has been largely based on sharing project expectations from the wider project area approach and Devenick-specific considerations with the key stakeholders (OPRED, Marine Scotland, JNCC and SFF).

4.2 EA methodology

4.2.1 Overview

The Devenick EA methodology was developed by reference to the Institute of Ecology and Environmental Management (IEEM) guidelines for marine impact assessment (IEEM, 2010), the Marine Life Information Network (MarLIN) species and ecosystem sensitivities guidelines (Tyler-Walters *et al*., 2004) and guidance provided by SNH in their handbook on environmental impact assessment (SNH, 2013) and by The Institute of Environmental Management and Assessment (IEMA) in their guidelines for environmental impact assessment (IEMA, 2015, 2016).

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

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

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

- Identification of receptor and impact (including duration, timing and nature of impact);
- Definition of sensitivity, vulnerability and value of receptor;
- Definition of magnitude and likelihood of impact; and
- Assessment of consequence of the impact on the receptor, considering the probability that it will occur, the spatial and temporal extent and the importance of the impact. If the assessment of consequence of impact is determined as moderate or major, it is considered a significant impact.

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

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

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

4.2.2 Baseline characterisation and receptor

To make an assessment of potential impacts on the environment it was necessary to firstly characterise the different aspects of the environment that could potentially be affected (the baseline environment). The baseline environment has been described in Section 3 and is based on desk studies combined with additional site-specific studies such as surveys and modelling where required.

The EA process requires identification of the potential receptors that could be affected by the Devenick Subsea decommissioning activities (e.g. other users of the sea, water quality). High level receptors are identified and described in Section 3. The impact assessments are set out in Sections 5.2 and 5.3.

4.2.3 Impact definition

4.2.3.1 Impact magnitude

Determination of impact magnitude requires consideration of a range of key impact criteria including:

- Nature of impact, whether it be beneficial or adverse;
- Type of impact, be it direct or indirect;
- Size and scale of impact, e.g. the geographical area;
- Duration over which the impact is likely to occur e.g. less than a year, a few years, etc.;
- Seasonality of impact, i.e. is the impact expected to occur all year or at specific times; and
- Frequency of impact, i.e. how often the impact is expected to occur.

Each of these variables is expanded upon in Table 4.1 – Table 4.5 to provide consistent definitions across all EA topics. In each impact assessment, these terms are used in the assessment summary table to summarise the impact and are enlarged upon as necessary in any supporting text. With respect to the nature of the impact (Table 4.1), it should be noted that all impacts discussed in this EA report are adverse unless explicitly stated otherwise.

Table 4.1 Nature of impact

Nature of impact	Definition
Beneficial	Advantageous or positive effect to a receptor (i.e. an improvement).
Adverse	Detrimental or negative effect to a receptor.

Table 4.2 Type of impact

Type of impact	Definition
Direct	Impacts that result from a direct interaction between the Devenick decommissioning activities and the receptor. Impacts that are actually caused by the activities.
Indirect	Reasonably foreseeable impacts that are caused by the interactions with the Devenick decommissioning activities but which occur later in time than the original, or at a further distance. Indirect impacts include impacts that may be referred to as ‘secondary’, ‘related’ or ‘induced’.
Cumulative	Impacts that act together with other impacts (including those from any concurrent or planned future third-party activities) to affect the same receptors as the Devenick subsea decommissioning activities. Definition encompasses “in-combination” impacts.

Table 4.3 Duration of impact

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

Table 4.4 Geographical extent of impact

Geographical extent	Description
Local	Impacts that are limited to the local area surrounding Devenick subsea decommissioning activities footprint and associated working areas. Alternatively, where appropriate, impacts that are restricted to a single habitat or biotope or community.
Regional	Impacts that are experienced beyond the local area to the wider region, as determined by habitat/ecosystem extent.
National	Impacts that affect nationally important receptors or protected areas, or which have consequences at a national level. This extent may refer to either Scotland or the UK depending on the context.
Transboundary	Impacts that could be experienced by neighbouring national administrative areas.
International	Impacts that affect areas protected by international conventions, European and internationally designated areas or internationally important populations of key receptors (e.g. birds, marine mammals).

Table 4.5 Frequency of impact

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

4.2.3.2 Impact magnitude criteria

Overall impact magnitude requires consideration of all the impact parameters described above. Based on these parameters, magnitude can be assigned following the criteria outlined in Table 4.6. The resulting effect on the receptor is considered under vulnerability and is an evaluation based on scientific judgement.

Table 4.6 Impact magnitude criteria

Magnitude	Criteria
Major	Extent of change: Impact occurs over a large scale or spatial geographical extent and/or is long term or permanent in nature. Frequency/intensity of impact: high frequency (occurring repeatedly or continuously for a long period of time) and/or at high intensity.
Moderate	Extent of change: Impact occurs over a local to medium scale/spatial extent and/or has a prolonged duration. Frequency/intensity of impact: medium to high frequency (occurring repeatedly or continuously for a moderate length of time) and/or at moderate intensity or occurring occasionally/intermittently for short periods of time but at a moderate to high intensity.
Minor	Extent of change: Impact occurs on-site or is localised in scale/spatial extent and is of a temporary or short-term duration. Frequency/intensity of impact: low frequency (occurring occasionally/intermittently for short periods of time) and/or at low intensity.
Negligible	Extent of change: Impact is highly localised and very short term in nature (e.g. days/few weeks only).
Positive	An enhancement of some ecosystem or population parameter.
Notes: Magnitude of an impact is based on a variety of parameters. Definitions provided above are for guidance only and may not be appropriate for all impacts. For example, an impact may occur in a very localised area (minor to moderate) but at very high frequency/intensity for a long period of time (major). In such cases informed judgement is used to determine the most appropriate magnitude ranking and this is explained through the narrative of the assessment.	

4.2.3.3 Impact likelihood for unplanned and accidental events

The likelihood of an impact occurring for unplanned/accidental events is another factor that is considered in this impact assessment. This captures the probability that the impact will occur and also the probability that the receptor will be present and is based on knowledge of the receptor and professional judgement.

4.2.4 Receptor definition

As part of the assessment of impact significance it is necessary to define a receptor's sensitivity, vulnerability and value. The sensitivity of a receptor is defined as 'the degree to which a receptor is affected by an impact' and is a generic assessment based on factual information whereas an assessment of vulnerability, which is defined as 'the degree to which a receptor can or cannot cope with an adverse impact' is based on professional judgement taking into account an number of factors, including the previously assigned receptor sensitivity and impact magnitude, as well as other factors such as known population status or condition, distribution and abundance. The value of a receptor can be defined as the benefits from use of the natural environment. These benefits may be direct or indirect and they may be from present use and/ or future use.

4.2.4.1 Receptor sensitivity

These range from negligible to very high and definitions for assessing the sensitivity of a receptor are provided in Table 4.7.

Table 4.7 Sensitivity of receptor

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

4.2.4.2 Receptor vulnerability

Information on both receptor sensitivity and impact magnitude is required to determine receptor vulnerability. These criteria, described in Table 4.6 and Table 4.7 are used to define receptor vulnerability as per Table 4.8.

Table 4.8 Vulnerability of receptor

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

It is important to note that the above approach to assessing sensitivity and vulnerability is not appropriate in all circumstances and in some instances professional judgement has been used in determining sensitivity. In some instances, it has also been necessary to take a precautionary approach where stakeholder concern exists with regard to a particular receptor. Where this is the case, this is detailed in the relevant impact assessment in Section 5.

4.2.4.3 Receptor value

The value or importance of a receptor is based on a pre-defined judgement based on legislative requirements, guidance or policy. Where these are absent, it is necessary to make an informed judgement on receptor value based on perceived views of key stakeholders and specialists. Examples of receptor value definitions are provided in Table 4.9.

Table 4.9 Value of receptor

Receptor Value	Definition
Very high	Receptor of international importance (e.g. United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site). Receptor of very high importance or rarity, such as those designated under international legislation (e.g. EU Habitats Directive) or those that are internationally recognised as globally threatened (e.g. IUCN red list). Receptor has little flexibility or capability to utilise alternative area. Best known or only example and/or significant potential to contribute to knowledge and understanding and/or outreach.
High	Receptor of national importance (e.g. Nature Conservation Marine Protected Area (NCMPA), Marine Conservation Zone (MCZ)). Receptor of high importance or rarity, such as those which are designated under national legislation, and/or ecological receptors such as United Kingdom Biodiversity Action Plan (UKBAP) priority species with nationally important populations in the study area, and species that are near-threatened or vulnerable on the IUCN red list. Receptor provides the majority of income from the Devenick Field area. Above average example and/or high potential to contribute to knowledge and understanding and/or outreach.
Medium	Receptor of regional importance. Receptor of moderate value or regional importance, and/or ecological receptors listed as of least concern on the IUCN red list but which form qualifying interests on internationally designated sites, or which are present in internationally important numbers. Any receptor which is active in the Devenick Field area and utilises it for up to half of its annual income/activities. Average example and/or moderate potential to contribute to knowledge and understanding and/or outreach.
Low	Receptor of local importance. Receptor of low local importance and/or ecological receptors such as species which contribute to a national site, are present in regionally. Any receptor which is active in the Devenick Field area and reliant upon it for some income/activities. Below average example and/or low potential to contribute to knowledge and understanding and/or outreach.
Negligible	Receptor of very low importance, no specific value or concern. Receptor of very low importance, such as those which are generally abundant around the UK with no specific value or conservation concern. Receptor of very low importance and activity generally abundant in other areas/ not typically present in the Devenick Field area. Poor example and/or little or no potential to contribute to knowledge and understanding and/or outreach.

4.2.5 Consequence and significance of potential impact

Having determined impact magnitude and the sensitivity, vulnerability and value of the receptor, it is then necessary to evaluate impact significance. This involves:

- Determination of impact consequence based on a consideration of sensitivity, vulnerability and value of the receptor and impact magnitude;
- Assessment of impact significance based on assessment consequence;
- Mitigation; and
- Residual impacts.

4.2.5.1 Assessment of consequences and impact significance

The sensitivity, vulnerability and value of receptor are combined with magnitude (and likelihood, where appropriate) of impact using informed judgement to arrive at a consequence for each impact, as shown in Table 4.10. The significance of impact is derived directly from the assigned consequence ranking. The assessment of consequence considers mitigation measures that are embedded within the proposed activities.

Table 4.10 Assessment of consequence

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

4.2.6 Cumulative impact assessment

While the scope of this impact assessment is restricted to the decommissioning of the Devenick subsea infrastructure as outlined in Section 2, there will be other marine activities which have the potential to interact with the activities completed under the decommissioning work scope. The impact assessments presented in the following sections consider the potential for significant cumulative impacts to occur as a result of overlapping activities.

4.2.7 Transboundary impact assessment

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

4.2.8 Mitigation

Where potentially significant impacts (i.e. those ranked as being of moderate impact level or higher in Table 4.10) are identified, mitigation measures must be considered. The intention is that such measures should remove, reduce or manage the impacts to a point where the resulting residual significance is at an acceptable or insignificant level. Mitigation is also proposed in some instances to ensure impacts that are predicted to be not significant remain so.

5 IMPACT ASSESSMENT AND JUSTIFICATION

An impact assessment screening discussion was undertaken to discuss the proposed decommissioning activities and any potential impacts these may pose. This discussion identified nine potential impact areas based on the proposed removal methods. Of these nine potential impacts, seven were screened out of further assessment based on the low level of severity, or likelihood of significant impact occurring. The potential impacts are tabulated in Section 5.1, together with justification statements for the screening decisions and proposed mitigation. Disturbance to the seabed and physical presence of infrastructure decommissioned *in situ* in relation to other sea users were scoped in for further assessment and are discussed in Sections 5.2 and 5.3, respectively.

5.1 Assessment of potential impacts

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Emissions to air	No	Emissions during decommissioning activities, (largely comprising fuel combustion gases) will occur following cessation of production. Emissions generated by infrastructure, equipment and vessels associated with operation of the assets will be replaced by those from vessel use as well as the recycling of decommissioned materials. Reviewing historical EU Emissions Trading Scheme data and comparison with the likely emissions from the proposed workscope suggests that emissions relating to decommissioning will be small relative to those during production. The estimated CO_2 emissions to be generated by the selected decommissioning options are 5, 215.72 te, this equates to 0.04% of the total UKCS emissions in 2018 (13,200,000 te; OGUK, 2019). These emissions have been calculated assuming a worst case of approximately 67 days of vessel emissions across the duration of the decommissioning project. This vessel time is split across four types of vessels which will participate in a variety of activities including: structure removal, pipeline/umbilical end cutting, rock placement and a post-decommissioning monitoring. The total emissions estimate also includes the emissions associated with the re-manufacture of steel decommissioned *in situ* (1,593.09 te CO_2). See Appendix E for a summary of the CO_2 emissions associated with the project. Review of available decommissioning EAs suggests that atmospheric emissions in highly dispersive offshore environments are not considered to	• Vessel management in accordance with TAQA's marine procedures • Minimal vessel use/movement • Vessel sharing where possible • Engine maintenance

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
		present significant impacts and are extremely small in the context of UKCS and global emissions. Most submissions also note that emissions from short-term decommissioning activities are small compared to those previously arising from the asset over its operational life. Furthermore, in line with the NSTA's (2021) expectations (in particular, Stewardship Expectation 11*)* TAQA is dedicated to minimising greenhouse gas emissions from decommissioning operations, as far as is reasonable for each project. TAQA is committed to working with the supply chain and joint ventures as part of meeting these commitments. Considering the above, atmospheric emissions do not warrant further assessment.	
Disturbance to the seabed	Yes	There is potential for decommissioning activities to generate disturbance to the seabed; these include activities associated with decommissioning of pipelines *in situ*, the removal of subsea structures and the surface laid pipelines and umbilicals, rock cover removal from cooling spool protection structures and remediation of free-spans and exposures. Currently it is envisaged that all vessels undertaking the decommissioning and removal works would be dynamically positioned vessels. As a result, there will be no direct interaction between vessels and the seabed for vessel anchoring. Should this change following the commercial tendering process and an anchor vessel be required, any potential impact would be assessed and captured in the Consent to Locate application and its supporting EIA justification within the Portal Environmental Tracking System (PETS). Seabed impacts may range in duration from temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. As buried pipelines will be decommissioned *in situ*, there is an associated potential impact of long-term discharges from degrading infrastructure on the receiving environment. Discharges are expected to occur in very small quantities and over a long period of time and will be highly localised as the pipelines will not degrade equally along their length.	See Section 5.2

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
		TAQA is committed to leaving a clear, safe seabed in the wake of the decommissioning activities. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. Survey methods will be discussed and finalised with OPRED and non-intrusive verification techniques will be considered in the first instance. Impacts to the seabed from project activities are assessed further in Section 5.2.	
Discharges to sea	No	Pipelines will be cleaned and flushed prior to decommissioning. Any residual discharges during decommissioning activities will be managed and risk assessed under the existing permitting regime. Discharges from vessels are typically well-controlled activities that are regulated through vessel and machinery design, management and operation procedures. Drill cuttings surveys at the East Brae platform and the surrounding area concluded that THCs were elevated in comparison to historical survey data but were comparable to other cutting piles in the North Sea. Areas that contained elevated hydrocarbon residuals and heavy metal concentrations are most likely influenced by their proximity to drill cuttings piles and current and historic drill centres. Considering the above, discharges to sea will not be assessed further.	• MARPOL compliance. • Bilge management procedures. • Vessel audit procedures. • Contractor management procedures.

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
Physical presence of vessels in relation to other sea users	No	The presence of a small number of vessels for pipeline and umbilicals and subsea installation decommissioning activities will be relatively short-term in the context of the life of the Devenick Field. Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities. The small number of vessels required will also generally be in use within the existing 500 m safety zones at the Devenick S1 and S2 wells and at the Devenick manifold and will not occupy 'new' areas. Other sea users will be notified in advance of activities occurring meaning those stakeholders will have time to make any necessary alternative arrangements for the very limited period of operations. The decommissioning of the Devenick pipelines, umbilicals and subsea structures is estimated to require up to four vessels, however these would not all be on location at the same time (maximum of two at any one time). Considering the above, temporary presence of vessels does not need further assessment.	• Minimal vessel use/movement • Notification to Mariners • Opening up of 500 m safety exclusion zones following close-out.
Physical presence of infrastructure decommissioned *in situ* in relation to other sea users	Yes	The physical presence of infrastructure decommissioned *in situ* has limited potential of impacting other sea users and is limited to potential snagging risks to commercial fisheries. Subsea installations and surface-laid pipelines and umbilicals will be fully removed. Seabed disturbance from the removal of infrastructure has the potential to modify the habitat in a way which might impact upon other sea users which utilise the seabed. The seabed typical of the Devenick Field may lend itself to the formation of clay mounds in areas of occasionally muddy benthic habitat. Clay mounds may pose a potential snagging hazard to commercial fishing gears which make contact with the seabed. As such, the seabed will be subsequently surveyed and remediated as required. The pipelines and umbilicals to be decommissioned *in situ* are the trenched and buried for the majority of their length, and only the buried sections will be decommissioned *in situ*. Where free-spans and exposures are present, these will be remediated with rock cover, as will any exposed pipeline ends following cutting activities.	See Section 5.3

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
		The burial status of these pipelines and umbilicals is such that, following placement of rock remediation over free-spans and exposures, they are not expected to pose any risk of interaction with other sea users. Future monitoring work will monitor the burial of these pipelines and umbilicals and ensure that snagging risks do not arise. The frequency of this monitoring work and any subsequent maintenance regime will be established after consultation with OPRED. TAQA is committed to leaving a clear, safe seabed. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive, survey methods used will be discussed and finalised with OPRED. To address any Stakeholder concerns and to provide more detail with regards to the proposed mitigation measures, assessment of potential snagging risks associated with the decommissioning of pipelines, umbilicals and flowlines *in situ*, as well as the condition of the seabed following the decommissioning of infrastructure via full removal, is provided in Section 5.3.	
Underwater noise emissions	No	Aside from vessel noise and cutting activities, there will be no other noise generating activities. Vessel presence will be limited in duration. Diamond wire and hydraulic shear cutting operations are not readily discernible above background noise levels. Thus, vessel presence during the cutting process will mask the cutting noise generated (Pangerc *et al.*, 2016). As a result, noise generated during the decommissioning activities will be largely undetectable. Furthermore, the project is not located within an area protected for marine mammals. With industry-standard mitigation measures and JNCC guidance, Eas for offshore oil and gas decommissioning projects typically show no injury, or significant disturbance associated with these projects (Shell, 2017; CNRI, 2013; CNRI, 2017; and Marathon, 2017). On this basis, underwater noise assessment will not be assessed further.	• Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • Cutting activities will be minimised and carried out separately from other noisy activities where possible.
Resource use	No	Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Such use of resources is not	• Adherence to the Waste Hierarchy

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
		typically an issue of concern in offshore oil and gas. The estimated total energy usage for the decommissioning activities is 67,306.88 GJ. A large amount (21,083.75 GJ) of this total is a theoretical value associated with the remanufacture of steel and rock decommissioned *in situ*, and in reality, will not be expended. Material will be returned to shore as a result of project activities, expectation is to recycle up to 95% of this returned material. Considering the above, resource use does not warrant further assessment.	• Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • Engine maintenance.
Onshore impacts/ Waste	No	Waste management is often cited as a stakeholder concern across DPs. The waste to be brought to shore, which will be routine in nature, will be managed in line with TAQA's Waste Management Strategy and the Waste Hierarchy, as part of the project AWMP, using approved waste contractors and in liaison with the relevant Regulators (Section 2.5). On this basis, no further assessment of waste is necessary.	• Overall 'Duty of Care' • Waste Management Strategy and Active waste tracking • Waste Hierarchy • Selection of suitably licenced site (if applicable) • Communication with relevant Regulator(s) -e.g. SEPA established • EEMs tracking and close-out reporting • Contractor management
Unplanned events	No	Pipeline flushing will be undertaken prior to decommissioning activities. The remaining risk for a hydrocarbon release relates to loss of diesel from a vessel involved in decommissioning activities. A maximum of four vessels will be deployed over the course of the decommissioning activities, with a maximum of two vessels on site at any one time, these may include a Diving Support Vessel (DSV), guard vessel, a rock placement vessel (if remediation is not carried out by DSV) and a survey vessel.	• OPEP in place for operations • SOPEP on all vessels • Navigational warnings in place • 500 m zones operational until seabed clearance certified

Impact Area	Further assessment	Rationale	Proposed Mitigation and Best Practice
		Although the risk of oil spill is remote, the East Brae OPEP (Reference 200033; TAQA, 2020) will be updated to cover the Devenick decommissioning activities. Any spills from vessels in transit and outside the 500 m zones are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). Any potential from dropped objects (Devenick infrastructure) whilst in transit, onto active subsea facilities, would be covered within 'Dropped object procedures', which are industry-standard. There is only a very remote probability of any interaction with any live infrastructure. The *in situ* decommissioning of some infrastructure will also limit the potential for dropped objects or dislodged materials/objects. Considering the above, the potential impacts from accidental chemical/hydrocarbon releases or dropped objects during decommissioning activities do not warrant further assessment.	• Spill response procedures • Contractor management and communication • Lifting operations management of risk • PON2 submission • Careful planning, selection of equipment, subsequent management and implementation of activities • The location of any dropped or dislodged material will be accurately recorded and reported via Hydrographic Office and Kingfisher notification system.

5.2 Disturbance to the seabed

5.2.1 Approach

The two seabed impact pathways associated with the proposed activities are direct and indirect disturbance. Direct disturbance is considered to be the physical disturbance of seabed sediments and habitats. Direct disturbance has the potential to cause temporary or permanent changes to the marine environment, depending upon the nature of the associated activity. Permanent impacts are generally considered to represent a worst-case where required. Activities which contribute to the direct disturbance impact pathway include the removal of infrastructure and remediation of snagging hazards, either from re-burial or placement of material (rock armour) on the seabed. The total area of seabed expected to be impacted by direct physical disturbance has been calculated by adding together the individual areas of physical disturbance estimated for each activity.

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

The seabed impacts resulting from the decommissioning activities associated with the Devenick decommissioning can also be classified as temporary or permanent. Temporary impacts are defined here as those which have transient impacts lasting a few days to a few years. Permanent impacts are those which will continue to have an impact for decades to centuries following decommissioning. In the following sections, potential impacts will be defined either as temporary or permanent.

5.2.2 Sources of potential impacts

The following activities have been identified as potential sources of direct or indirect seabed disturbance:

- Subsea infrastructure decommissioning:
  - Removal of manifold foundation piles, Devenick SSIV, WHPS and pipeline cooling spool protection frames (Section 5.2.2.1).
- Decommissioning of pipelines, umbilicals and flowlines:
  - Removal of pipeline ends, surface laid pipeline spools and SSIV umbilical (Section 5.2.2.2);
  - Remediation of cut pipeline ends and exposures via rock placement (Section 5.2.2.3);
  - Decommissioning *in situ* of trenched and buried / rock covered flowlines (Section 5.2.2.4); and
  - Removal of SSIV control umbilical.
- Removal of protection material and debris (Section 5.2.2.3):
  - Relocation of rock cover over the cooling spool protection frames;
  - Removal of concrete mattresses and grout bags, etc.; and
  - Removal of concrete debris from S2 well site.

5.2.2.1 Structures

All subsea structures within the Devenick Field are to be fully removed. Decommissioning of the S1 wellhead is out with the scope of this EA and a complete impact assessment will be undertaken as part of the permit applications associated with well P&A, however the footprint associated with the removal of the WHPS will be considered as part of this EA.

The pipeline cooling spool protection structures will be recovered to shore, however the rock cover on the structures will be relocated to facilitate this recovery. Therefore, there will be seabed impacts associated with the removal of the cooling spool protection structures, removing the rock cover and placing it at a temporary location, and relocating it to a permanent site within the Devenick decommissioning area, potentially as remediation following the excavation of the piles associated with the WHPS and the Devenick manifold.

The boulder(s) identified at the S2 well site (Table 2.1) will either be:

- Broken up as necessary and used to partly fill the void in the seabed resulting from the removal of the S2 wellhead; or
- Broken up as necessary and recovered to a vessel and thence to shore for recycling or disposal.

The remediation measure adopted will be determined during detailed engineering. TAQA will consult with OPRED to agree the selected remediation measure adopted.

To calculate the area of direct disturbance the dimensions of the structures have been used. To account for the potential extended impact due to removal methods, a 5 m buffer has been added to the length and width of the structures. This methodology has been used in the interest of being conservative and calculating a worst-case possible impact and will incorporate the removal of the four piles from both the WHPS and the Devenick manifold.

An estimate has been made of the possible indirect disturbance due to re-suspension and settlement of sediment. Most re-suspended sediment will settle within the initial disturbance area, but it has been assumed that some will land beyond that area. As a conservative estimate, the area of indirect disturbance has been assumed to be double the area of direct disturbance. This disturbance will be temporary and resettlement will only occur as long as activities are underway and shortly afterwards. The direct and indirect disturbance areas associated with these proposed operations are summarised in Table 5.1.

Table 5.1 Seabed disturbance associated with the decommissioning of structures

Activity	Quantity and dimensions	Expected duration of disturbance	Temporary direct disturbance area (km^2)	Temporary indirect disturbance area (km^2)
Removal	S1 WHPS: 14 m (L) x 14 m (W)	Temporary	0.00036	0.0007
Removal	S1 Pipeline cooling spool protection frames: Type A, B, C: 15 m (L) x 5.2 m (W) Type D: 18 m (L) x 1.5 m (W)	Temporary	0.00076	0.0015
Removal	S2 Pipeline cooling spool protection frames: Type A, B, C: 15 m (L) x 5.2 m (W) Type D: 18 m (L) x 3.9 m (W)	Temporary	0.00082	0.0016
Removal	1 x manifold: 14 m (L) x 8.5 m (W)	Temporary	0.00026	0.0005
Removal	1 x SSIV: 10.75 m (L) x 6.5 m (W)	Temporary	0.00018	0.0004
Removal	Concrete block(s) at S2 well location	Temporary	0.000004	0.000008
Total (temporary)		**0.005**	**0.0024**	**0.005**

Please note, any apparent discrepancy in the totals is due to rounding within the table.

5.2.2.2 Removal of pipeline and umbilical ends and SSIV umbilical

Pipelines will be decommissioned *in situ*, pipeline ends and the surface laid SSIV umbilical will be cut and removed, and rock will be placed over the pipeline ends as remediation. Rock will also be deposited along the pipelines where exposures and spans have been identified (Appendix C).

The area of seabed disturbed by recovery of each individual pipeline end and SSIV umbilical to the surface has been estimated by multiplying the length of each individual line section which will be removed, by a 1 m buffer width. The areas disturbed by recovery of each individual line have then been summed to give an overall area of disturbance.

Indirect disturbance has been assumed to be twice that of the direct area. This accounts for the resuspension of sediment generated due to the direct disturbance, most of which will settle within the direct footprint. However, in light of the very fine sand sediment composition, the resettlement of sediment is likely to be minimal.

The direct and indirect disturbance areas associated with these proposed operations are summarised in Table 5.2. A full inventory of infrastructure dimensions is available in Section 2.4. All disturbance will be temporary.

Table 5.2 Seabed disturbance associated with the decommissioning of pipeline ends, spools and SSIV umbilical

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km^2)	Indirect disturbance area (km^2)
Production Pipeline PL2746 (PL2747 piggybacked)	Removal of 50 m at each end, disturbance corridor of 1 m	Temporary	0.0001	0.0002
S1 Production PL2748 (PL2749 piggybacked)	Removal of 50 m at each end, disturbance corridor of 1 m	Temporary	0.0001	0.0002
Control Umbilical PLU2752	Removal of 50 m at each end, disturbance corridor of 1 m	Temporary	0.0001	0.0002
S1 Infield Control Umbilical	Removal of 50 m at each end, disturbance corridor of 1 m	Temporary	0.0001	0.0002
S2 Infield Umbilical	Removal of 50 m at each end, disturbance corridor of 1 m	Temporary	0.0001	0.0002
SSIV control umbilical	Removal of full SSIV control umbilical, 500 m length, disturbance corridor of 1 m	Temporary	0.0005	0.001
Total (temporary)			**0.0010**	**0.0020**

5.2.2.3 Stabilisation and protection (mattresses, grout bags and rock cover)

Concrete mattresses and grout bags have previously been deployed across Devenick Field to stabilise and protect the seabed infrastructure. The intention is that, where possible and if condition of material allows, all concrete mattresses and grout bags will be recovered; this will cause temporary direct and indirect disturbance. There are an estimated 475 concrete mattresses across the Devenick infrastructure which will be removed where possible. The dimensions of the concrete mattresses (6 m by 4 m) were used to determine the area of cover. It is likely that mattresses are overlapping or have been used in conjunction with other forms of remediation, therefore the seabed footprint of these mattresses likely represents an overestimate.

There are an estimated 780 grout bags in the Devenick Field, including those contained within gabions (five gabions, each containing 40 grout bags). Full inventory details are presented in Section 2.1.2. Grout bags are used in conjunction with different subsurface installations to provide protection or stability. As such, they are usually stacked or piled on top of one another or on top of other installations / mattresses. The exact location and layout of the bags is unknown. Although unlikely, the worst-case scenario has been defined as 580 individual bags spread in a single layer on the seabed and five gabions. A maximum area of 1m^2 of impact has been assumed for each individual grout bag, with an area of 10 m^2 representing the footprint of each gabion.

The rock cover on the pipeline cooling spool protection structures will be displaced temporarily before being relocated to a permanent location, potentially as remediation for areas of the seabed where natural backfill is unlikely and where pile excavation has left a depression. Therefore, there will be seabed impacts from removing the rock cover, placing it at a temporary location, and relocating it to a permanent site within the Devenick decommissioning area.

The direct and indirect seabed disturbance areas associated with the stabilisation materials are summarised in Table 5.3. As previously, the indirect impact has been assumed to be double the direct impact area.

Table 5.3 Seabed disturbance associated with the decommissioning of protection materials

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km^2)	Indirect disturbance area (km^2)
Removal of existing concrete mattresses	Estimated 475 concrete mattresses of varying dimensions	Temporary	0.0114	0.0228
Removal of grout bags	Estimated 580 grout bags of 1 m^2	Temporary	0.00058	0.001
Removal of salt sacks/grout gabion	Estimated 5 salt sacks/grout gabion of 10 m^2	Temporary	0.00005	0.0001
Temporary relocation of rock cover	Estimated 200 m^2	Temporary	0.0002	0.0004
Permanent relocation of rock cover	Estimated 200 m^2	Permanent	0.0002	0.0004
Total (permanent)			**0.0002**	**0.0004**
Total (temporary)			**0.012**	**0.025**

5.2.2.4 **Pipelines decommissioned *in situ***

Pipelines will all be decommissioned *in situ* and have their ends and exposures remediated where required. As remediation activities will overlie the footprint of the activities associated with the cutting of pipelines, the area of impact only relates to the direct and indirect impact due to the placement of rock. The area of rock placed per end will equate to a worst-case footprint of 100 m^2 per pipeline end.

The remediation associated with the decommissioning of the pipelines *in situ* is considered a permanent disturbance and represents a worst-case scenario. As before, as a conservative estimate, the indirect disturbance is twice that of the direct area, however this type of impact is considered temporary. The permanent direct and temporary indirect disturbance areas associated with these proposed operations are summarised in Table 5.4. A full inventory of infrastructure is available in Section 2.4.

The Devenick pipelines and umbilicals are trenched and buried and will be decommissioned *in situ*. Structural degradation of the pipelines and umbilicals will be a long-term process caused by corrosion, and eventual collapse of the pipelines under their own weight and that of the overlying sediment. During this process, degradation products derived from the exterior and interior of the pipe and umbilical will breakdown and potentially become bioavailable to benthic fauna in the immediate vicinity. Pathways from the pipelines to the receptors would be via the interstitial spaces in seabed sediments.

All pipelines and umbilicals to be decommissioned *in situ* have a number of exposures and free spans identified along them, with total length of 85 m, however, some of these exposures are located at pipeline ends (Figure 5.1) and may therefore be removed along with the pipeline ends. The remediation activities associated with the decommissioning of the pipelines *in situ* are considered a permanent disturbance and represent a worst-case scenario. As before, as a conservative estimate, the indirect disturbance is twice that of the direct area, however this type of impact is considered temporary. The permanent direct and temporary indirect disturbance areas associated with these proposed operations are summarised in Table 5.4. A full inventory of infrastructure dimensions is available in Section 2.1.1.

Table 5.4 Area of seabed impact associated with the remediation of pipeline ends and exposures and spans along the pipelines left *in situ*

Activity	Quantity and dimensions	Expected duration of disturbance	Permanent direct disturbance area (km^2)	Temporary indirect disturbance area (km^2)
Remediation of Pipeline Ends	6 pipeline route ends to remediate, 100 m^2 disturbance at each end	Temporary/ Permanent	0.0012	0.0024
Remediation of Exposures and Spans	85 m of exposures and spans, disturbance corridor of 10 m	Temporary/ Permanent	0.00085	0.0017
Total (permanent)			**0.0020**	**0.0041**

Note: Piggy-backed pipelines have not been added to the total count of pipeline route ends to remediate as remediation of their ends is already accounted for.

The area of impact associated with the lengths of pipelines and umbilicals being decommissioned *in situ* has been calculated in Table 5.5. This has been calculated using the exact dimensions of the pipelines. There is no disturbance associated with this area, this is currently the area that the Devenick Field pipelines occupy and will continue to do so once they are decommissioned *in situ*.

Table 5.5 Area of seabed impact associated with the decommissioning *in situ* of pipelines and umbilicals

Pipelines/Umbilical Left *in situ*	Quantity and dimensions	Expected duration of disturbance	Direct area (km^2)
Production Pipeline PL2746 (PL2747 piggybacked)	33.7 km (L) x 41 cm (W)	Permanent	0.014
S1 Production PL2748 (PL2749 piggybacked)	1.39 km (L) x 36 cm (W)	Permanent	0.0005
S2 Production PL 2750 (PL2751 piggybacked)	1.28 km (L) x 36 cm (W)	Permanent	0.00046
Control Umbilical	33.68 km (L) x 10.5 cm (W)	Permanent	0.0035
S1 Infield Control Umbilical	1.41 km (L) x 10 cm (W)	Permanent	0.00014
S2 Infield Umbilical	1.29 km (L) x 11.5 cm (W)	Permanent	0.00015
Total (permanent)			**0.019**

5.2.2.5 Summary of disturbance to the seabed

The seabed disturbance from the decommissioning activities calculated throughout this section is summarised in Table 5.6. This illustrates a worst-case scenario for seabed disturbance, in which the majority of the temporary seabed impact is associated with the removal and relocation of existing remediation materials and most of the permanent seabed impact is associated with rock remediation over free spans/exposures and pipeline ends on pipelines decommissioned *in situ*.

Table 5.6 Total potential seabed disturbance from the decommissioning activities

Activity	Temporary direct disturbance area (km^2)	Temporary indirect disturbance area (km^2)	Permanent direct disturbance area (km^2)
Removal of structures	0.0024	0.005	0
Removal of pipeline ends and SSIV umbilical	0.001	0.002	0
Removal and relocation of protection material (mattresses, grout bags and salt sacks/grout grabion)	0.012	0.025	0.0002
Remediation of pipelines decommissioned *in situ*	0.0020	0	0.0041
Total	**0.018**	**0.03**	**0.0043**

5.2.3 Effects on sensitive receptors

5.2.3.1 Direct disturbance

Decommissioning activities are expected to lead to two types of direct physical disturbance. The first is temporary disturbance, which will result from the removal of pipelines and infrastructure from the seabed, and the placement of protective material. The sediment will be disturbed by the action of retrieving equipment from the seabed and rock placement, but once decommissioning is complete, the affected areas will be free of anthropogenic material. In the case of rock placement, temporary disturbance will only apply to the wider area impacted by suspended sediments, not the area covered by rock. Temporary disturbance should allow recovery in line with natural processes such as sediment re-suspension and deposition, movement of animals into the disturbed area from the surrounding habitat, and recruitment of new individuals from the plankton.

The second type of direct disturbance will be permanent disturbance caused by the deposition of additional rock armour on the seabed to protect infrastructure decommissioned *in situ*. This type of disturbance will effectively change the seabed type in the affected areas from the naturally occurring silty sand to a hard substrate. These materials will be permanently left on the seabed and potentially become fully buried by the deposition of new natural sediment. While the seabed will eventually recover and the substrate will return to pre-disturbance conditions, the time frame over which this occurs is so long-term that the disturbance is considered permanent. The temporary and permanent seabed effects associated with direct disturbance are discussed in the subsections below.

Temporary direct disturbance

As noted in Table 5.1, Table 5.2, and Table 5.3, approximately 0.018 km^2 of seabed would be affected by temporary direct disturbance. The scale of the disturbance is minimal when compared to other forms of disturbance that occur in the area, such as commercial trawling. A commercial trawler with a 12 m wide beam trawl trawling at its slowest rate of approximately 4.7 km/h would cover an area of roughly 0.06 km^2 per hour so would therefore take approximately 8 hours to cover the anticipated direct disturbance area (FAO, 2019).

Decommissioning disturbance will cause mortality, due to injuries arising from the crushing of benthic and epibenthic fauna which are sedentary or unable to move quickly. Mobile fauna will likely also be disturbed. The sediment structure, including the burrows of any animals present, will be affected. Past surveys of the Devenick Fields have identified the most common taxa living on the surface of the seabed as the polychaetes *Paramphinome jeffreysii* and *Galathowenia oculata,* molluscs, hermit crabs, anemones, brittlestars and sea urchins (see Section 3.2.2).

The primary features of conservation concern in the Devenick Fields include:

- Submarine structures made by leaking gases' Annex I Habitat;
- Ocean quahog *Arctica islandica* – OSPAR list of threatened and/or declining species and habitats (Region II – Greater North Sea); and
- 'Seapens and burrowing megafauna in circalittoral mud' – OSPAR list of threatened and/or declining species and habitats (Region II – Greater North Sea), a component of which is the Scottish Priority Marine Feature (PMF) habitat 'Burrowed mud'.

The Braemar Pockmarks SAC lies approximately 1.5 km west of the Devenick pipelines (Figure 3.6). The Braemar Pockmarks SAC is designated for the Annex I habitat 'Submarine structures made by leaking gases'. Possible small carbonate structures and/or bacterial mats were seen during camera investigations at some stations along the Devenick to East Brae route, mostly in the southern section of the pipeline route, which are indicative of pockmarks. It was concluded that this section of the pipeline was in an active pockmark area with potential presence of the Annex I 'submarine structures created by leaking gases' habitat (Gardline, 2006). The carbonate structures, or methane-derived authigenic carbonates (MDAC) that are characteristic of this Annex I habitat are highly sensitive to physical abrasion, smothering and siltation that may occur during the decommissioning activities. MDAC are biogenic rocky substrate formed by microbial assemblages below the seabed. The recoverability of MDAC from physical damage and smothering is therefore very low. The likelihood of temporary disturbance activities on the main pipeline route (where MDAC occurrence is most likely) is very low, given that the pipeline will be decommissioned *in situ* with little intervention other than targeted rock placement.

Seapens and their associated EUNIS habitat, 'Seapens and burrowing megafauna in circalittoral fine mud' (which falls within the broader OSPAR threatened or declining habitat 'Seapen and burrowing megafauna communities'). Burrows and burrowing megafauna were encountered in pockmarks investigated in the Devenick pipelines habitat assessments, however, the Devenick pipeline area was not considered to support a particularly wide coverage of this habitat (see Section 3.3.1 for a full description of the seabed habitats and benthos). Seapens have some resistance to being disturbed and generally can reinsert themselves into the sediment if removed, as long as they remained undamaged. However, damaged individuals show poor recovery, and therefore resilience is considered low, giving an overall sensitivity of medium (Hill, Tyler-Walters and Garrard, 2020). As such, temporary disturbance is expected to cause some mortality to any seapens that are physically damaged during operations, but this is expected to be extremely localised and not have any effect on the viability of the local population. Replacement of damaged individuals would be expected to occur either from plankton or from "adult" seapens moving in from the surrounding area. Where there has been a disturbance but the seapens remain undamaged, recovery may be rapid (<2 years; Hill, Tyler-Walters and Garrard, 2020). The nature of the activities is such that the removal of subsea structures should only have a highly localised impact on the seabed, there will be no placement of items thus the crushing of benthos is unlikely. Given the extent of their habitat across the North Sea the recovery of seapens and burrowing megafauna would be swift.

Low abundances of ocean quahog were observed at the Harding, Brae Bravo and Devenick fields, therefore the impact assessment is based on the assumption that this protected species is present in the Devenick area. Ocean quahogs live at the surface of sediments while feeding but are able to burrow to depths of 14 cm, therefore they are vulnerable to physical abrasion from removal of infrastructure and smothering from placement of rock cover. They are long-lived bivalves which take 5 - 15 years to reach sexual maturity and spawns over a short period in the year. Recruitment is sporadic and variable (Tyler-Walters & Sabatini, 2017). Considering these, the recoverability of ocean quahog to physical abrasion is very low. Similarly, to the "sea pens and burrowing megafauna communities" referred to above, while ocean quahog has been shown to occur in the areas surveyed in the Devenick Field, there has been no evidence of aggregations of within the areas surveyed. While scattered individuals of ocean quahog may occur in the Devenick area, they would not be expected to occur either in significant densities or in communities of specific conservation value.

Permanent direct disturbance

Permanent direct disturbance will occur due to placing further rock cover on the seabed in perpetuity. Approximately 0.002 km^2 of seabed will be subject to permanent direct disturbance due to the introduction of rock protection material, as detailed in Table 5.5. There will also be 0.0043 km^2 of seabed that may be permanently impacted by the relocation and addition of protection material (see Table 5.3).

The immediate effect of the introduction of new rock cover will be mortality and injury of immotile benthic and epibenthic, as well as disturbance of motile fauna. Following the introduction of the rock cover, the ongoing effect will be the change of an area of softer habitat to a hard substrate, and a related change in the types of organisms that can use the habitat. Organisms such as sea pens and burrowing bivalves, anemones and crustaceans will no longer be able to use the area affected, while new habitat will be created for other groups such as encrusting sponges and anemones.

The 'Seapens and burrowing megafauna in circalittoral fine mud' habitat has no resistance to physical loss or change of substrate – where the soft sediment is no longer available, the community ceases to exist. Seapens themselves show poor recovery when physically damaged (Hill, Tyler-Walters and Garrard, 2020). While the habitat could be affected by the remediation activities, this represents a highly localised impact. Furthermore, the prevalence of the habitat in the surrounding Devenick area would ultimately promote quick recovery of seapens.

The deposition of rock cover on MDAC would result in a localised loss of habitat and communities living in the carbonate structures. However, as rock will only be deposited along the Devenick pipelines to remediate spans and areas of exposures, it is unlikely that MDAC will have formed in these areas.

While the introduction of rock cover clearly results in a change in the habitat type and associated fauna present, the scale of the impact is negligible considering the very large extent of seabed of a similar composition available in the NNS. Rock remediation will be targeted and localised.

5.2.3.2 Temporary indirect disturbance

Indirect disturbance (being twice the area of direct disturbance) is projected to have an area of temporary impact of 0.03 km^2 with no permanent impacts anticipated. The temporary indirect disturbance area of increased sediment in the water column is expected dissipate rapidly as generally it is the coarser, upper layers of sediment that would be disturbed. Given the very fine sand nature of the sediments, the overall level of re-suspended sediment will be low. However, increased suspended sediment may reduce feeding efficiency of filter feeders due to clogging of feeding structures. However, though not well studied, the bioturbation associated with burrows will generate sediment resuspension, thus implying that species typical of the 'Sea pen and burrowing megafauna communities' habitat may have some natural tolerance to sedimentation (Hill, Tyler-Walters and Garrard, 2020). Experimental evidence suggests that seapens, the main filter feeder of concern in the Devenick Field, are not sensitive to increased suspended sediment. Both species observed in the area (*P. phosphorea* and *V. mirabilis*) are tolerant to heavy smothering and siltation.

V. mirabilis in particular are capable of retracting into their burrows thereby cleaning themselves of excess sediment by the production of mucous within the burrow (Hill, Tyler-Walters and Garrard, 2020). As such, effects due to increased suspended sediment are not expected to impact the benthos of the Devenick Field.

5.2.3.3 Impact of pipelines decommissioned *in situ*

The decommissioning of items *in situ* has associated legacy impacts. This arises from the gradual breakdown of materials left *in situ*. In this instance, the pipelines and umilicals will undergo long-term structural degradation caused by corrosion, leading to the eventual collapse of the pipelines under their own weight and that of overlying pipeline coating material, scale and sediment. During this process, degradation products derived from the exterior and interior of the pipe will breakdown and potentially become bioavailable to benthic fauna in the immediate vicinity.

The primary degradation products will originate from the following pipeline components:

- Pipeline scale;
- Steel;
- Sacrificial anodes; and
- Plastic coating.

As the Devenick Field pipelines will have already been flushed and cleaned prior to decommissioning activities, the pipeline and umbilical contents are limited to treated seawater. Therefore, the impact of the contents of the pipelines and umbilicals decommissioned *in situ* is not discussed further in this EA.

Heavy metals

Metals with a relatively high density or a high relative atomic weight are referred to as heavy metals. It is expected that these metals will be released into the sediments and water column during the breakdown of the components of the pipeline scale, steel and sacrificial anodes.

The toxicity of a given metal varies between marine organisms for several reasons, including their ability to take up, store, remove or detoxify these metals (Kennish, 1997). Concentrations of the metals are not expected to exceed acute toxicity levels at any time owing to the decommissioning. However, chronic toxicity levels may be reached for short periods within the interstitial spaces of the sediments or in close proximity to the pipelines. At these levels, heavy metals act as enzyme inhibitors, adversely affect cell membranes, and can damage reproductive and nervous systems. Changes in feeding behaviour, digestive efficiency and respiratory metabolism can also occur. Growth inhibition may also occur in crustaceans, molluscs, echinoderms, hydroids, protozoans and algae (Kennish, 1997). It is expected that any toxic impacts will be short lived and localised with minimal potential to impact populations of marine species. The potential for uptake and concentration of metals would also be limited to the local fauna and due to the slow release of these chemicals not likely to result in a significant transfer of metals into the food chain.

The slow release of the metals associated with the pipeline steel and steel associated with the concrete coating is expected to have a negligible impact on the local environment. It is anticipated that failure of the pipelines due to through-wall degradation would only begin to occur after many years (up to 400 years) (HSE, 1997).

Along buried pipeline corridors heavy metals may accumulate in the sediments as the pipelines degrade. The finer fraction of these sediments (silts and clays) are likely to form bonds with these metals, making them less bioavailable to marine organisms. The sandy (coarser fraction) of the sediments surrounding the pipelines are less likely to retain metals (MPE, 1999). The seabed within the Devenick Field is largely composed of silty sand and is therefore likely to retain any metals, prolonging their release to the surrounding seawater.

The pipelines to be decommissioned *in situ* cover 0.019 km^2 within the context of the wider NNS (see Table 5.5). Degradation is unlikely to occur at a constant rate and across the entire length of the pipeline. Therefore, due to the highly localised nature of any degradation products and the low concentrations of contaminants being released over an elongated period it is highly unlikely that these products will be detectable above current background conditions.

Plastics

There are plastic components within the composition of the pipelines within the Devenick Field. However, as no micro-organisms have evolved to utilise chemically resistant polymer chains as a carbon source, these plastics can be expected to persist in the environment for centuries (OGUK, 2013). As the rate of biodegradability in the marine environment is also low, it can be assumed that the environmental effect of leaving these plastics in place is insignificant (MPE, 1999).

Opportunity also exists for microplastics to enter into the food chain. Adverse effects of microplastics on marine organisms can potentially arise from the physical obstruction or damage of feeding appendages or digestive tract or other physical harm. In addition, microplastics can act as vectors for chemical transport into marine organisms causing chemical toxicity (Hylland and Erikson, 2013). However, the pipeline degradation process which facilitates the availability of plastics to marine organisms will occur very gradually over a highly protracted timeframe.

Due to the highly localised nature of any degradation products and the low concentrations of contaminants being released over an elongated period it is highly unlikely that these products will be detectable above current background conditions in the area.

5.2.4 Cumulative and transboundary impacts

The decommissioning activities taking place within the Devenick Field will not be occurring in close proximityof any other third-party oil and gas installations; the closest installation is the Gudrun Platform which is located 12.9 km from the proposed activities. The East Brae platform, that is the tie-in point of the Devenick pipelines, will be decommissioned as part of the wider Brae Area decommissioning programme, and there is no anticipated cumulative seabed impact with the decommissioning of the platform. Therefore, cumulative impacts on the seabed caused by decommissioning activities are considered negligible.

The Devenick pipelines are located approximately 4.2 km from the UK/Norway median line. Given this distance, and the area of indirect temporary disturbance being 0.03 km^2, there is no potential for sediment to travel beyond the immediate vicinity of the decommissioning area and into neighbouring territorial waters. The potential for transboundary impacts is therefore highly unlikely.

5.2.5 Mitigation measures

The following measures will be adopted to ensure that seabed disturbance and its impacts are minimised to a level that is as low as reasonably practicable:

- A pre decommissioning environmental baseline survey will be conducted in Q4 2022 to fill any environmental data gaps. The results of this survey will be shared with OPRED.
- All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised;
- Careful planning, selection of equipment, management and implementation of activities;
- A debris survey will be undertaken at the completion of the decommissioning activities. Any debris identified as resulting from oil and gas activities will be recovered from the seabed where possible;

- Rock armour will be placed by a fall pipe vessel equipped with an underwater camera on the fall pipe. This will ensure accurate placement of the rock armour and reduce unnecessary spreading of the rock armour footprint and ensuring that minimum safe quantity or rock is used; and
- Clear seabed verification will ensure there is no residual risk to other sea users. Non-intrusive verification techniques will be considered in the first instance and in agreement with OPRED and fishing bodies.

5.2.6 Seabed disturbance residual impact

Receptor	Magnitude	Sensitivity	Vulnerability	Value
Seabed habitats and fauna	Minor	High	Low	Low

Devenick infrastructure decommissioning activities will result in temporary direct and indirect disturbance to the seabed. Temporary direct disturbance has the potential to impact approximately 0.018 km^2 of seabed. Temporary indirect disturbance has the potential to impact approximately 0.03 km^2. There will be a 0.0020 km^2 area of permanent disturbance as a result of new rock placement (for pipeline ends and exposures/spans remediation) and 0.0043 km^2 of permanent disturbance as a result of relocation of existing rock cover. These are considered highly conservative estimations of the likely impact of the proposed decommissioning activities, as the buffers added to the structures are likely to overestimate the range of impact generated by various removal methods. Overall, given the localised nature of the seabed disturbance, and the very small area of seabed that will be permanently impacted the magnitude of the impacts on seabed habitats and fauna is considered minor.

The Braemar Pockmarks SAC lies approximately 1.5 km west of the Devenick pipelines. It is designated for the Annex I habitat 'Submarine structures made by leaking gases'. As the southern section of the Devenick to East brae pipeline route was observed as being an area with active pockmarks, it is considered that there is potential for this Annex I habitat to be present in the decommissioning area. Overall, the proposed decommissioning activities are expected to have a permanent impact on the site, covering a worst-case area of 0.0043 km^2. Considering the highly localised nature of the activities and the mitigation measures outlined above, the habitat, though highly sensitive, is not likely to be affected significantly by the decommissioning.

Surveys have identified the potential presence of the OSPAR threatened or declining habitat 'Seapen and burrowing megafauna communities' within the Devenick Field (Gardline, 2009a). The general benthos and the species associated with the OSPAR habitat specifically are likely to have some natural resilience to increased sedimentation, if not to abrasion associated with direct disturbance. Considering the nature of the removal of the subsea structures from the seabed, the opportunity for crushing or physical damage to seapens is minimal. Furthermore, taking into account the mitigation measures described above (Section 5.2.5), this should ensure that the area of impact will be as small as practicably possible. Given the very small area of direct and indirect impact predicted to be generated by the proposed decommissioning, the activities are not likely to negatively affect the seabed and benthos in the Devenick area.

Low abundances of ocean quahog were observed at the Devenick Field and in surrounding fields. The species could be affected by the proposed decommissioning activities via physical abrasion and smothering, and recoverability to these pressures is very low due to the low level of recruitment. However, the decommissioning activities have a highly localised impact as demonstrated in this chapter, it is therefore expected that a very low number of individuals would be impacted by the proposed decommissioning activities.

Given the very small area of direct and indirect impact predicted to be generated by the proposed decommissioning activity, the vulnerability of the seabed receptors is considered as being low.

Based on the anticipated localised and temporary nature of the disturbance, the proposed decommissioning of the Devenick Field will have a negligible impact on seabed receptors.

Consequence	Significance
Negligible	Not significant

5.3 Physical presence of infrastructure decommissioned *in situ* in relation to other sea users

5.3.1 Approach

The proposed Devenick decommissioning activities have the potential to impact upon other users of the sea, namely commercial fisheries. This may happen during the decommissioning activities themselves of after, should any infrastructure decommissioned *in situ* interact with fishing gear. Sea users, other than commercial fisheries are unlikely to be affected by the proposed decommissioning, as explained in Section 5.1. The following issues were considered as potentially having a significant impact on commercial fisheries:

- Physical presence of subsea infrastructure decommissioned *in situ* posing a potential snagging risk.

This is anticipated to be the only potential impact to fisheries as a result of the decommissioning and is assessed against the receptor throughout the rest of this Section.

5.3.2 Sources of potential impacts

5.3.2.1 Physical presence of subsea infrastructure decommissioned *in situ* posing a potential snagging risk

The long-term presence of subsea infrastructure decommissioned *in situ* has the potential to interfere with other sea users. The greatest identified risk to commercial fisheries is the potential snagging of fishing gear on exposures or free spans associated with infrastructure decommissioned *in situ*, as well as any clay mounds or depressions generated by the removal of infrastructure. These potential snagging risks may arise during initial decommissioning and/ or over the longer-term. In addition to the physical presence of the flowlines decommissioned *in situ*, local pipeline remediation (i.e. rock placement) may increase the potential for interaction with fishing gear.

Demersal fishing gears which interact with the seabed are most vulnerable to snagging. Snagging may lead to loss or damage of catch or fishing gear and may result in vessel destabilisation in extreme circumstances. Generally, the patterns in interactions between oil and gas infrastructure and fishing gear are most prevalent in the NNS where demersal fishing effort is relatively high (Rouse, Hayes and Wilding, 2018). The Devenick infrastructure is located within the NNS, however, demersal fishing activity is considered to be low to moderate based on VMS landings values and weights, annual effort data and VMS data.

5.3.3 Effects on sensitive receptors

Annual fishing effort in the Devenick decommissioning area (ICES rectangles 47F1 and 46F1) is low-moderate; in 2019 there were 329 days of effort in ICES rectangle 47F1 and 403 days of effort in ICES rectangle 46F1. When compared with the four preceding years, this represents a decrease in effort in ICES rectangle 47F1 and an increase in effort in ICES rectangle 46F1 (Table 3.5).

The landings values and weights were dominated by demersal fish in ICES rectangle 47F1, accounting for >97% of landed value and > 90% of landed weight between 2015 and 2018. Demersal fish accounted for a lower proportion (80%) and landed value and weight (58%) in 2019, however, this species type was still dominant. Landings values and weights were also generally dominated by demersal fish in ICES rectangle 46F1, although to a lesser extent and variable by year. In 2015, landings values and weights were fairly evenly split between demersal, pelagic and shellfish and in 2016, pelagic fish were dominant. In 2017 and 2018, demersal fish were dominant and in 2019 the incidence of shellfish catch increased to become the dominant species type.

Notably, through all four of these years, demersal fish still accounted for a large proportion of landed values and weights (> 43% of landings values and > 31% of landed weights) (Scottish Government, 2020).

Trawls are the most utilised gear in ICES rectangles 47F1 and 46F1, although seine nets were also operated to a lesser extent between 2015 and 2019. Traps were operated in ICES rectangle 46F1 in a single year only. It is likely that most of the trawl effort in ICES rectangle 47F1 and 46F1 is attributed to demersal fish, due to the higher proportion of demersal catch, however, some pelagic fishing effort is likely to occur, especially in ICES rectangle 46F1 where pelagic catch is higher.

VMS data indicates that demersal fishing effort is concentrated to the north of the pipelines area occupied by the Devenick infrastructure, with average annual effort in the range of 51- 67 days a year between 2009 and 2017 (Figure 5.1). On review of demersal trawling activity in the North Sea, Rouse *et al.* (2017) found that a low percentage (0.93%) of demersal trawling trips specifically targeted oil and gas pipelines compared with surrounding areas.

As detailed in Appendix C, there are 21 exposures along eight of the Devenick pipelines and umbilicals, totalling a length of 68.6 m. There are also eight free spans along six of the Devenick pipelines and umbilicals with a total length of 16 m. Most of the exposures are clustered at the pipeline ends (which are to be removed) and the area around the East Brae platform and coincide with areas of very low trawling intensity (Figure 5.1). Several of the exposures and free spans coincide with areas of high demersal and *Nephrops* trawling intensity. Where required, the exposures and free spans will be remediated as appropriate using rock placement.

The most recent 2016 Depth of Burial (DoB) survey data indicate that the Devenick Pipelines and accompanying piggyback pipelines remain trenched and buried below the seabed. On average the pipelines are currently buried between 1.23 and 1.6 m below the seabed surface, and upon comparison with the ‘as laid’ data from installation, it can be seen that each pipeline and accompanying piggyback pipeline, have further buried over their operational lifespan. In addition to this, the seabed within the surrounding area is relatively stable, which further reduces the risk of exposure over time. Umbilicals are buried below the seabed and where historical exposures occurred, these have previously been remediated with spot rock cover. Any potential changes in burial status of the pipelines resulting in legacy impacts to commercial fisheries due to degradation over time will be managed through continued monitoring and communication with relevant users of the sea, as detailed in Section 5.3.5.

Overall, the region experiences low to moderate fishing activity and effort. Some permanent snagging risks will arise in areas of exposures or free-spans and at the pipeline ends where rock remediation is required and at any clay berms which result from infrastructure being removed. There are some exposures and free spans present along the pipelines which will be remediated by rock cover, however, these extend across a short portion of the pipeline only. Further, all rock cover will be designed with an overtrawlable (1:3) profile to minimise any residual risk to commercial fishers. Considering this, and the low to moderate fishing effort observed at the Devenick pipeline areas and the remediation strategies to be put in place, the snagging risks associated with the decommissioning of the pipelines *in situ* is considered minimal.

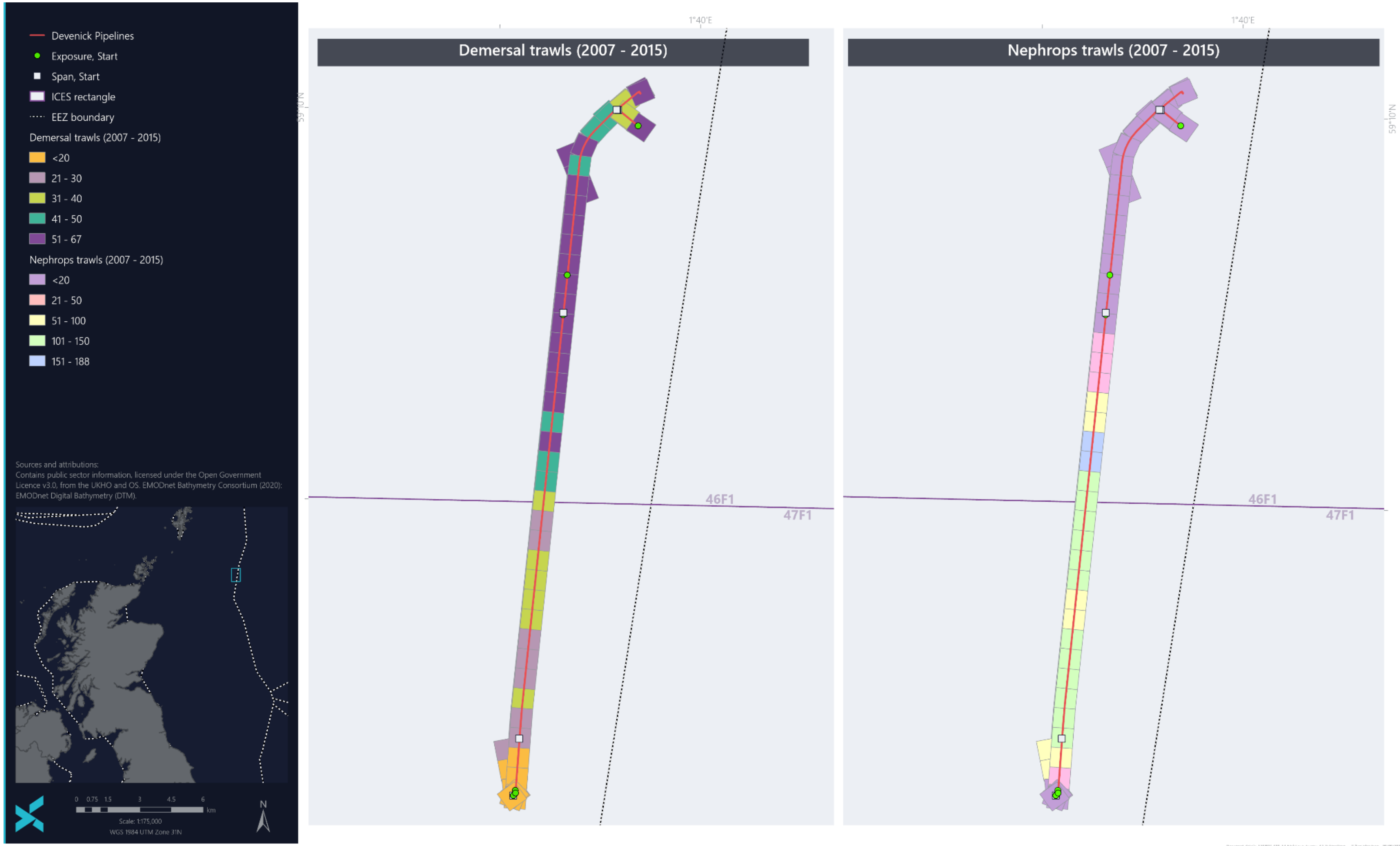


Figure 5.1 Trawling across the Devenick infrastructure in relation to areas of exposure and free span

5.3.4 Cumulative and transboundary impacts

The Devenick infrastructure is located approximately 4.2 km from the UK/Norway border. The most recent AIS vessel track data shows the density of vessels in 2017 were generally low across the pipelines (ranging from 0 – 100 transits per 2 km^2) which suggests that, despite proximity to an international border, there is minimal vessel movement around the Devenick pipelines. However, considering the proximity of the infrastructure to the UK/Norway border, there are likely to be marginally higher effort levels by foreign fishing compared to other nearshore areas of the UKCS.

In the wake of the decommissioning activities, pipeline exposures will be remediated and the seabed will be left in a safe overtrawlable condition, so no impacts to any UK and / or foreign fishing fleets are expected to result from the proposed activities.

There is the potential for cumulative impacts to occur with other activities occurring nearby to the Devenick infrastructure which could also interfere with commercial fishing activity. Decommissioning activities at the Brae East platform are planned for 2025 - 2031 and decommissioning at the Brae Alpha and Brae Bravo fields are scheduled to take place up until 2029 (Rock Rose, 2020; Marathon Oil UK, 2017). However, it is expected that adequate mitigations will be in place at these fields to minimise snagging risk as far as possible. In addition, snagging risk or interference with commercial fisheries may arise due the decommissioning of wells at the Devenick field and the removal of other infrastructure, however, these will be remediated/ mitigated prior to the removal of any 500 m safety exclusion zones. Overall, considering the low potential for snagging risk along the Devenick pipeline and the fact that any rock placement will be overtrawlable, no cumulative impacts are expected to arise.

5.3.5 Mitigation measures

The following measures will be adopted to ensure that snagging risks to commercial fisheries as a result of the Devenick pipelines being decommissioned *in situ*, are minimised to a level that is ALARP:

- The Devenick pipelines are currently shown on Admiralty Charts, the FishSafe system and the NSTA (formerly the OGA) Infrastructure data systems (NSTA Open Data). Once decommissioning activities are complete, updated information (i.e. which infrastructure remains *in situ* and which has been removed) will be made available to allow Admiralty charts and the FishSafe system to be updated;
- Any exposures or cut pipeline ends will be rock covered to ensure they are overtrawlable by fishing vessels;
- Any objects dropped during decommissioning activities will be removed from the seabed where appropriate;
- TAQA will monitor the seabed to assess any seabed depressions or clay berms which may present a snag risk. The survey results will be used in discussion with OPRED prior to the commencement of any intervention;
- Clear seabed verification will ensure there is no residual risk to other sea users. Non-intrusive verification techniques will be considered in the first instance, but if deemed necessary, seabed clearance may require conventional overtrawl survey methods. Where there is evidence of residual snagging hazards (e.g. any spans, berms, dropped objects, etc.), then intervention in the form of overtrawling to re-level the seabed or the addition of rock placement will be discussed with OPRED, and implemented as appropriate;
- Ongoing consultation with fisheries representatives; and

- TAQA recognises its obligation to monitor any infrastructure decommissioned *in situ* and therefore intends to set up arrangements to undertake post-decommissioning monitoring. The frequency of the monitoring that will be required will be agreed with OPRED and future monitoring will be determined through a risk-based approach established from the findings of each survey in turn. During the period over which monitoring is required, the burial status of the infrastructure decommissioned *in situ* would be reviewed and any necessary remedial action undertaken to ensure it does not pose a risk to other sea users.

5.3.6 Physical presence of material decommissioned *in situ* residual impact

<table>
<tr><th>Receptor</th><th>Magnitude</th><th>Sensitivity</th><th>Vulnerability</th><th>Value</th></tr>
<tr><td>Physical Presence of Material Decommissioned in situ</td><td>Moderate</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td colspan="5">While the impact magnitude may be considered major owing to the potential severity of a snagging events, the frequency of such an event is relatively unlikely. The Devenick pipelines are considered to be suitably buried within a relatively stable seabed and survey data collected in 2016 has shown that since installation, the pipelines have further buried. Historical exposures, freespans and areas of upheaval buckling were previously remediated with rock. A monitoring schedule will be produced for any pipeline decommissioned in situ. All existing exposures and freespans will be remediated as appropriate during decommissioning activities. Therefore overall the magnitude is considered moderate. These impacts will be restricted to commercial fisheries that make active contact with the seabed, such as bottom trawls and dredging gears. Commercial fisheries as a receptor are considered to be of low sensitivity as the industry is able to accommodate change. The vulnerability of the receptor is also considered low as the presence of the pipelines are not likely to influence fishing activity in the area beyond current natural variation. The value of commercial fisheries is also considered low when comparing the financial value and contribution of the catch within the wider regional context. The re-opening of three 500m safety zones will also expand the available fishing grounds by approximately 2.4 km^2. Foreign fleets are also not considered to be highly dependent on the area, based on recent AIS data. Coupled with mitigation measures which include non-intrusive and intrusive surveys (as required), impacts to commercial fisheries from snagging risk from the decommissioning of the Devenick infrastructure are deemed negligible and not significant.</td></tr>
</table>

Consequence	Significance
Negligible	Not significant

6 CONCLUSIONS

Following detailed review of the proposed decommissioning activities, the environmental sensitivities characteristic of the area surrounding the Devenick infrastructure, industry experience and consideration of stakeholder concerns, it was determined that potential project-related impacts to the seabed, and commercial fisheries required further consideration

The Devenick subsea infrastructure is located over 185 km offshore in the NNS, remote from coastal sensitivities and within 1.5 km of the Braemar Pockmarks SAC, which is designated for the protection of Annex I Submarine structures made by leaking gases.

Decommissioning activities within the Devenick Field area will result in temporary direct and indirect disturbance to the seabed (Section 5.2). Temporary direct disturbance has the potential to impact approximately 0.018 km^2 of seabed. Temporary indirect disturbance has the potential to impact approximately 0.03 km^2 of seabed. Rock remediation activities will permanently impact an area of approximately 0.0043 km^2. These activities have the potential to cause minor discernible change to the baseline of existing benthic receptors. Considering the temporary and/ or localised nature of the activities and the mitigation measures outlined, the habitat, though sensitive, is not likely to be affected significantly by the decommissioning. Based on the anticipated localised and temporary nature of the disturbance, the proposed decommissioning of the Devenick infrastructure will have a negligible impact on seabed receptors.

Activities with the potential to impact upon commercial fisheries were limited to the possible legacy impacts from the decommissioning of pipelines and associated protection materials *in situ* (Section 5.3). Such impacts are restricted to commercial fisheries which make active contact with the seabed, such as those which operate bottom trawl or dredging gears. Recent trawling data indicates that some areas of pipeline exposure and free-span coincide with higher-intensity trawling routes. All pipelines will be adequately buried and all exposures, free spans and seabed depressions will be remediated. In the wider regional context, the waters in which the Devenick infrastructure is located experience overall low to moderate fishing effort, based on available fishing data. Based on these observations, coupled with mitigation measures which include focussed surveys and ongoing monitoring for exposures, impacts to commercial fisheries from snagging risk from the decommissioning of the Devenick infrastructure are deemed negligible.

This EA has considered the objectives and marine planning policies of the NMP across the range of policy topics including biodiversity, natural heritage, cumulative impacts and the oil and gas sector. TAQA considers that the proposed decommissioning activities are in alignment with these objectives and policies.

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

7 REFERENCES

Aires, C., Gonzlez-Irusta, J. M. & Watret, R., 2014. Scottish Marine and Freshwater Science Report, Vol 5 No 10, Updating Fisheries Sensitivity Maps in British Waters.

Bakke, T., Klungsøyr, J. & Sanni, S., 2013. Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry, *Marine Environmental Research*, 92, 154-169.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., & Moffat, C.F. (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. pp. 191.

Beare, D., Batten, S., Edwards, M. & Reid, D., 2002. Prevalence of boreal Atlantic, temperate Atlantic and neritic zooplankton in the North Sea between 1958 and 1998 in relation to temperature, salinity, stratification intensity and Atlantic inflow. Journal of Sea Research, 48, p 29 – 49.

BEIS, 2018. Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760560/Decom_Guidance_Notes_November_2018.pdf

Carter, M. I. D., Boehme, L., Duck, C. D., Grecian, W. J., Hastie, G. D., McConnell, B. J., Miller, D. L, Morris, C. D., Moss, S. E. W., Thompson, D., Thompson P. M. & Russel, D. J. F. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. Sea Mammal Research Unit, University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78

Coull, K., Johnstone, R. & Rogers, S., 1998. Fisheries Sensitivity Maps in British Waters, Published and distributed by UKOOA Ltd.

DECC (Department of Energy Climate Change), 2009. UK Offshore Energy Strategic Environmental Assessment. OESEA supporting documents. Available at: https://www.gov.uk/government/publications/uk-offshore-energy-strategic-environmental-assessment-oesea-supporting-documents [Accessed 24/08/2021].

DECC, 2016. UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3). Available at: https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3-oesea3 [Accessed 24/08/2021].

Decom North Sea, 2018. Managing Offshore Decommissioning Waste. First Edition, November 2018.

DTI, 2001. Report to the Department of Trade and Industry. Strategic Environmental Assessment of the mature areas of the offshore North Sea 2. Consultation document, September 2001. Available online at http://www.offshore-sea.org.uk/consultations/SEA_2/index.php [Accessed 19/02/2021].

Edwards, M., Beaugrand, G., Halaouet, P., Licandro, P., McQuatters-Gollop, A. & Wootton, M., 2010. Ecological Status Report (2010): results from the CPR survey 2009/2010. SAHFOS Technical Report 8 1-8, Plymouth UK.

Ellis, J. R., Milligan, S. P., Readdy, L., Taylor, N., & Brown, M. J., 2012. Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas Lowestoft, 147, 56.

FAO, 2019. Fishing gear types – beam trawls. Available at: http://www.seafish.org/geardb/gear/beamtrawl/

FRS (Fisheries Research Services), 2004. Zooplankton and climate change – the Calanus story. Available online at http://www.vliz.be/docs/Zeecijfers/zooplankton_and_climate_change.pdf [Accessed 24/08/2021].

Fugro, 2013b. Marathon Oil UK Ltd. Brae Bravo Environmental Monitoring Survey. UKCS Block 16/7A. September 2013. Project Number: J/1/20/2386, Rev 2 (final).

Fugro, 2016a. Braemar Pre-Decommissioning Environmental Survey UKCS Block 16/3C March and April 2015. Document Number: J/3/20/2805-10(2), Issue 2.

Fugro, 2016b. East Brae Pre-Decommissioning Environmental Survey UKCS Block 16/3A March and April 2015. Document Number: J/3/20/2805-8(2), Issue 2.

Fugro, 2017. East Brae Cuttings Pile Characterisation Survey. UKCS Block 16/3A. April and May 2015. Document Number: J/3/20/2805-12(3), Issue 2

Gardline, 2002. Marathon Oil U.K. Limited. Pipeline Route Surveys Brae Area. Volume 4 – Environmental Report. Report No: M2092/ 5705 (Final).

Gardline, 2006a. BP Exploration Operating Company LTD. UKCS 9/23, 24, 27, 28, 16/2, 3. Harding Area Gas Project Seabed Habitat Assessment Survey. Environmental Habitat Assessment Report. Report Ref 6704.3.

Gardline, 2006b. BP Exploration Operating Company LTD. UKCS 9/23, 24, 27, 28, 16/2, 3. Harding Area Gas Project Seabed Habitat Assessment Survey. Environmental Habitat Assessment Report. Report Ref 6704.3.

Gardline, 2009a. BP Devenick Project – Pipeline Route and Field Area Surveys, Habitat Assessment Report, Gardline Report Ref 7872.

Gardline, 2009b. BP Devenick to East Brae Route Survey. Summary of Environmental Camera Work. Habitat Assessment. Gardline Ref.8063 (preliminary report).

Gardline, 2013. BP Exploration Operating Company Ltd. UKCS 9/23b Harding Site Survey. Environmental Report. Issued August 2013. Gardline Report Ref 6782.2

Gardline, 2019c. UKCS 9/23 Harding North Site and Route Survey. Habitat Assessment. Gardline Report Ref 11360.3 (final).

Gardline, 2019d. UKCS 9/23 Harding North Site and Route Survey. Environmental Baseline Report. Gardline Report Ref 11360.4 (draft).

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M. and Teilmann, J., 2017. Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys (report revised 2021). Wageningen Marine Research.

Hill, J.M., Tyler-Walters, H. & Garrard, S. L., 2020. Seapens and burrowing megafauna in circalittoral fine mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 10-09-2021]. Available from: https://www.marlin.ac.uk/habitat/detail/131 [Accessed 07/09/2021].

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

IEEM, 2010. Guidelines for Ecological Impact Assessment in Britain and Ireland, marine and Coastal. August 2010. Final Version 5.

IEMA, 2015. Environmental impact assessment Guide to Shaping Quality Development.

IEMA, 2016. Environmental impact assessment Guide to Delivering Quality Development.

IUCN (International Union for Conservation of Nature), 2018. IUCN Red List of Threatened Species. Available at: https://www.iucnredlist.org/ [Accessed 24/08/2021].

JNCC (Joint Nature Conservation Committee), 1999. Seabird vulnerability data in UK waters, block specific vulnerability. Joint Nature Conservancy Committee.

JNCC, 2017. UKSeaMap 2016. A broad-scale seabed habitat map for the UK. Available at: http://jncc.defra.gov.uk/ukseamap [Accessed 19/02/2021].

JNCC, 2018. Braemar Pockmarks Marine Protected Area. Available from: https://jncc.gov.uk/our-work/braemar-pockmarks-mpa/#site [Accessed 24/008/2021].

Johns, D.G. and Reid, P.C,. 2001. An Overview of Plankton Ecology In The North Sea. Technical report produced for Strategic Environmental Assessment – SEA2. Produced by SAHFOS, August 2001. Technical Report TR_005.

Jones, E. L., McConnell, B. J., Smout, S. C., Hammond, P. S., Duck, C. D., Morris, C., Thompson, D., Russell, D.J.F., Vincent, C., Cronin, M., Sharples, R. J. & Matthiopoulos, J., 2015. Patterns of space use in sympatric marine colonial predators reveals scales of spatial partitioning. Marine Ecology Progress Series, vol 534 , pp. 235-249 . DOI: 10.3354/meps11370. Available online at https://research-repository.st-andrews.ac.uk/bitstream/handle/10023/9386/Jones_2015_MEPS_Patterns_AM.pdf?sequence=1&isAllowed=y [Accessed 24/08/2021].

Kafas, A., Jones, G., Watret, R., Davies, I. and Scott, B., 2012. Representation of the use of marine space by commercial fisheries in marine spatial planning. ICES CM I: 23.

Kennish, M. J.,1997. Pollution Impacts on Marine Biotic Communities. CRC Press LLC, USA, ISBN 0-8493-8428-1.

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L. J., & Reid, J. B., 2010. An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. JNCC report, 431.

Marathon Oil U.K. LLC, 2017. Brae Alpha, Brae Bravo, Central Brae, West Brae and Sedgwick – Combined Decommissioning Programmes. Document reference number: 9000-MIP-99-PM-RP-00003-000,102. June 2017.

McBreen, F., Askew, N., Cameron, A., Connor, D., Ellwood, H. & Carter, A., 2011. UK SeaMap 2010. Predictive mapping of seabed habitats in UK waters. JNCC Report No. 446. Available online at http://jncc.defra.gov.uk/PDF/jncc446_web.pdf [Accessed 19/02/2021].

MMO, 2017. Vessel Density Grid 2015. Available at: https://data.gov.uk/dataset/b7ae1346-7885-4e2d-aedf-c08a37d829ee/vessel-density-grid-2015 [Accessed 24/08/2021].

MPE (Ministry of Petroleum and Energy), 1999. The Final Disposal of Disused Pipelines and Cables. Summary of the Findings of a Norwegian Assessment Programme. Oslo, December, 1999.

NatureScot, 2020. Scottish Biodiversity List. Available from: https://www.nature.scot/scottish-biodiversity-list [Accessed 24/08/2021].

NMPI, 2021. National Marine Plan Interactive. Available at: https://marinescotland.atkinsgeospatial.com/nmpi/ [Accessed 24/06/2021].

OGA (Oil and Gas Authority), 2016. Information of levels of shipping activity. 29th Offshore Licensing Round information and resources. Available online at https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/offshore-licensing-rounds/#tabs [Accessed 07/09/2021].

OGA (Oil and Gas Authority), 2021. Stewardship Expectation 11 – Net Zero (2021). Available at: https://www.ogauthority.co.uk/news-publications/publications/2021/stewardship-expectation-11-net-zero/ [Accessed 07/09/2021].

OGUK, 2015. Guidelines for Comparative Assessment in Decommissioning Programmes.

OGUK, 2019. OGUK Environment Report (2019). Available at: https://oilandgasuk.cld.bz/Environment-Report-2019 [Accessed 10/08/2021].

OSPAR, 2008. Case Reports for the OSPAR List of threatened and/or declining species and habitats. OSPAR Commission. Available online at http://qsr2010.ospar.org/media/assessments/p00358_case_reports_species_and_habitats_2008.pdf [Accessed 24/08/2021].

OSPAR, 2009. Background for ocean quahog *Arctica islandica*. OSPAR Publication No. 407/2009.

OSPAR, 2010. Background Document for Seapen and Burrowing megafauna communities. Available online at http://www.ospar.org/documents/dbase/publications/p00481/p00481_seapen%20and%20burrowing%20megafauna.pdf [Accessed on 07/09/2021].

Pangerc, T., Robinson, S., Theobald, P. and Galley, L., 2016. Underwater sound measurement data during diamond wire cutting: First description of radiated noise.

Reid, J., Evans, P. & Northridge, S., 2003. An atlas of cetacean distribution on the northwest European Continental Shelf, Joint Nature Conservation Committee: Peterborough.

Rouse, S., Hayes, P. and Wilding, T. , 2018. Commercial fisheries losses arising from interactions with offshore pipelines and other oil and gas infrastructure and activities. ICES Journal of Marine Science, 77(3), pp.1148-1156.

SAHFOS, 2015. Sir Alister Hardy Foundation for Ocean Science. CPR Data: Standard Areas. Available at: https://www.cprsurvey.org/1409 [Accessed 24/08/2021].

SCOS, 2014. Scientific advice on matters related to the management of seal populations 2013. Available online at http://www.smru.st-and.ac.uk/documents/1803.pdf [Accessed 24/08/2021].

SCOS, 2017. Scientific advice on matters related to the management of seal populations: 2017. Available at: http://www.smru.st-andrews.ac.uk/files/2018/01/SCOS-2017.pdf [Accessed 24/08/2021].

SCOS, 2020. Scientific advice on matters related to the management of seal populations: 2019. Available at: http://www.smru.st-andrews.ac.uk/scos/scos-reports/ [Accessed 24/08/2021].

Scottish Government, 2020. Scottish Sea Fisheries Statistics, 2019. Scottish Government. Available at: https://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/RectangleData [Accessed 24/08/2021].

Shell U.K. Limited, 2017. Brent Topsides Decommissioning Technical Document. Document Reference: BDE-F-TOP-HE-0709-00001. February 2017.

SNH, 2013. A handbook on environmental impact assessment Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland. Online at http://www.snh.gov.uk/docs/A1198363.pdf [Accessed 24/08/2021].

SNH, 2014. Priority Marine Features in Scotland's seas, available online at http://www.snh.gov.uk/docs/A1327320.pdf [Accessed 24/08/2021]

TAQA, 2020. Oil Pollution Emergency Plan (OPEP) East Brae. TAQA Document Reference: 200033

TAQA, 2022 Brae Area Devenick Subsea Equipment Comparative Assessment and Selected Decommissioning Options

Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S., Roos, S., Bolton, M., Langston, R.H. and Burton, N.H., 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation, 156, pp.53-61.

Tyler-Walters, H. and Sabatini, M., 2017. Arctica islandica Icelandic cyprine. In Tyler-Walters H. and Hiscock K. (eds) Marine life information network: Biology and sensitivity key information reviews [online]. Marine Biological Association of the United Kingdom. Available at: http://www.marlin.ac.uk/species/detail/1519 [Accessed 21 September 2021].

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T., 2016. Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406. Available online at https://www.nature.scot/doc/naturescot-commissioned-report-406-descriptions-scottish-priority-marine-features-pmfs [Accessed 24/06/2021].

Tyler-Walters, H., Lear, D. and Allen J.H., 2004. Identifying offshore biotope complexes and their sensitivities. Report to Centre for Environmental, Fisheries, and Aquaculture Sciences from the Marine Life Information Network (MarLIN). Plymouth: Marine Biological Association of the UK. [Sub contract reference A1148]. Online at https://1library.net/document/zpv7mooz-identifying-offshore-biotope-complexes-and-their-sensitivities.html [Accessed 24/08/2021].

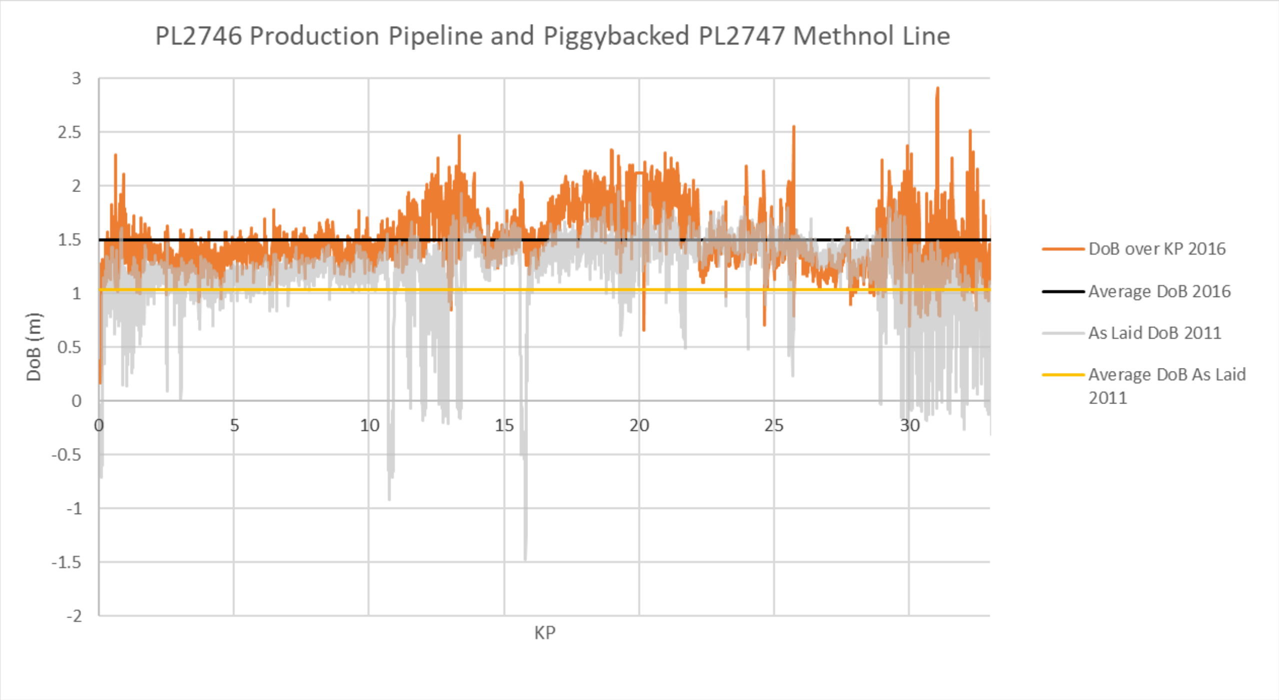
UKOOA, 2001. An Analysis of U.K. Offshore Oil and Gas Environmental Surveys 1975-95.

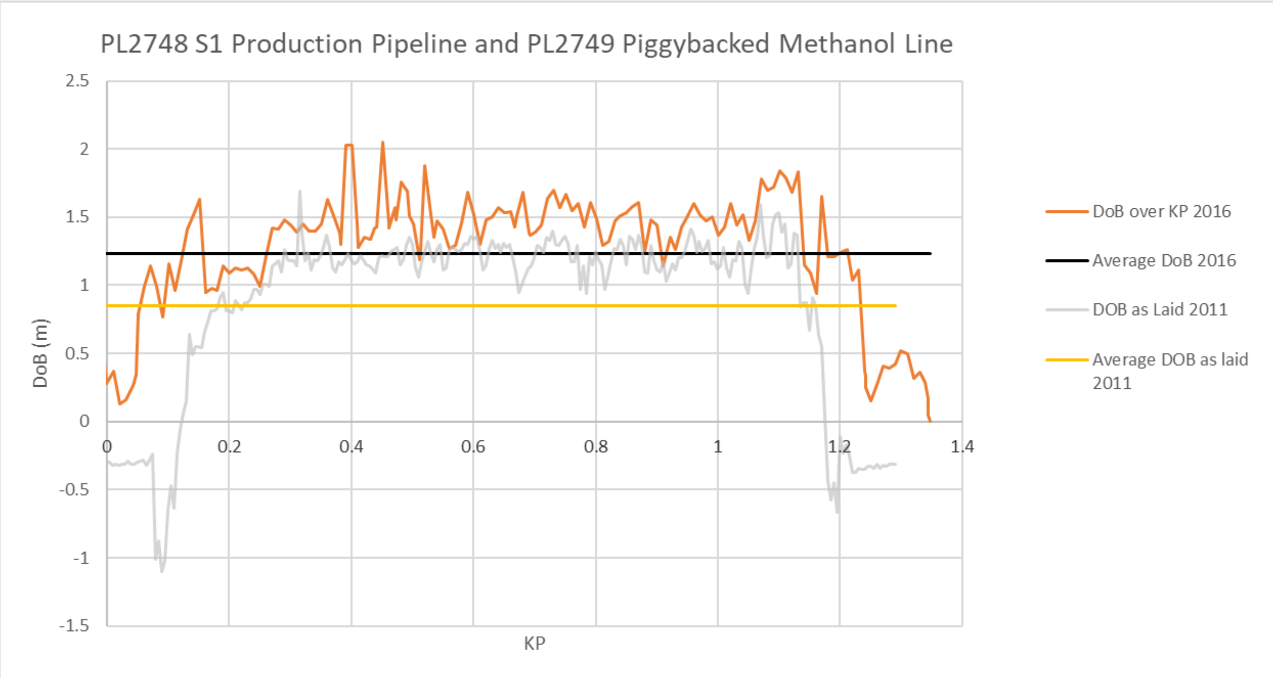
Webb, A., Elgie, M., Irwin, C., Pollock, C. & Barton, C., 2016. Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK. Document No HP00061701. Available online at http://jncc.defra.gov.uk/page-7373 [Accessed 24/08/2021].

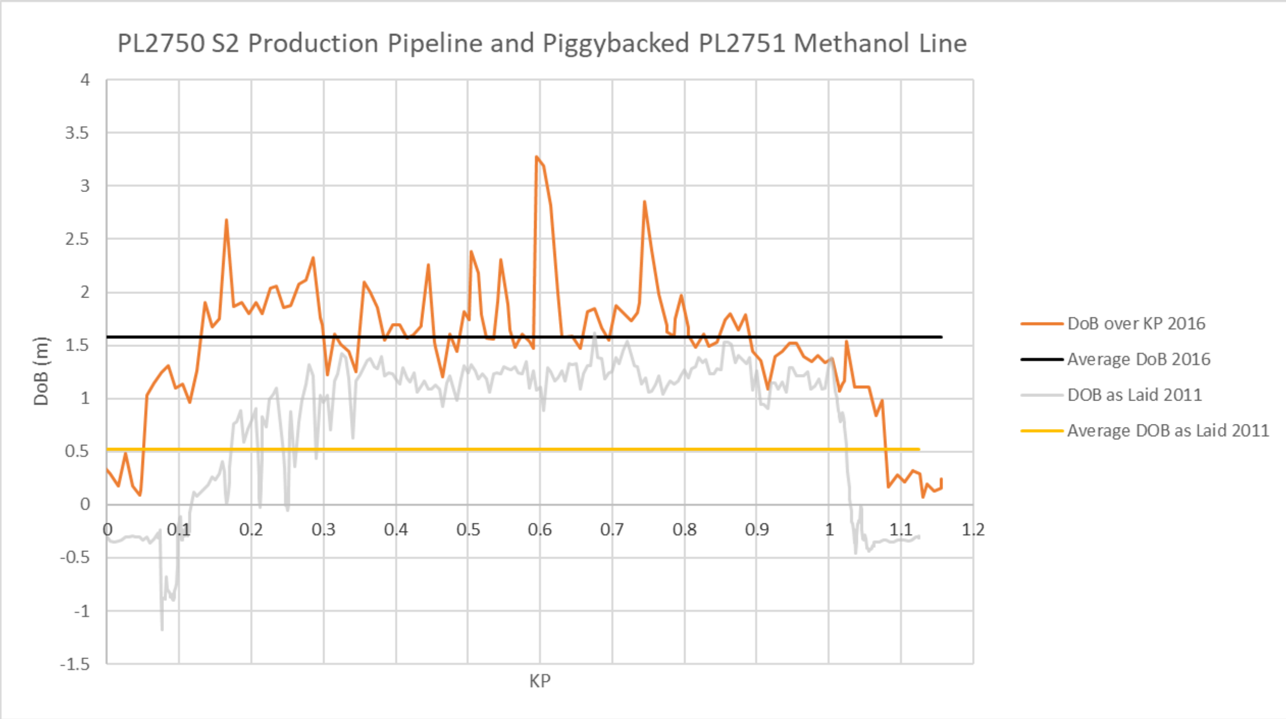
Wolf, J. Yates, N., Brereton, A., Buckland, H., De Dominicis, M., Gallego, A. & O'Hara Murray, R., 2016. The Scottish Shelf Model. Part 1: Shelf-Wide Domain. Scottish Marine and Freshwater Science Vol 7 No 3, 151pp. Available online at http://data.marine.gov.scot/sites/default/files//SMFS%20Vol%207%20No%203.pdf. [Accessed 24/08/2021]

Xodus, 2021. Survey Gap Analysis for TAQA Devenick Pipelines. Document number A-303185-S00-REPT-001.

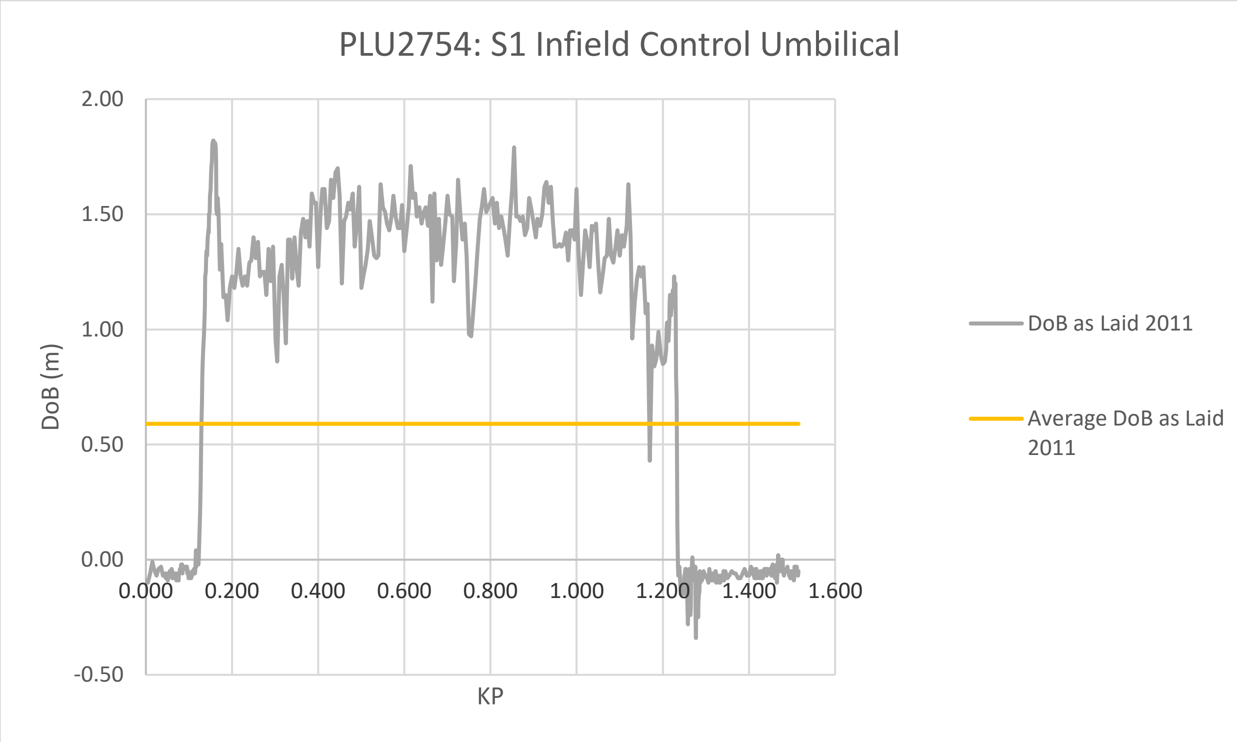
APPENDIX A - PIPELINE DEPTH OF BURIAL

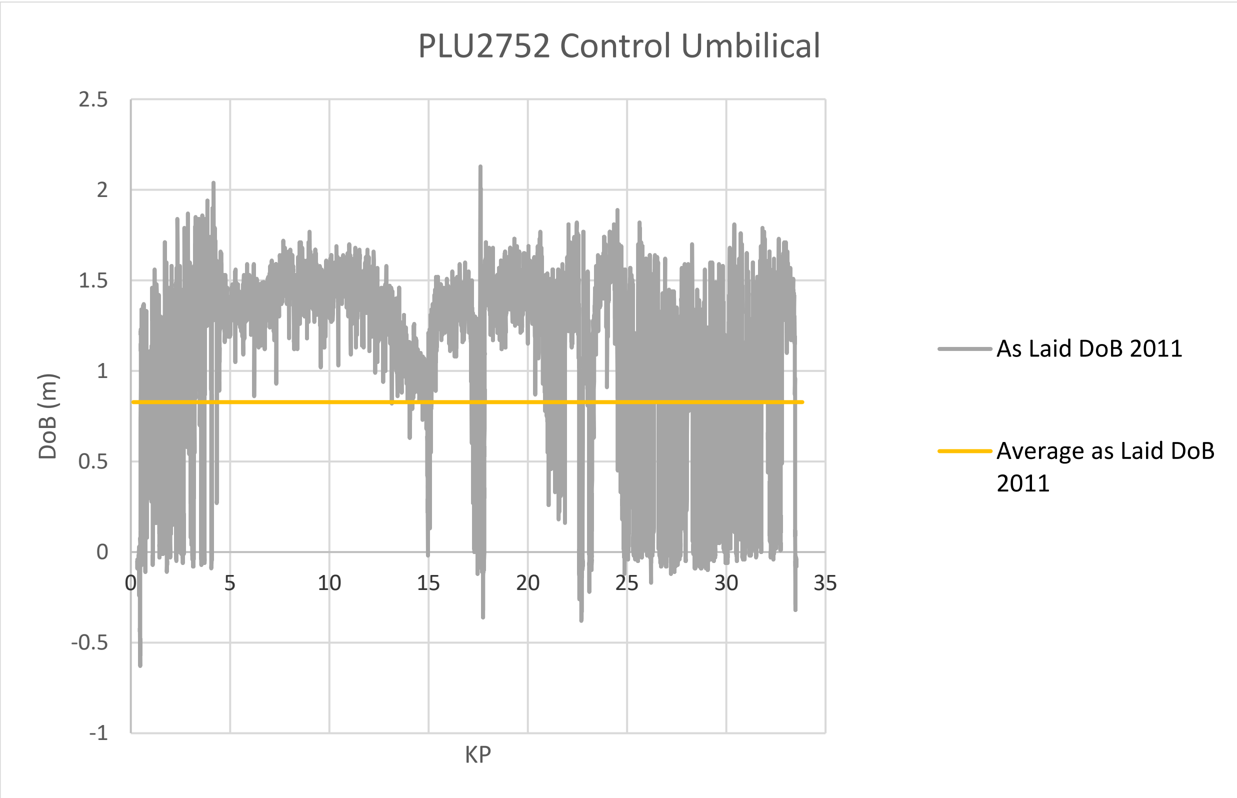


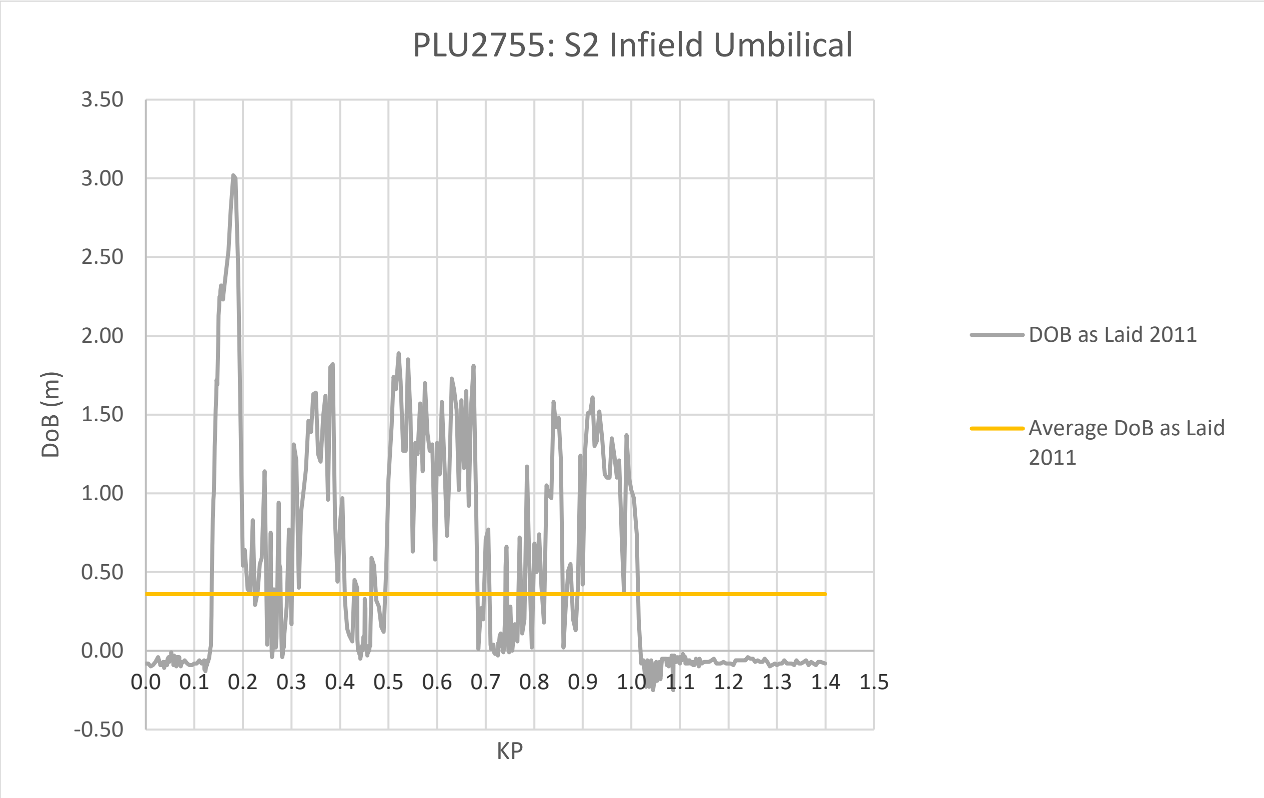



PL2750 S2 Production Pipeline and Piggybacked PL2751 Methanol Line
DoB (m)
KP
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
DoB over KP 2016
Average DoB 2016
DOB as Laid 2011
Average DOB as Laid 2011

APPENDIX B – UMBILICAL DEPTH OF BURIAL







** Visual representations of Umbilical DoB are based upon the 'As Laid' data recorded in 2011. Data recorded during the 2016 survey has not been presented as only surface data (i.e. spans and/or exposures) were recorded and data points could not be presented in a meaningful way. All spans and exposures are listed in Appendix C and will be remediated as appropriate during decommissioning activities. Further data will be collected in future surveys to inform ongoing monitoring and the potential requirement for future remediation.*

APPENDIX C - PIPELINE EXPOSURES AND FREE SPANS SUMMARY

Exposures and free spans located on the Devenick pipelines and umbilicals

Pipeline Status	Easting	Northing	Length (m)
Exposure	415061.9	6527370.38	5.7
Exposure	415158.8	6527613.54	4.5
Exposure	415342.4	6530060.23	3.6
Free Span	415342.4	6530060.7	N/A
Free Span	415342.5	6530062.62	N/A
Exposure	417424.07	6550169.73	1.6
Exposure	417433.94	6550260.93	12.4
Free Span	417434.48	6550269.48	N/A
Exposure	417621.12	6552052.66	0.2
Exposure	419969.04	6559897.01	5.4
Free Span	415062.7	6527368.6	7.4
Exposure	415062.7	6527368.63	7.9
Exposure	415168.5	6527486.21	3.8
Exposure	419979.7	6559891.74	2.9
Exposure	419988.8	6559900.23	1.4
Exposure	419981.3	6559890.22	0.7
Exposure	419983.0	6559891.98	1.4
Exposure	419984.1	6559893.07	2.8
Exposure	419987.2	6559896.64	2
Exposure	419988.7	6559898.44	0.7
Exposure	420984.2	6559132.27	1
Free Span	419970.0	6559891.2	1.1
Exposure	419970.0	6559891.21	1.8
Exposure	420037.7	6559875.4	5.6
Free Span	420036.8	6559876.2	4.3
Exposure and Free Span	419979.9	6559894.6	1.4
Exposure and Free Span	419969.3	6559890.4	1.8

APPENDIX D - TAQA HSSE POLICY

TAQA Europe Health, Safety, Security and Environment Policy

The health, safety and security of our employees, contractors and the public is our highest priority; it is more important than any operational priority.

We must also:

- Ensure that our assets are operated safely
- Assure the integrity of our assets
- Respect, protect and understand the natural environment

HSSE = Health, Personal Safety, Major Accident Prevention, Security and Environment

We strongly believe that excellent business performance requires excellent HSSE performance – we recognise this as a core value.

Employees and contractors are required to focus on the four areas below:

Leadership

- Everyone within TAQA understands their accountabilities for the management of HSSE
- The structure and resources necessary to achieve and measure HSSE accountabilities are provided
- Requirements of applicable legislation and standards are identified, understood and complied with
- Personnel have the required competencies and are fit for work
- Our workforce is aligned, involved and empowered in the identification and management of HSSE hazards and the achievement of our HSSE goals
- Key stakeholder groups are identified and a good working relationship is maintained with them (understanding and addressing their issues and concerns)
- Everyone within TAQA demonstrates commitment and accountability to implement this policy and to work in accordance with the TAQA Management System Elements and Expectations

Operational Risk Identification and Assessment

- Risks are identified, assessed and appropriately managed
- Information required to support safe operation is identified, accurate, available and up to date

Operational Risk Management

- The standards, procedures and operating manuals required to support project, maintenance and operational activities are identified, developed, understood and consistently applied
- Process and operational status monitoring and handover requirements are defined, understood and carried out
- Operational interfaces with third parties are identified, assessed and appropriately managed

Document No: TUK-01-A-001 Issue Date: September 2020

TAQA Europe Health, Safety, Security and Environment Policy

- Risks arising from any form of change are systematically identified, assessed and managed
- A systematic process is in place to verify the safe condition of plant and equipment and to ensure that personnel are appropriately prepared (before start-up or return to normal operations)
- We are appropriately prepared for all necessary actions which may be required for the protection of the public, personnel (including contractors), the environment, plant equipment and reputation in the event of an incident
- We aim to prevent pollution and protect the environment from the impact of our operations

Review and Improvement

- We routinely monitor our activities through internal/external audits and produce key performance indicators – we review these indicators and intervene as necessary
- Compliance with our expectations is routinely reviewed and audited to determine whether this policy remains appropriate and is being implemented effectively
- The management system is routinely reviewed for continual improvement and to enhance HSSE performance
- All incidents, near misses and opportunities for improvement are consistently reported and investigated, and that identified actions and learnings are implemented on a timely basis

We all have a personal responsibility to work safely and protect the environment. We are all safety leaders, irrespective of our role or location. Everyone is empowered to challenge and stop work if they are in any doubt regarding a job they are involved in or observing.

Donald Taylor, Managing Director

John Hogg, HSSEQ Director

René Zwanepol,
NL Country Manager

Sandy Hutchison,
Legal, Commercial
and Business Services Director

Calum Riddell,
Operations Director

Iain Lewis,
Europe CFO / Europe
Decommissioning Director

Gary Hunt,
Human Resources Manager

Gary Tootill, Technical Director –
Subsurface / Wells

David Wilson,
Technical Director – Projects,
Engineering and Assurance

Document No: TUK-01-A-001

Issue Date: September 2020

APPENDIX E - ENERGY USE AND ATMOSPHERIC EMISSIONS

Energy use and atmospheric emissions by project activity for decommissioning

Planned activity	Operations energy (GJ)	Operations CO_2 (te)
Onshore transportation of materials	0.70	0.05
Onshore recycling of materials	6,001.51	636.34
New manufacture to replace recyclable materials	21,083.75	1,593.09
Offshore transport (See table 8.2)	40,220.92	2,986.24
Total	**67,306.88**	**5,215.72**

Offshore transport energy use and atmospheric emissions for decommissioning

Vessel type	Total Duration (days)*			Operations energy (GJ)	Operations CO_2 (te)
	Mob/ Demob	Transit	Working		
DSV	2	2	40	40,220.92	2,986.24
Guard Vessel	2	2	6		
Rock vessel	2	2	1		
Survey vessel	2	2	4		

**Worst case durations also account for waiting on weather.*