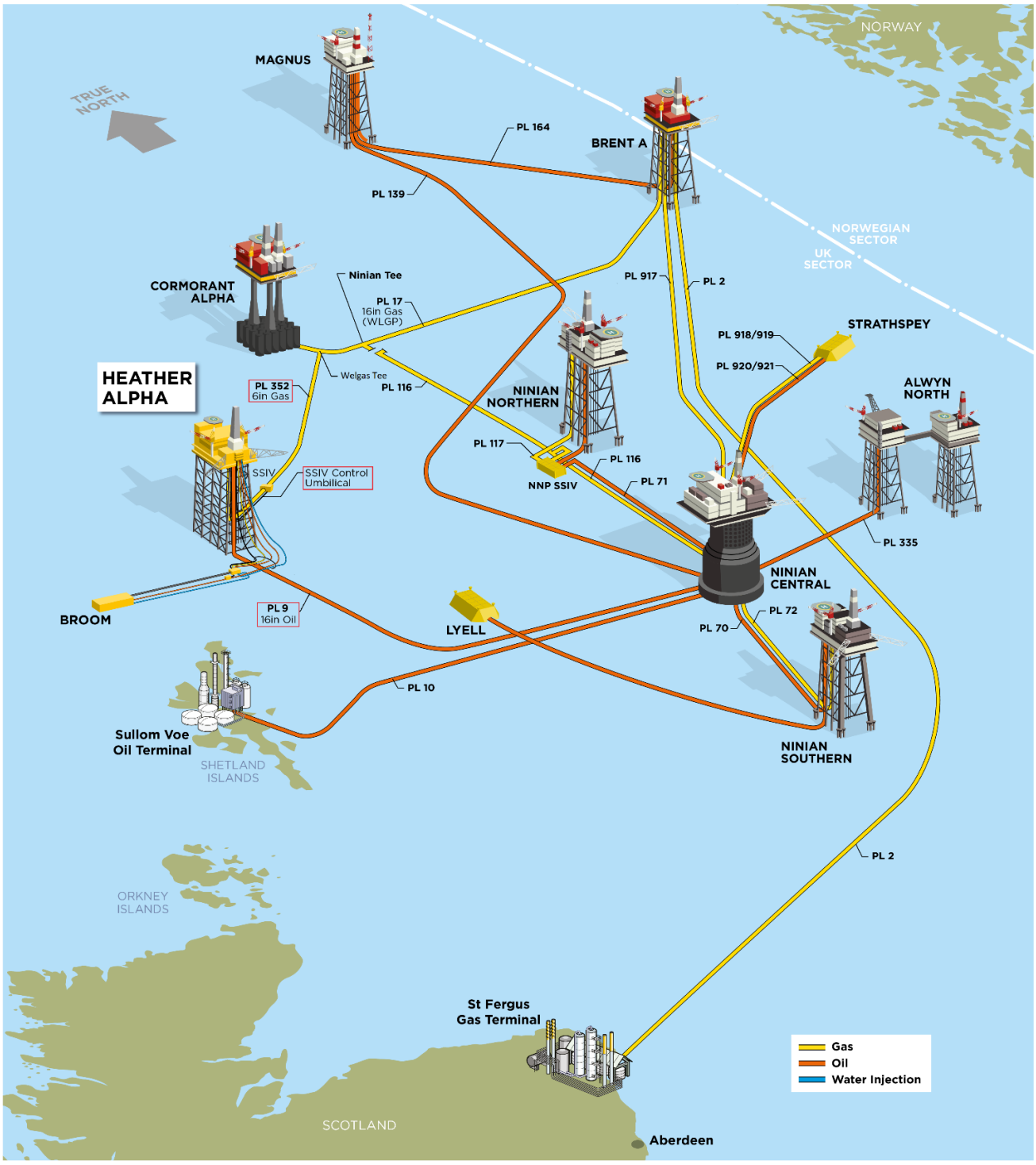
Heather Pipeline Decommissioning Environmental Appraisal



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Abbreviation	Meaning
AIS	Automatic Identification System
ALARP	As low as reasonably practicable
Al	Aluminium
APEs	Alkylphenol ethoxylates
As	Arsenic
Ba	Natural Barium
BAP	Biodiversity Action Plan
BEIS	(Department of) Business, Energy, and Industrial Strategy
CA	Comparative Assessment
CCME	Canadian Council of Ministers of the Environment
CCUS	Carbon Capture, Use and Storage
Cd	Cadmium
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CIEEM	Chartered Institute of Ecology and Environmental Management
CIP	Communication and Interface Plan
CoP	Cessation of Production
CPR	Continuous Plankton Reader
Cr	Chromium
CSV	Construction Support Vessel
CTE	Coal Tar Epoxy
Cu	Copper
CWC	Concrete Weight Coated
DECC	Department for Energy and Climate Change (ow OPRED)
DOC	(taken from burial profiles in appendix)
DOL	(taken from burial profiles in appendix)
DP	Decommission Programme
DWS	Diamond Wire Saw
E	East
EA	Environmental Appraisal
EAC	Environmental Assessment Criteria
EMS	Environmental Management System

Abbreviation	Meaning
EEMS	Environmental and Emissions Monitoring System
EIA	Environmental Impact Assessment
EL	Elevation; height relative to LAT
ENVID	Environmental Impact Identification
EPS	European Protected Species
ERL	Effect Range Low
ESDV	Emergency Shutdown Valve
EU	European Union
EUNIS	European Nature Information System
FishSAFE	The FishSAFE database contains a host of oil & gas structures, pipelines, and potential fishing hazards. This includes information and changes as the data are reported for pipelines and cables, suspended wellheads pipeline spans, surface & subsurface structures, safety zones & pipeline gates (www.fishsafe.eu)
GHG	Green House Gas
GRP	Glass Reinforced Plastic
HDPE	High Density Polyethylene
HLV	Heavy Lift Vessel
HSE	Health and Safety Executive
HSE&A	Health, Safety, Environment and Assurance
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organisation
in	Inches
IRM	Inspection, Repair and Maintenance
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
Kg	Kilogram
Km	Kilometre
KPIs	Key Performance Indicators
LAT	Lowest Astronomical Tide
m	Metre
m^2	Square Metre
m^3	Cubic Metre
mg/kg^{-1}	Milligram per kilogram

Abbreviation	Meaning
MAIB	Marine Accident Investigation Branch
MarLIN	The Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echosounder
MDAC	Methane Derived Authigenic Carbonates
MoD	Ministry of Defence
MPA	Marine Protected Area
NCMPA	Nature Conservation Marine Protected Area
NCP	Ninian Central Platform
Ni	Nickel
NMP	National Marine Plan
NMPI	National Marine Plan Interactive
NNE	North-Northeast
NNS	Northern North Sea
NNW	North-Northwest
NOAA	National Oceanic and Atmospheric Administration
NORM	Naturally Occurring Radioactive Material
NPD	Naphthalene, Anthracene and Dibenzothiophene
NSTA	North Sea Transition Authority
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning (Branded Department within BEIS)
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PAH	Polycyclic Aromatic Hydrocarbons
PCO	Precipitated Carbonate
PETS	Portal Environmental Tracking System
PMF	Priority Marine Feature
POC	Particulate Organic Carbon
PON2	Environmental alerts and incident reporting: Loss of deposition of materials to sea
ppm	Parts Per Million
PSA	Particle Size Analysis
ROV	Remotely Operated Vehicle
SAC	Special Areas of Conservation

Abbreviation	Meaning
SACFOR	Abundance scale used for both littoral and sublittoral taxa (Superabundant, Abundant, Common, Frequent, Occasional, Rare)
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Association
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area
SSS	Side Scan Sonar
SVT	Sullom Voe Terminal
Te	Tonnes
TEL	Threshold Effect Level
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
VMS	Vessel Monitoring System
WLGP	Western Leg Gas Pipeline
WONS	Well Operations Notification System
Zn	Zinc

1. EXECUTIVE SUMMARY

1.1 Introduction and Background

This non-technical summary provides an outline of the findings of the Environmental Appraisal ('EA') conducted by EnQuest Heather Limited ('EnQuest') for the proposed decommissioning of the Heather pipelines and associated subsea infrastructure. The purpose of the EA is to understand and communicate the potentially significant environmental impacts associated with the proposed decommissioning options.

The Heather Alpha installation is in Block 2/5 of the United Kingdom Continental Shelf ('UKCS') and is a fixed and fully integrated installation consisting of a modular topside providing manned production, drilling, and utilities facilities and a piled steel jacket. The Heather Field is located approximately 458 kilometres ('km') north-northeast ('NNE') of Aberdeen in a water depth of ~143 metres ('m') below Lowest Astronomical Tide ('LAT').

The Heather Alpha installation was installed in 1977, with first oil produced on 6th October 1978. A Cessation of Production ('CoP') application for Heather was accepted by the Oil and Gas Authority ('OGA') – now the North Sea Transition Authority ('NSTA') - on 18th June 2020. Until production ceased in 2020, produced crude oil from the Heather Field was exported to Ninian Central Platform ('NCP') using PL9 and PL9A. PL9 is a 16 inch ('in') concrete weight coated ('CWC') pipeline ~33.2 km long. PL9A is a 139 m high density polyethylene ('HDPE') 15 in flexible flowline installed to replace a section of PL9. The oil was then comingled with production from other facilities and transported to the Sullom Voe Terminal ('SVT') using PL10, a 36 in pipeline, which is out of scope.

Processed gas was imported from the Western Leg Gas Pipeline ('WLGP') using a 6 in pipeline (PL352) routed between what is commonly referred to as the "Welgas Tee" to the Heather platform. This pipeline is ~19.4 km long.

The Heather platform is also host to a number of risers and umbilicals associated with the Broom development tied back to Heather. These include PL2693 (formerly PL2003), PL2004, PL3758 (formerly PL2005), PL2006, PL2007 and PLU2008. These will be subject to separate Decommissioning Programmes ('DP'), Comparative Assessment ('CA') and EA.

1.2 Regulatory Context

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the UKCS. The responsibility for ensuring compliance with the Petroleum Act 1998 rests with Department for Business, Energy & Industrial Strategy ('BEIS'). The Petroleum Act 1998 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 the Secretary of State. The DP should outline in detail the infrastructure being decommissioned and the method by which the decommissioning will take place.

This EA has been conducted to assess the environmental impacts that may result from undertaking of activities as part of the decommissioning of the Heather pipelines, umbilicals, cables and associated protection and stabilisation materials. This EA supports the DP submitted to Offshore Petroleum Regulator for Environment and Decommissioning ('OPRED') [28]. The EA has been written considering the BEIS, OPRED 2018 Guidance Notes [4] and the 2018 Decom North Sea EA Guidance [17] and focuses on screening out non-significant impacts to present a detailed assessment of potentially significant impacts.

In terms of activities in the Northern North Sea ('NNS'), the Scottish National Marine Plan ('NMP') has been adopted by the Scottish Government to help ensure sustainable development of the

marine area. The NMP has been developed in line with UK, European Union ('EU') and The Convention for the Protection of the Marine Environment of the North-East Atlantic ('OSPAR') legislation, Directives and Guidance. The NMP 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'. As part of the conclusions to this assessment (Section 7), EnQuest demonstrates due consideration to the NMP during project decision making and the interactions between the project and NMP.

1.3 Decommissioning Overview

1.3.1 Proposed Schedule

The precise timing of the decommissioning activities is not yet confirmed and the proposed schedule for the decommissioning of the Heather pipelines is shown in Figure 3.5.1. The activity windows are subject to the acceptance of the DP as presented in this document and any unavoidable constraints (e.g., vessel availability) that may be encountered while executing decommissioning activities.

1.3.2 Selected Decommissioning Options

Options to re-use the Heather pipelines *in situ* for future hydrocarbon or alternative developments have been considered. However, to date, none have yielded a viable commercial opportunity. There is an implicit assumption that options for re-use of the pipelines have been exhausted before facilities and infrastructure move into the decommissioning phase and CA. Therefore, the re-use option has been excluded from this assessment.

Given the unlikely re-use of the Heather pipelines, there is no reason to delay decommissioning of the infrastructure (in a way that is safe, environmentally and societally acceptable). The 'do nothing' approach to the infrastructure is thus rejected.

The decommissioning methods for the associated flushed and cleaned pipeline infrastructure were assessed against each other in CA which looked at three decommissioning options. These were: full removal, partial removal and leave *in situ*. Subsets of the partial removal option were explored by examining the possibilities of post-trenching the pipelines and remedial works such as the deposition of rock [26]. The Heather gas import emergency shutdown valve ('ESDV') and associated protection frames located inside the Heather 500 m safety zone will be completely removed. For PL9, PL9A, PL352 and the ESDV umbilical, the buried sections will be decommissioned *in situ*. On the approaches, the ends of PL9 and PL352 will be cut at trench depth where they enter burial and the associated surface laid sections will be removed. The exposed cut ends of the pipelines will be remediated with the placement of rock. Existing spans and exposed sections (total length up to ~14km) of PL9 will be remediated with the placement of rock. PL352 is to remain *in situ* following the removal of any short, exposed sections of the pipe. The remaining pipeline ends will be buried in deposited rock.

The option to bury the exposed sections under rock remains a valid approach but has been considered in this EA as a worst-case scenario. A section of PL9Awill be decommissioned *in situ,* connected to the riser on the lower section of the Heather jacket. Any sections of PL9A which are buried within the Heather Alpha cuttings pile will be left *in situ* and the short sections of PL9A which are not buried, will be removed. The ESDV umbilical will also be decommissioned *in situ* with all spans and exposures removed and the umbilical ends will be buried by deposited rock.

The CA also addressed the stabilisation materials associated with the Heather pipelines. The recommendation of the CA was that if pipeline stabilisation materials such as concrete mattresses, sand and cement bags are exposed at the pipeline ends, they will be completely removed.

Otherwise, they will be left *in situ*. The burial status of these materials will be determined when decommissioning activities are carried out. There are approximately 3,274 sand and cement bags (25 kilogram ('kg') each) and 107 concrete mattresses associated with the Heather pipelines and umbilical.

1.4 Environmental and Societal Sensitivities

The key environmental and societal sensitivities in the Heather area have been summarised in Table 1.4.1 below.

Table 1.4.1 Environmental and Societal sensitivities
Physical Environment
The Heather pipelines and associated infrastructure are located in Blocks 2/5, 3/1, 3/2 and 3/3. The water depth across the surveyed area varied from 141.9 m below LAT to 145.3 m below LAT [7].
Conservation Interests
No adult specimens of ocean quahogs *Arctica islandica* were recorded, however, one juvenile individual was recorded in macrofauna analysis at a single station. No evidence of *A. islandica* siphons was observed on any of the video footage [7]. Survey imagery identified evidence of bioturbation and burrowing megafauna communities. The seapen species *Virgularia mirabilis* and *Pennatula phosphorea* were observed [7]. Thus, it was concluded that the OSPAR-protected 'Seapen and burrowing megafauna communities' habitat is present within the surveyed area [1].
Conservation Sites
The Heather Field lies approximately 49 km from any conservation sites (Figure 4.5.1). The Fetlar to Haroldswick Nature Conservation Marine Protected Area ('MPA (NC)') is located approximately 95 km west, the Hermaness Saxa Vord and Valla Field Special Protection Area ('SPA') is located approximately 94 km west and the Pobie Bank Reef Special Areas of Conservation ('SAC') is located approximately 49 km southwest of the Heather area respectively. The Braemar Pockmarks SAC (Annex I habitat 'Submarine structures made by leaking gases') is around 250 km south of the survey area.
Conservation Species
Harbour porpoise, Atlantic white-sided dolphin, minke whale and white-beaked dolphin have all been observed in the Heather Field [61][33]. All of which are Scottish Priority Marine Features ('PMF's), European Protected Species ('EPS') and are covered by the UK Biodiversity Action Plan ('BAP'). Grey and harbour seal densities are very low (0-1 individuals per 25 km^2) across the area due to its distance from shore [66][8]. Both seal species are PMFs and Habitats Directive Annex II protected species.
Benthic Environment
The seabed within the project area is considered to be EUNIS (European Nature Information System) 'Deep circalittoral sand' (A5.27) and 'Deep circalittoral coarse sediment' (A5.15). Side-scan sonar ('SSS') indicated medium reflectivity attributed to the muddy sand sediment [7]. Particle size analysis ('PSA') identified the sediment to be mainly composed of sand with lesser contributions of fines and gravels [7]. Along PL9 to Ninian Central, the pipeline travels through Deep circalittoral sand' (A5.27) habitat into Deep circalittoral mud (A5.37) before returning to Deep circalittoral sand at the Ninian Central location. The sediment type found throughout the NCP area generally showed low variation with mean diameters ranging from 113 µm to 176 µm and were classified as fine to very fine sands. Samples taken at the Heather cuttings pile contained a greater percentage of cohesive silt and drill cutting material, intermixed with coarse sediment and Mytilus shells [6]. Annelid species made up 45.2% of the total infaunal species recovered, which is expected considering the sediment type. Within the limits of the cuttings pile, Nematoda dominated at all but one station [6]. A low diversity of epifauna was found across the project area due to the nature of the sediment which reduces attachment opportunities, however, survey imagery did identify evidence of bioturbation and burrowing megafauna communities. Additionally, the presence of seapen species such as *Virgularia*

mirabilis and *Pennatula phosphorea* was observed [7]. It was concluded that the UK BAP 'Seapen and burrowing megafauna communities' habitat was present at a number of stations in the surveyed area [7].

Fish

The Heather pipelines are located in an area of high concentration spawning for Norway pout [14]. Cod, haddock, saithe, sandeel and whiting also use the area for spawning [14][30]. Additionally, the project area is located in a high nursery intensity area for blue whiting. The following species have nursery grounds near the project area: anglerfish; European hake; haddock; herring; ling; mackerel; Norway pout; spurdog; sandeel, and whiting [30].

Aires *et al.* provides modelled spatial representations of the predicted distribution of juvenile fish (less than one year old) [1]. The probability of juvenile aggregations of anglerfish, blue whiting, European hake, haddock, herring, mackerel, horse mackerel, Norway pout, plaice, sprat, and whiting occurring is very low [1].

Seabirds

The following species could be found within the project area: northern fulmar; razorbill; lesser black-backed gull; European storm-petrel; northern gannet; great skua; black-legged kittiwake; great black-backed gull; herring gull; common guillemot; little auk, and Atlantic puffin [42]. The Seabird Oil Sensitivity Index ('SOSI') identifies areas at sea where seabirds are likely to be most sensitive to surface pollution [71]. Seabird sensitivity in Blocks 2/5, 3/1, 3/2 and 3/3 is low throughout the year [71].

Societal Receptors

Commercial Fisheries

Vessel Monitoring System ('VMS') data from 2009-2013 indicates that fishing intensity within Block 2/5 is low for shellfish species, moderate for pelagic species (mackerel/herring), and high for demersal species [41].

In 2020, fishing effort in ICES ('International Council for the Exploration of the Sea') rectangle 50F0 was highest in October, accounting for 18% of the total number of days fished, followed by the period running from August to November contributing for 51% of fishing effort (Table 4.4.1). Fishing efforts for ICES rectangle 50F1 was highest in June and January, accounting for 26% of the total number of days fished, followed by the period running July to August contributing 23% of fishing effort (Table 4.4.2). In September, November and December the effort was lower, accounting for 15% of the annual effort [68]. Trawls were the most utilised gear in rectangle 50F0 accounting for 77% of the total number of days fished and 90% of the total number of days fished for in rectangle 50F1. Other gear type utilised include hooks and lines, seine nets and gill nets and entangling nets [68][4].

The five top landed species in rectangle 50F0 in 2020 in terms of weight included hake, saithe, mackerel, herring and whiting, while the top five landed species in rectangle 50F1 in 2020 in terms of weight included saithe, whiting, haddock, hake and cod [68].

Other Sea Users

Shipping activity is assessed to be 'low' in Blocks 2/5, 3/1, 3/2 and 3/3 [20][55]. There are seven third-party surface installations within 40 km of the Heather installation; the closest being the Cormorant Alpha platform operated by TAQA (18 km northeast of Heather).

The nearest active cable is located 105 km east of the Heather installation. There are some historic cables in the vicinity of the project location – though disused, sections of these cables may remain on the seabed [52]. Blocks 2/5, 3/1, 3/2 and 3/3 are all in an area of concern to the Ministry of Defence ('MoD') as it lies within training ranges [56]. There are no renewable energy sites within 100 km of the project area [52]. The nearest wreck is located approximately 10 km north-east of the project area and is classified as 'non-dangerous' [52].

1.5 Impact Assessment

This EA has been prepared in line with the BEIS, OPRED Decommissioning Guidance Notes [60] and with Decom North Sea's EA Guidelines for Offshore Oil and Gas Decommissioning [18]. The OPRED Decommissioning Guidance states that an EA, in support of a DP, should be focused on the key issues related to the specific activities proposed; and that the impact assessment write-up

should be proportionate to the scale of the project and to the environmental sensitivities of the project area.

The EA has been informed by several different processes, including the identification of potential environmental issues through Project Engineer and marine Environmental Specialist review in an Environmental Identification ('ENVID') screening workshop and consultation with key stakeholders.

The impact assessment screening identified ten potential impact areas based on the proposed Heather pipeline decommissioning activities:

- Atmospheric emissions;
- Seabed disturbance;
- Physical presence of infrastructure decommissioned *in situ*;
- Physical presence of vessels in relation to other sea users;
- Underwater noise;
- Discharges to sea;
- Resource use;
- Waste;
- Disturbance to seabirds; and,
- Accidental events

Of these, the following three were screened in and taken forward for assessment based on the potential severity and/or likelihood of their respective environmental impact: seabed disturbance and physical presence of infrastructure decommissioned *in situ*

Table 1.5.1 Key potential impacts assessed

Impact on physical presence of infrastructure decommissioned *in situ*	ENVID	Impact Assessment	Significance
Physical presence of infrastructure decommissioned *in situ* was investigated as a potential impact on commercial fisheries. Understanding the use of the Heather areas for commercial fisheries purposes and the risk that infrastructure decommissioned *in situ* may pose as a gear snagging risk was of key importance. The CA outcome has determined that any surface laid infrastructure and associated stabilisation material that is not buried within the Heather and Ninian Central 500m exclusion zones will be fully removed to shore. Large portions of the Heather pipelines and umbilical will be decommissioned *in situ*. However, past burial survey data has shown that each pipeline and umbilical are slowly increasing in burial over time, with length of exposures also reducing with time. In total 25% of the Heather pipelines and umbilicals are exposed and 4% are in span. All spans will be remediated with 2 km of rock placement, and for worst case scenario this EA has assessed a total of 14	Initial assessment of this aspect within the ENVID (Appendix B) yielded; 'Medium' Consequence (spatial extent), 'Low' Frequency, 'High' Magnitude and 'Low/Medium' Probability. These scores gave an overall level of 'Medium'. Due to this and potential stakeholder concern this aspect was carried forward for further assessment.	Following full assessment of this aspect, taking into consideration fishing, vessel, and shipping activity within ICES Rectangle 50F0 and 50F1, along with industry and EnQuest mitigation measures, the overall assessment was reduced to 'Low'. While the Magnitude of this aspect could not be lowered, both Consequence (spatial extent) and Probability were reduced to 'Low'.	Not significant

km of rock placement (covering all exposures and spans). Any rock placed will be appropriately graded with a 1:3 slope which allows fishing gear to trawl across it without snagging and EnQuest will also engage in a monitoring schedule with the assumption that should any further spans or potential snagging points emerge, these will be remediated.			
Seabed Disturbance	**ENVID**	**Impact Assessment**	**Significance**
Disturbance to seabed was investigated further for potential impacts due to the nature of the proposed activities. The proposed decommissioning activities may impact a temporary (direct and indirect) area of 0.31 km^2 of seabed habitat, with an additional area of 0.14 km^2 of permanent impact associated with rock remediation. While the activities may result in the mortality of some individuals, many of the taxa within the project area are relatively resilient; sandy communities are comparatively quick to recover from disturbance. No decommissioning activity will be taking place in a protected area; therefore, it is highly unlikely that habitat or species of conservation interest will be directly or indirectly affected. With regards to the sediment and benthic features within area, the Heather pipeline activities are unlikely to affect the natural physical processes of the area. Pipelines being decommissioned *in situ* are also unlikely to have an impact on these processes and their gradual degradation over time will have a negligible impact on the surrounding sediments.	Initial assessment of this aspect within the ENVID (Appendix B) yielded; 'Low' Consequence (spatial extent), 'Medium' Frequency, 'Medium' Magnitude and 'High' Probability. These scores gave an overall level of 'Medium'. Due to this, this aspect was carried forward for further assessment.	Following full assessment of this aspect, taking into consideration the benthic environment, seabed characteristics, commercial fishing, relatively small size of disturbance area along with industry and EnQuest mitigation measures, the overall assessment was reduced to 'Low'. While the Probability of this aspect could not be lowered, both Magnitude and Frequency were reduced to 'Low'.	Not significant

1.6 Conclusion

This EA has considered the relevant Marine Plans, adopted by the UK ('United Kingdom') and Scottish Governments to help ensure sustainable development of the marine area. EnQuest consider that the proposed decommissioning activities are in alignment with its objectives and policies.

Having reviewed the project activities within the wider regional context; and taking into consideration the mitigation measures to limit any potential impacts, the findings of this EA conclude that the activities do not pose any significant threat to environmental or societal receptors within the UKCS.

2. INTRODUCTION

2.1 Background

The Heather Field is situated within Block 2/5 of the NNS sector of the UKCS. The Heather pipelines PL9 and PL352 (up to ESDV) run through Blocks 2/5, 3/1, 3/2 and 3/3. The Heather Field was first discovered in 1973, approximately 93 km northeast of the Shetland Islands and 50 km from the UK/Norway boundary line (Figure 2.1.1 and Figure 2.1.2).

Initial production began in 1978, with peak production capacity reaching 36,500 barrels of oil per day in 1982. In 2010, EnQuest became the Operator of the Heather Field. However, production ceased in 2020 and CoP justification was accepted by the OGA on 18th June 2020. Produced crude oil from the Heather Field was exported to NCP using PL9 and PL9A. PL9 is a 16 in concrete weight coated ('CWC') pipeline ~33.2 km long. PL9A is a 139 m high density polyethylene ('HDPE') 15 in flexible flowline installed to replace a section of PL9. The oil was then comingled with production from other facilities and transported from Ninian Central (via PL10, a 36 in pipeline) to the SVT'. Processed gas for the gas turbines used to be imported from the WLGP using a 6 in pipeline (PL352) routed between what is commonly referred to as the Welgas Tee to the Heather platform via the ESDV skid. PL352 is ~19.4 km long.

The Heather platform is also host to risers and umbilicals associated with the Broom development, which is tied back to Heather. These include PL2693 (formerly PL2003), PL2004, PL3758 (formerly PL2005), PL2006, PL2007 and PLU2008. These will be subject to separate DP's and CA's.

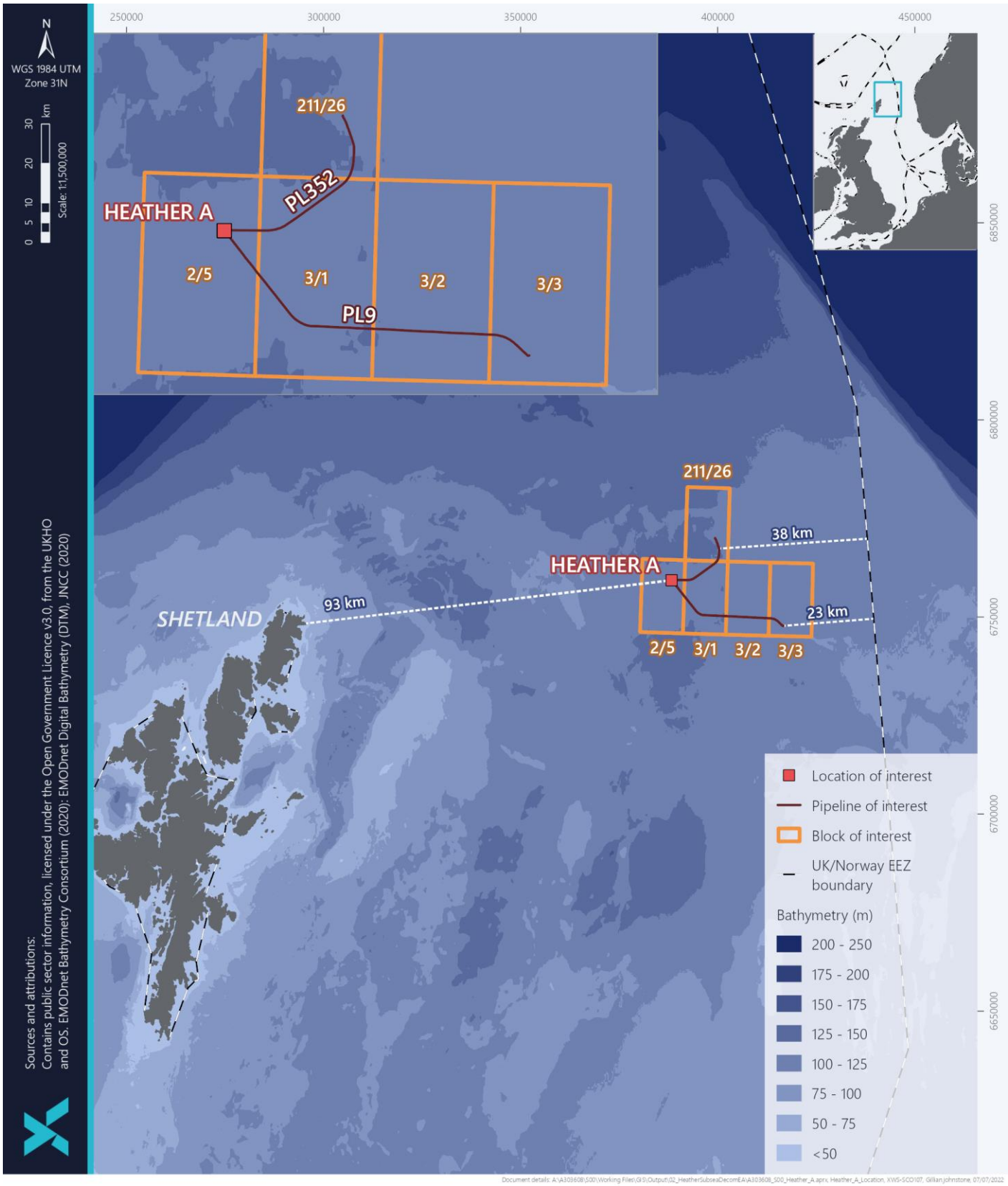


Figure 2.1.1 Heather Field Location in UKCS

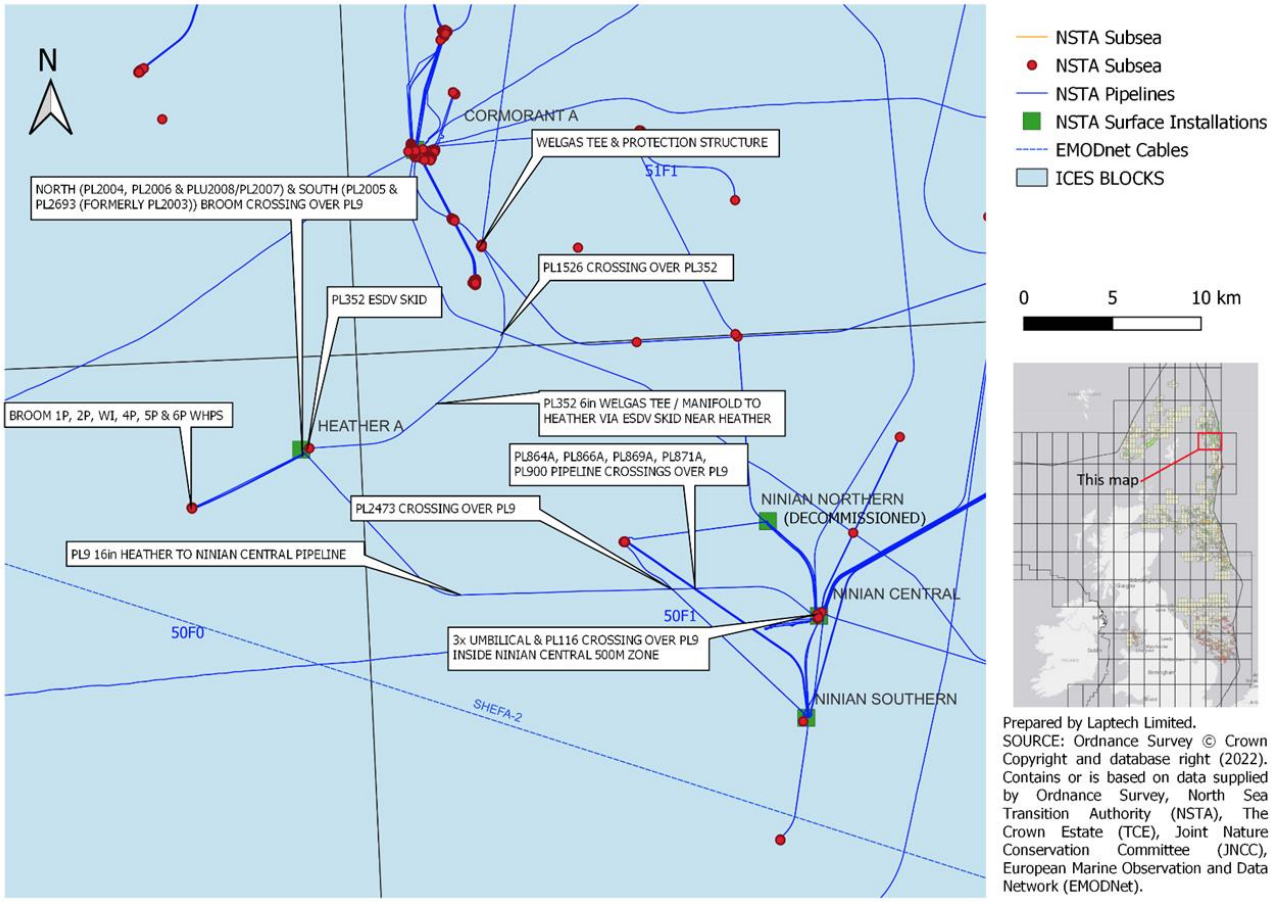


Figure 2.1.2 Locality of Heather in relation to other infrastructure

2.2 Overview of the Infrastructure

The following sections provide an overview of the infrastructure relevant to the Heather Pipelines and associated subsea infrastructure.

Table 2.2.1 Infrastructure within project area

Description	Route	Burial	Length
PL9, 16 in CWC pipeline	Heather to Ninian Central	Trenched, left to backfill naturally, deposited rock along part of its length	33.2 km
PL9A, 15 in HDPE flexible pipe	Replaces 65m long section of PL9 near Heather	Part suspended in water column part laid on seabed (drill cuttings)	0.139 km
PL352, 6 in FBE pipeline	Welgas Tee to Heather	Trenched, left to backfill naturally. Buried	19.4 km
ESDV umbilical	Heather to ESDV skid	As PL352	0.570 km

Notes:
1. The ESDV umbilical share the same trench as PL352 between the ESDV skid and the Heather platform.
2. The length of PL9A includes 2 x Morgrip pipe connectors, one at each end.

2.2.1 PL9: 16 in oil export pipelines (Heather to Ninian Central)

PL9 is a 16 in carbon steel pipeline ~33.2 km long coated using 5 mm coat tar epoxy ('CTE') and furnished with a 1 in (25.4 mm) thick CWC. The riser at Heather is furnished with a 12 mm thick Neoprene coating, while at Ninian Central (Figure 2.2.3) in the splash zone, the riser is provided with a 3 mm thick Monel coating. The pipeline is routed to Ninian Central and crossed by pipelines associated with the Lyell development, by a pipeline and a few umbilicals: PLU4182, PL116 (not in use), PLU4265 (not in use) and umbilical UH on the final approach to Ninian Central in the 500 m safety zone. When installed the pipeline was laid in a trench that was left to backfill naturally. Near the Heather platform the pipeline is now buried under drill cuttings (Figure 2.2.1).

2.2.2 PL9A 15 in Flexible flowline replacement section

PL9A is a 15 in flexible flowline manufactured from HDPE that was installed to replace a section of PL9 where the integrity had been compromised. The section is 139 m long including the length the 1.5 m long "Morgrip" connectors at each end (Figure 2.2.1). The replacement section was installed in 2004.

PL9A is part suspended in the water column where it connects to the PL9 riser at the Heather platform, and was part laid on the drill cuttings. It is now partly buried in the drill cuttings.

2.2.3 PL352 6 in gas import pipeline (Welgas tee to Heather)

PL352 is a 6 in carbon steel pipeline ~19.4 km long coated along most of its length using fusion bonded epoxy ('FBE') with the riser section at Heather being provided with a 3 mm thick Monel coating in the splash zone. The pipeline is routed from the Welgas tee to the Heather platform via a dedicated ESDV skid about 320 m from Heather (Figure 2.2.4). The design intent was that the pipeline be trenched with a one metre minimum cover with the trench being left to backfill naturally. At the vicinity of the Heather platform, the pipeline is buried under drill cuttings.

2.2.4 ESDV umbilical (Heather to ESDV Skid)

The ESDV umbilical is an 81 mm OD umbilical ~570 m long and it is routed from the Heather topsides to the PL352 ESDV skid located approximately 350 m away from the platform. The umbilical is installed inside a caisson that was retrospectively installed between EL +22.5 m and EL -68.0 m within the Heather jacket. Below the caisson, the umbilical is clamped to the jacket at EL. -79 m, EL. -101 m, EL -122 m levels before being routed onto the seabed where it is trenched. Near the jacket, the umbilical is buried in drill cuttings. The umbilical was manufactured using a variety of materials including steel and plastics. It lies within the same trench as PL352. Although, it was subject to its own survey in 2010 (Appendix E.3).

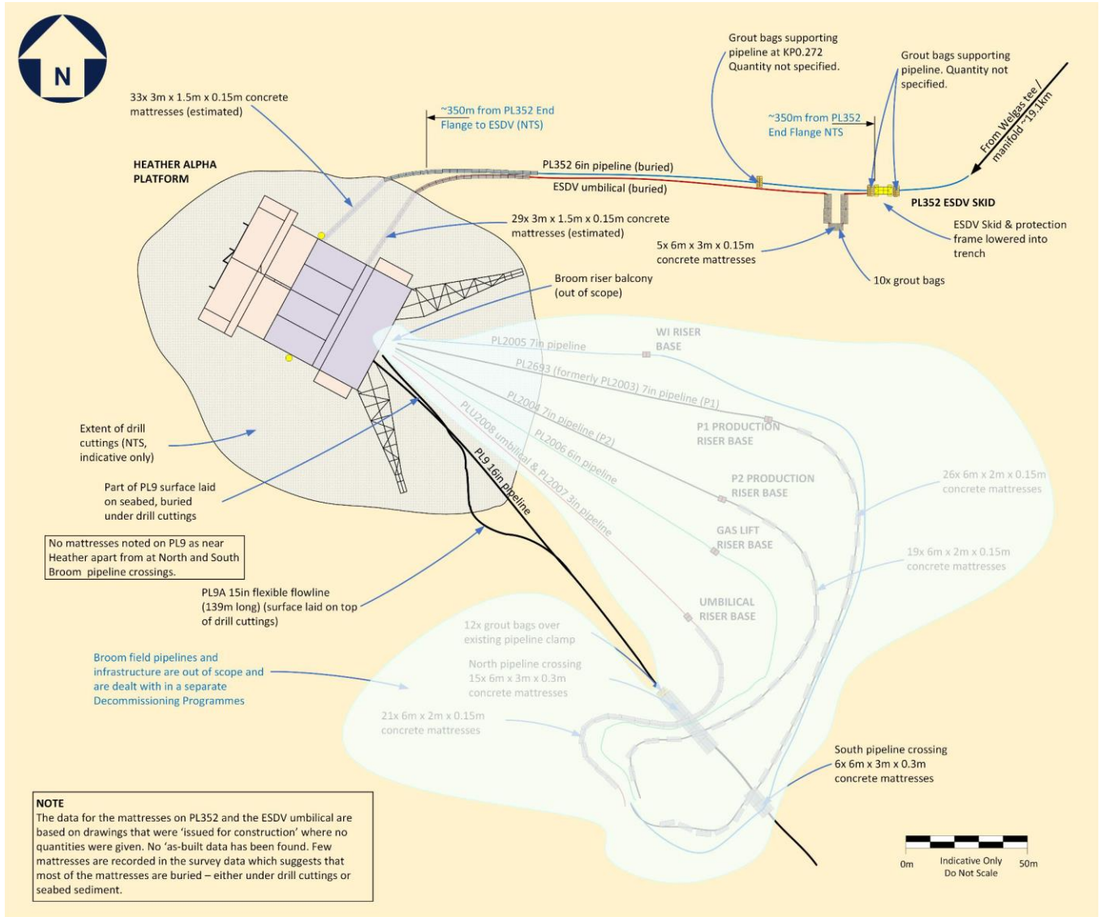


Figure 2.2.1 Heather platform approaches

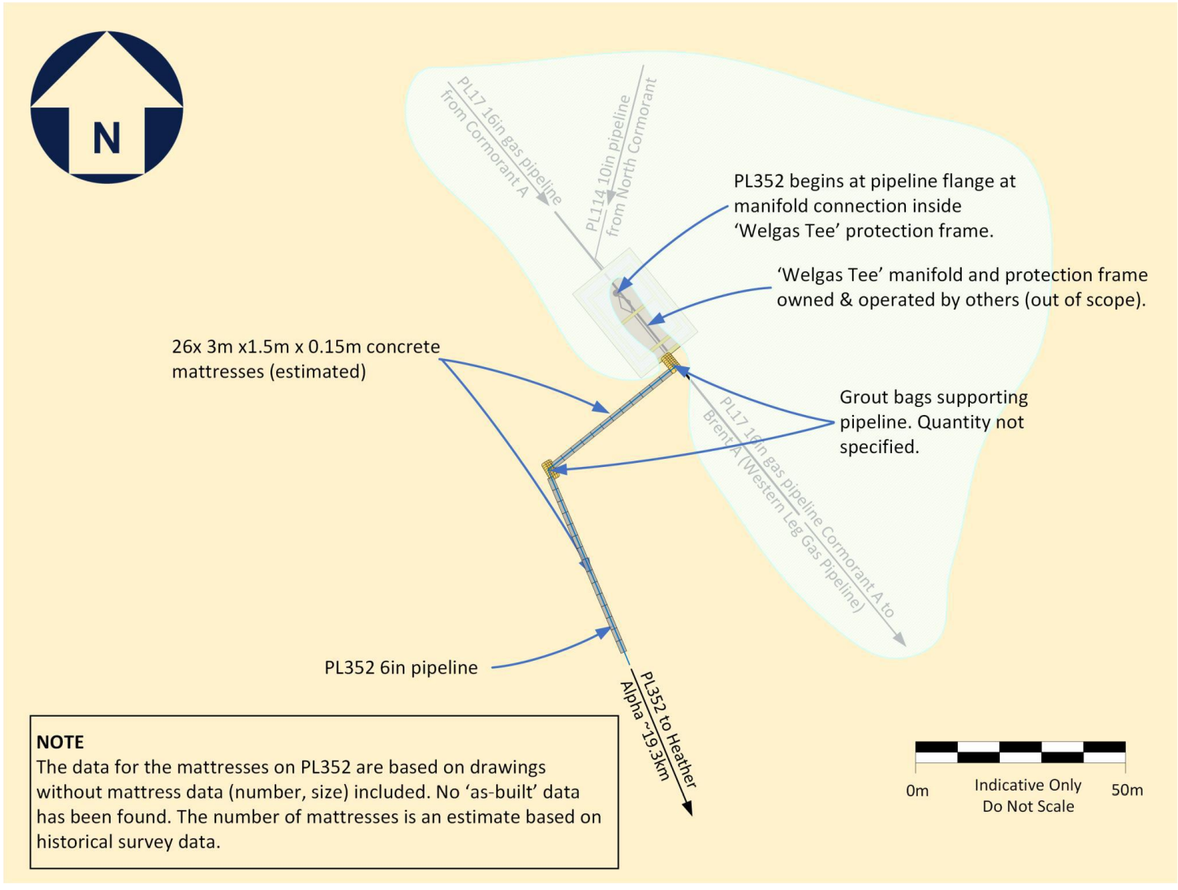


Figure 2.2.2 Welgas tee/manifold approaches

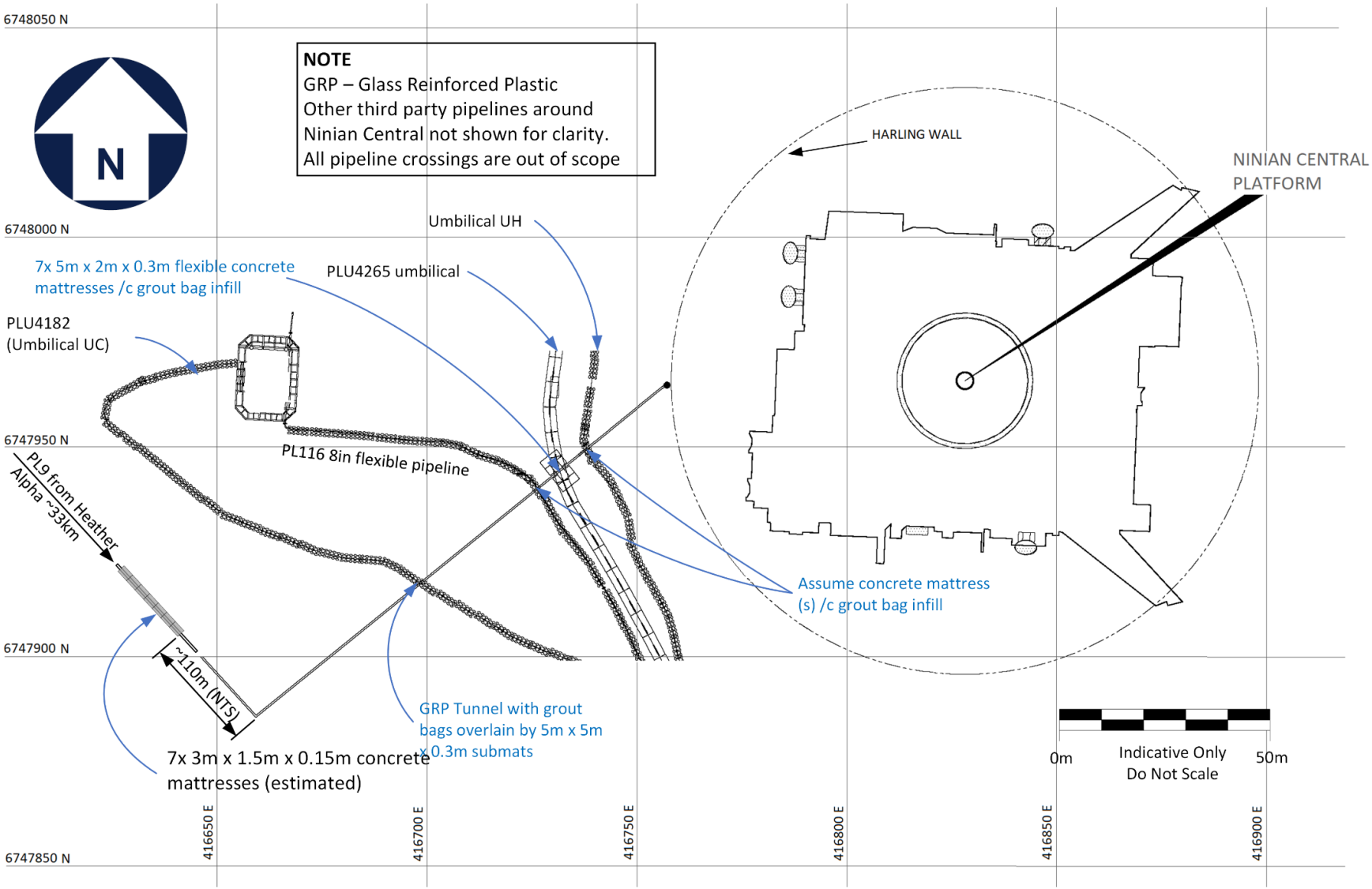


Figure 2.2.3 Ninian Central approaches

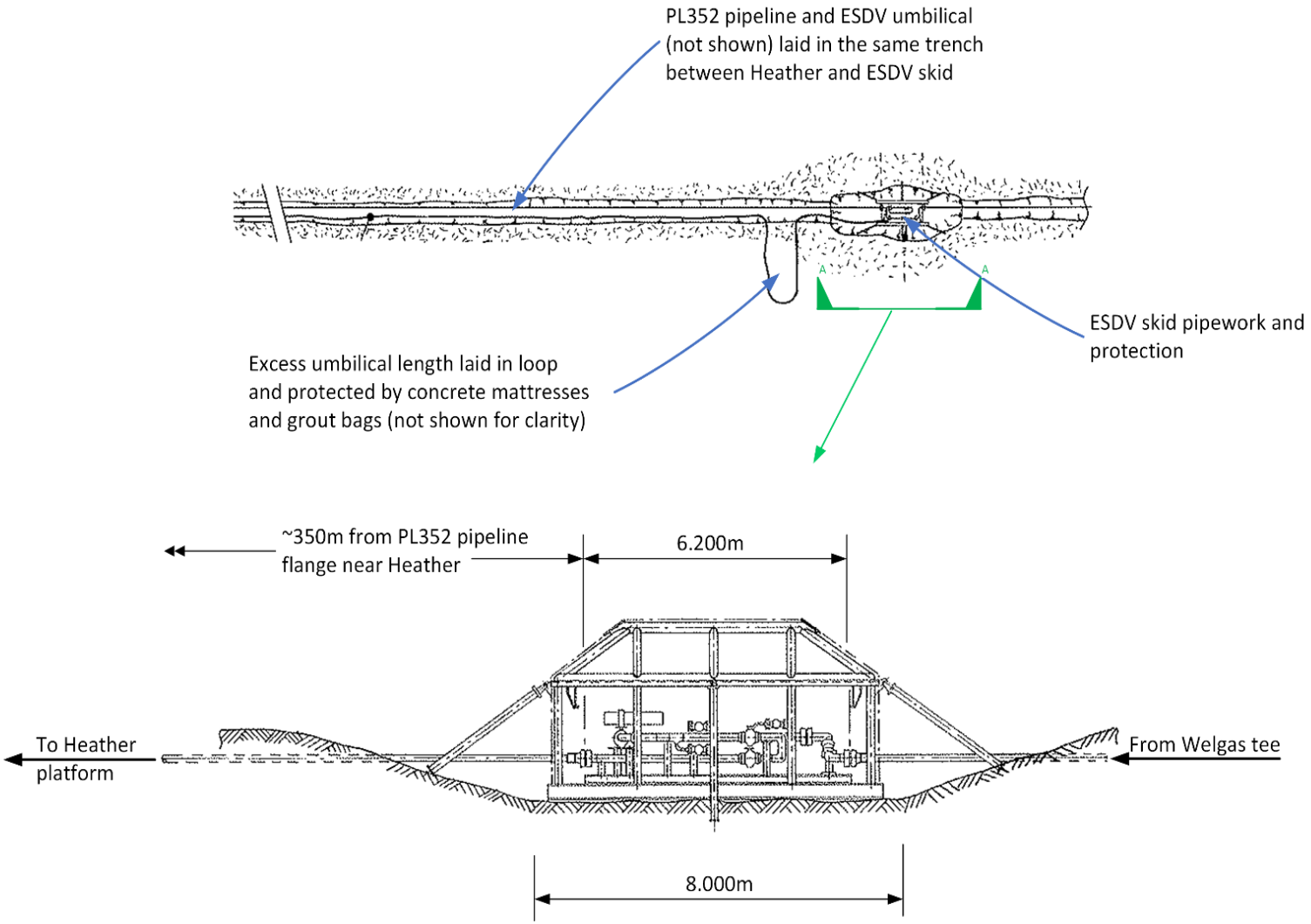


Figure 2.2.4 PL352 & protection frame

2.3 Purpose of the Environmental Appraisal

This EA assesses the potential environmental impacts associated with the proposed Heather infrastructure decommissioning activities. The impact identification and assessment process accounts for stakeholder engagement, comparison of similar decommissioning projects undertaken on 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 proposed mitigation/control measures.

2.4 Regulatory Context

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the UKCS. The responsibility for ensuring compliance with the Petroleum Act 1998 rests with BEIS. The Petroleum 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 the Secretary of State. The DP should outline in detail the infrastructure being decommissioned and the method by which the decommissioning will take place. Well decommissioning is determined under a different process to the Decommissioning Programme, called the Well Operations Notification System ('WONS').

This 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 installations and associated pipelines, umbilicals, cables and protective materials. This EA supports the combined DP submitted to OPRED, the Offshore Decommissioning Regulator under BEIS. The EA has been written considering the BEIS, OPRED 2018 Guidance Notes [4] and the 2018 Decom North Sea EA guidance [17].

In terms of activities in the NNS, the Scottish NMP has been adopted by the Scottish Government to help ensure sustainable development of the marine area and will be considered throughout this EA. This NMP has been developed in line with UK, EU and OSPAR legislation, Directives and Guidance. With regards to decommissioning, the NMP 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'. EnQuest has given due consideration throughout this EA to the NMP during project decision making and the interactions between the project and NMP.

2.5 Environmental Assessment Process

To evaluate the environmental impact of the proposed DP on the environment, The chosen decommissioning option must be supported with an EA. This EA documents the results of the EA process and is used to communicate the process. An overview of the EA process is provided in Figure 2.5.1.The full method can be found in Appendix A.

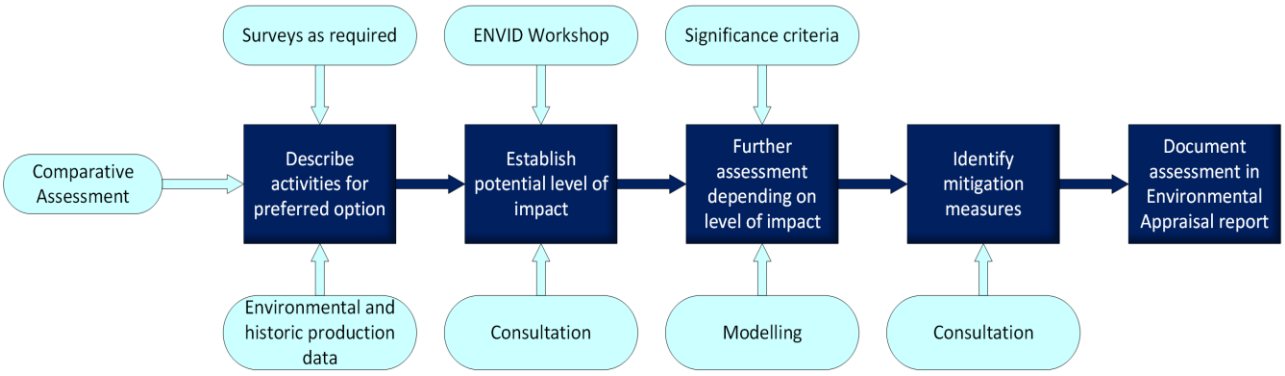


Figure 2.5.1 EA process

2.6 Stakeholder Engagement

Engagement with stakeholders is an important part of the decommissioning process as it enables the issues and concerns of stakeholders to be incorporated into the EA and presented within the DP, where applicable, and acted upon during the subsequent planning and implementation stages of the project.

EnQuest recognise the importance and benefit of early engagement and as a result has regularly engaged with regulatory bodies and stakeholders such as OPRED, BEIS, NSTA and Scottish Fishermen's Federation ('SFF') through quarterly meetings where the initial recommendations from the CA were presented and no significant comments were received. SFF expressed concern over concrete coated pipelines breaking up, presenting a snagging hazard for fishermen. However, SFF stated that formal comments will be provided on receipt of all project documents.

Formal stakeholder consultation will begin with the submission of the draft DP, supported by this EA report, to OPRED. The consultation process, at this stage, will include the use of the EnQuest website to make these documents publicly available.

2.7 EA Scope and Structure

This EA supports the Heather Pipeline DP, which is concerned only with the decommissioning of the Heather pipelines and infrastructure. The EA report sets out to describe, in a proportionate manner, the potential environmental impacts of proposed activities associated with decommissioning of the Heather pipelines and aims to demonstrate the extent to which these impacts can be mitigated and controlled to an acceptable level. This is presented in the following sections, which will cover:

- A project description (Section 3), including:
  - Infrastructure and protection and stabilisation materials (Sections 3.1 and 3.2);
  - The process by which EnQuest has arrived at the selected decommissioning strategy (Section 3.4);
  - Proposed schedule (Section 3.4);
  - A description of the proposed decommissioning activities (Section 3.6); and
  - Waste management (Section 3.5)
- Description of the environment and identification of the key environmental sensitivities which may be impacted by the proposed decommissioning activities (Section 4);

- A review of potential impacts from the proposed decommissioning activities and justification for the assessments that support this EA (Section 5);
- Assessment of the key environmental impacts (Section 6); and
- Conclusions (Section 7).

The following key elements are also included in the EA:

- EA Method (Appendix A); and
- Environmental Risk Identification ('ENVID') results summary (Appendix B).

This EA report has been prepared in line with EnQuest's environmental assessment requirements and has given due consideration to the Regulatory Guidance [59] and to Decom North Sea's Environmental Appraisal Guidelines [18].

3. PROJECT SCOPE

This section outlines the infrastructure being decommissioned as part of the Heather pipeline project (covered by this EA) and describes the manner in which the assets will be removed and/or be decommissioned *in situ*.

3.1 Pipelines, Umbilicals and Cables

Table 3.1.1 Pipeline information

Description	Pipeline Number (as per PWA)	Diameter (NB) (inches)[1]	Length (km)	Description of Component Parts	Product Conveyed	From – To (End Points)[2]	Burial Status	Pipeline Status	Current Content
Oil export pipeline	PL9	16	33.176	Steel pipeline, coated with 5 mm coal tar epoxy and 25 mm concrete weight coating	Oil, condensate	Heather A platform to NCP.	Trenched with 14 km of exposures (2021 survey data)	Shut-in	As product conveyed
Oil export pipeline replacement section	PL9A	466 mm	0.139	15in HDPE flexible pipe (replaces 121.8 m long section of PL9)	Oil, condensate	Between upstream and downstream Morgrip connectors near the Heather A platform.	Part suspended in water column; part laid on seabed (drill cuttings)	Shut-in	As product conveyed
Gas import pipeline	PL352	6	19.394	Steel pipeline with FBE coating (end sections have asphalt enamel and concrete weight coating)	Gas	Welgas tee on the WLGP to Heather A platform.	Trenched and buried	Shut-in	As product conveyed
ESDV umbilical	TBA	81 mm	0.570	Steel armoured electrohydraulic umbilical	Power, signals, hydraulics	Heather A platform to ESDV skid.	Trenched and buried	Shut-in	As product conveyed

					and injection chemicals				

Notes:
1. If diameter is expressed in mm it refers to outside diameter of umbilical or flexible flowline;
2. For brevity, the description of the end-to-end points may differ slightly from those consented in the Pipeline Works Authorisation ('PWA') ;
3. The length of PL9A includes the length of two Morgrip connectors (each 1.5 m long) at each end of the pipeline;
4. Reference PWA PL9 (PWA dated 23 Sept 1980), PL9 & PL9A (13/V/04), PL352 (PWA dated 27 Aug 1985. A pipeline number for the umbilical will be applied for in due course.

3.2 Pipeline Protection and Stabilisation

Table 3.2.1 Pipeline protection & stabilisation features

Stabilisation Feature	Total Number	Total Mass (Te)	Location	Exposed/Buried/Condition
Heather Pipeline (PL9 at Heather)				
n/a	n/a	n/a	n/a	n/a
Heather Pipeline PL9 (Infield)				
Sand & cement bags (25 kg)	2,590	64.8	Used to remediate pipeline spans at various locations along the pipeline. Most are outside of the Heather and Ninian Central 500 m safety zone.	Most will be underneath or next to the pipeline. Burial status will be determined when decommissioning activities are being carried out.
Deposited rock	1,032m	4,863	At various locations along PL9 outside of Heather and Ninian Central 500 m safety zones.	Assume exposed, resting on the seabed.
Heather Pipeline (PL9 at Ninian Central)				

Concrete mattresses 3m x 1.5m x 0.15m	7	6.6	PL352 on approach to Ninian Central.	Expected to be exposed. Burial status will be determined when decommissioning activities are being carried out.
Heather Pipeline (PL352 at Heather)				
Concrete mattresses 3m x 1.5m x 0.15m; 6 x 3m x 0.3m	41	103.9	PL352 on approach to Heather.	At least 12x expected to be buried under drill cuttings. 8x used to rectify a pipeline span between at KP0.434 and KP0.452. Leave these *in situ*. but remove 21x mattresses expected to be exposed. Burial status of the mattresses will be determined when decommissioning activities are being carried out.
Sand & cement bags (25 kg)	574	14.4	PL352 on approach to Heather.	Of these 250x (estimate) used to remediate 6x spans at various locations, 24x used to remediate span at KP0.447 and 300x (estimate) used to support pipeline at ESDV protection frame. Burial status will be determined when decommissioning activities are being carried out.
Heather Pipeline (PL352 at Welgas Tee)				
Concrete mattresses 3m x 1.5m x 0.15m	26	24.5	PL352 on approach to Welgas tee.	Expected to be exposed. Burial status will be determined when decommissioning activities are being carried out.
Sand & cement bags (25 kg)	100	2.5	PL352 on approach to Welgas tee.	Expected to be exposed. Burial status will be determined when decommissioning activities are being carried out.

Heather Pipeline (ESDV Umbilical)				
Concrete mattresses 3m x 1.5m x 0.15m	33	50.9	ESDV umbilical on approach to Heather.	At least 12x expected to be buried under drill cuttings. 5x used to protect and stabilise the ESDV umbilical loop near the ESDV protection frame. Burial status will be determined when decommissioning activities are being carried out.
Sand & cement bags (25 kg)	10	0.3	ESDV umbilical loop on approach to Heather.	Burial status will be determined when decommissioning activities are being carried out.

Note:

1. The number of sand & cement bags is not always specified within the 'as-built' data or subsequent Inspection, Repair and Maintenance ('IRM') data. The numbers quoted here are based on engineering judgement but will need to be confirmed during decommissioning activities.

Table 3.2.2 Protection structure information

Pipeline structure incl. stabilisation features	Number	Mass (Te) / Size (m)	Location: WGS84 Decimal	Location: WGS84 Decimal Minute	Comments/status
PL352 ESDV & protection structure	1	24	60.955857° N	60°57.3514' N	Not piled; lowered into pipeline trench.
		7.7 x 4.2 x 3.7	0.942545° E	00°56.5527' E	

Note:

1. There are no protection and stabilisation features associated with the PL352 ESDV protection structure itself, but the protection and stabilisation features associated with PL352 and the ESDV umbilical are listed in above.

Table 3.2.3 Heather pipeline crossing information (PL9 only)		
Pipeline, umbilical or cable description	**Location**	**Protection**
Heather 500 m Zone		
North crossing (PLU2008/PL2007, PL2006, PL2004) over PL9; all associated with the Broom field.	Heather 500m zone.	15x 6m x 3m x 0.3m concrete mattresses
South crossing (PL2693 (formerly PL2003), PL2005) over PL9; all associated with the Broom field.	Heather 500m zone.	6x 6m x 3m x 0.3m concrete mattresses
Outside 500 m Zones		
PL1526 crossing over PL352	397010.008E 6764509.652N	Concrete mattresses, deposited rock
PL2473 (12in Production) & PL9 Crossing (Lyell B to Ninian South)	408588.379E 6749884.903N	Concrete mattresses, deposited rock
PL900 Chemical Injection umbilical (Ninian South to Lyell B)	409864.311E 6749819.834N	Concrete mattresses, deposited rock
PL869A/PL871A & PL9 Crossing (Lyell 10in/3in Pipeline)	409864.311E 6749819.834N	Concrete mattresses, deposited rock
PL864A & PL9 Crossing (Lyell 12" Water Injection Pipeline)	409864.311E 6749819.834N	Concrete mattresses, deposited rock
PL866A & PL9 Crossing (Lyell 8" Test Pipeline)	409864.311E 6749819.834N	Concrete mattresses, deposited rock
Ninian Central Platform 500m Zone		
PLU4182 (umbilical UC) & PL9	416680.510E 6747818.615N	
PL116 & PL9	416709.010E 6747840.410N	
PLU4265 & PL9	416713.510E 6747844.210N	
Umbilical UH & PL9	416720.510E 6747849.710N	
Notes: 1. For location, please refer Figure 2.1.2; the Universal Transverse Mercator ('UTM') Eastings and Northings are indicative only. 2. All of these crossings are third-party crossings are outside of the scope of this DP.		

3.3 Decision-making Approach

The latest BEIS, OPRED Guidance Notes (2018) states that subsea installations (e.g. drilling templates, wellheads and their protective structures, production manifolds and risers) must, where practicable, be completely removed for re-use or recycling or final disposal on land [4]. Any piles used to secure such structures in place should be cut below natural seabed level at such a depth to ensure that any remains are unlikely to become uncovered. Should an Operator wish to make an application to leave a subsea infrastructure in place because of the difficulty of removing it, justification in terms of the environmental, technical or safety reasons are required. With regards to pipelines (including flowlines and umbilicals), these are 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 can be decommissioned *in situ*. For example, pipelines that are adequately buried or trenched or which are expected to self-bury. Where an Operator is considering decommissioning pipelines *in situ*, the decision-making process must be informed by CA of the feasible decommissioning options. This CA takes account of safety, environmental, technical, societal and economic factors to arrive at a preferred decommissioning solution.

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

3.3.1 Alternatives to Decommissioning

Options for re-use and alternate use were considered at the option screening stage in the decommissioning planning for the pipelines. Under the current proposed schedule, the Heather infrastructure, at the time of removal, will be approaching 50 years of service. It was concluded that re-use of the Heather pipelines would not be a realistic option for a number of reasons:

- Significantly past original design life;
- Structural integrity concerns;
- High operating and maintenance costs, future reliability and likely obsolescence of equipment and uncertainty around future levels of support from original equipment manufacturers;
- Unlikely to meet current design and certification standards, for example wooden accommodation and helideck;
- Suitability of infrastructure for new location, for example, water depth, environmental conditions fatigue life, etc;
- Scope, schedule, and cost of refurbishment; and
- Relative economics of re-use against new build.

No opportunities have been identified for the continued use of the Heather pipelines for the export of oil or gas. All other possible non-oil and gas uses for the infrastructure, at its present location or at another site, would be technically infeasible and/or economically unviable.

3.4 Comparative Assessment

PL9, PL352 and the ESDV umbilical were subject to a CA [26]. The approach to a CA is largely qualitative and carried out at a level that is sufficient to differentiate between the options. The 'complete removal', 'partial removal' and 'leave *in situ*' decommissioning options were compared.

In line with the guidance, EnQuest has committed to fully removing all surface laid pipeline sections within both the Heather and Ninian Central 500m zone. The pipelines within and associated with the Heather area have been considered within a CA in order to arrive at an optimal decommissioning method. The CA methodology is described fully within the CA for pipelines.

A summary of the infrastructure for which a CA of options was made and the selected option (based on consideration of safety, environmental, technical, societal and economic factors) is given in Table 3.4.1, Table 3.4.2 and Table 3.4.3. The CA used a non-weighted process to eliminate any subjectivity. Actual environmental data was considered when comparing options including seabed disturbance, habitat loss and underwater noise in line with the conservation objectives and sensitivities of protected sites in the vicinity.

Table 3.4.1 Selected decommissioning option (Pipelines & Umbilical)

Pipeline or group	Recommended option	Justification
Risers		
PL9, PL352 & ESDV umbilical	Sections of the risers connected to the lower jacket will be addressed in the Decommissioning Programme for the lower jacket. **PL9** - remove upper riser, severing it at a height between 75 and 85 m below LAT with the lower part remaining *in situ* until the fate of the jacket footings has been determined. **PL352** - remove upper riser, severing it at a height between 75 and 85 m below LAT with the lower part remaining *in situ* until the fate of the jacket footings has been determined. **ESDV umbilical** - remove the umbilical, severing it at a height between 75 and 85 m below LAT with the lower part remaining *in situ* until the fate of the jacket footings has been determined.	
Pipelines		
PL9	Leave most of the pipeline *in situ* with remedial work to pipeline spans (Refer to Appendix E). Leave *in situ* the sections of pipelines near the Heather platform that are buried under drill cuttings or under seabed sediment. Remove the surface laid sections near the Heather and Ninian Central platforms including those currently protected and stabilised with concrete mattresses, but otherwise leave *in situ*.	No change to the current situation. This results in minimal disturbance to the seabed, lower energy use, reduced risk to personnel, and lower cost. Taking this approach reduces environmental impact on the seabed and need for extensive pipeline remedial works in the short-term and accounts for the pipeline becoming more extensively buried in future from

	The remedial works will involve the deposition of rock on the spans for a length of ~1.8 km based on 2018 survey data). Exposures will be left where they are found and monitored. Thereafter, the pipeline burial status should continue to be monitored using a Risk Based Inspection regime to a frequency and timescale agreed with OPRED.	the natural migration of the seabed.
PL9A	Leave the section connected to the PL9 riser on the lower jacket *in situ* until the fate of the jacket footings has been decided. Leave *in situ* any part that is buried in the drill cuttings. Completely remove short section of the pipeline that is not buried in the drill cuttings.	This results in minimal disturbance to the seabed, lower energy use, reduced risk to personnel, and lower cost.
PL352	Leave most of the pipeline *in situ*. Remove the surface laid sections near the Heather platform and the Wellgas tee including those currently protected and stabilised with concrete mattresses, but otherwise leave *in situ*. Leave *in situ* those sections of pipelines (along with the associated protection and stabilisation features) near the Heather platform that are buried under drill cuttings. Subject to survey, leave PL352 *in situ* without remediation. This on the basis that the number and extent of exposure and spans will have reduced since 2018 and the pipeline will become buried.	No change to the current situation. This results in minimal disturbance to the seabed, lower energy use, reduced risk to personnel, and lower cost. Once decommissioned, the pipeline will continue to be monitored for a period of time to be agreed with OPRED.
ESDV umbilical	Leave most of the umbilical *in situ*. Remove the surface laid sections near the Heather platform and adjacent to the ESDV protection frame including those currently protected and stabilised with concrete mattresses, but otherwise leave *in situ*. Leave *in situ* those sections of umbilical (along with the associated protection and stabilisation features) near the Heather platform that are buried under drill cuttings. Subject to survey, leave the ESDV umbilical *in situ* without remediation. This on the basis that the number and extent of exposure and spans will have reduced since 2018 and the umbilical will become buried.	No change to the current situation. This results in minimal disturbance to the seabed, lower energy use, reduced risk to personnel, and lower cost. Once decommissioned, the umbilical will continue to be monitored for a period of time to be agreed with OPRED.
Note: 1. Where the pipelines have been cut, for example where they enter the seabed, remedial work may be required to bury the end of the pipeline. As a contingency measure, small deposits of rock up to 25 Te may need to be used to make sure that the pipeline ends remain buried.		

Table 3.4.2 Selected decommissioning option			
Asset description	**Number/length**	**Description**	**Disposal route (if applicable)**
PL9 at Heather			
n/a	n/a	n/a	n/a
PL9 Infield between Heather & Ninian Central			
Sand & cement bags (25 kg)	2,590	Used to remediate PL9 pipeline spans at ~KP28.9 (Refer to Appendix E)	Refer note 1.
Deposited rock	1,032 m	Refer to Table 3.2.1	Leave *in situ*.
PL9 at Ninian Central			
Concrete mattresses 3mx 1.5m x 0.15m	7	Refer to Table 3.2.1	Recover all exposed (estimate: 7x) concrete mattresses. Leave balance of concrete mattresses (estimate: 8x) used for remediation of spans *in situ*. Also refer note 2.
PL352 at Heather			
Concrete mattresses 3mx 1.5m x 0.15m	41	Refer to Table 3.2.1	Leave concrete mattresses buried (estimate: 12x) under drill cuttings *in situ*. Leave concrete mattresses (estimate: 8x) used for remediation of spans *in situ*. Recover all exposed (estimate: 21x) concrete mattresses. Also refer note 2.
Sand & cement bags (25 kg)	574	Refer Table 3.2.1 & Figure 2.2.1	Completely remove the sand and cement bags used to support PL352 (estimate: 300x) at the ESDV protection structure. Leave sand & cement bags (estimate: 274x) used for remediation of spans *in situ*.
Heather Pipeline & Cable Mattresses & Sand and Cement Bags (PL352 at Welgas Tee)			
Concrete Mattresses	26	Refer Table 3.2.1 & Figure 2.1.2	Recover all exposed concrete mattresses (estimate: 26x).
Sand & cement bags (25 kg)	100	Refer Table 3.2.1 & Figure 2.1.2	Recover all exposed sand & cement bags (estimate: 50x)

			to shore for reuse, recycling, and disposal. Also refer note 1.
Heather Pipeline & Cable Mattresses & Sand and Cement Bags (ESDV Umbilical)			
Concrete Mattresses	33	Refer Table 3.2.1 & Figure 2.2.1	Recover all exposed (estimate: 21x) concrete mattresses. Leave concrete mattresses buried (estimate: 12x) under drill cuttings *in situ*.
Sand & Cement bags (25 kg)	10	Refer Table 3.2.1 & Figure 2.2.1	Recover all exposed sand & cement bags (estimate: 10x). Also refer note 1.

Notes:

1. The number of sand and cement bags is not specified within the 'as-built' data or Inspection, Repair and Maintenance ('IRM') data and is therefore indicative only except where noted on the schematics. Aim to recover all exposed sand & cement bags to shore for recycling & disposal except for where they were used for remediation of pipeline spans where they will be left *in situ* and buried under deposited rock used to remediate pipeline spans under these decommissioning proposals.
2. Propose to leave mattresses used to remediate spans *in situ* and buried under deposited rock used to remediate pipeline spans under these decommissioning proposals.
3. All materials that are removed will be returned to shore to reuse, recycling or disposal to landfill as appropriate.

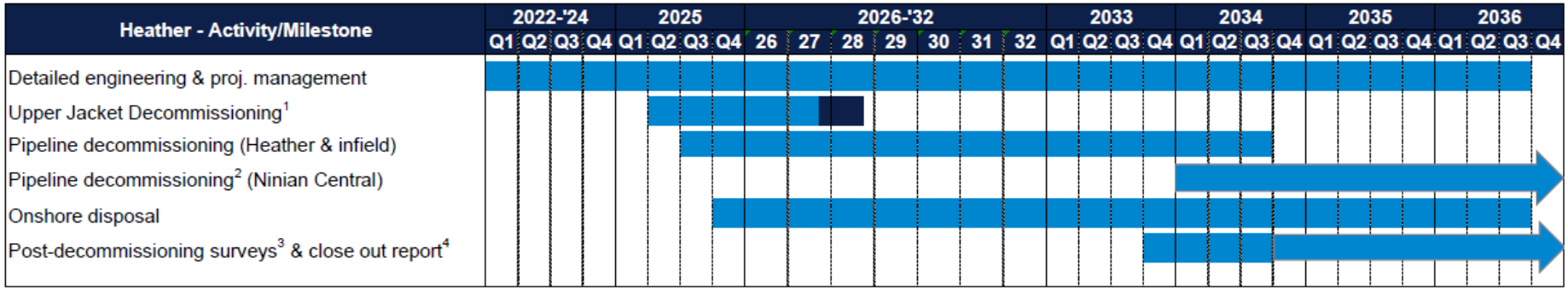
Table 3.4.3 Selected decommissioning option (Protection structures)

Subsea structures and stabilisation features	Number	Option	Disposal Route (if applicable)
ESDV protection frame	1	Complete removal	Return to shore for reuse or recycling

3.5 Proposed Schedule

The proposed schedule for the decommissioning of the Heather pipelines can be seen below in Figure 3.5.1.

The activities are subject to the acceptance of the DP and any unavoidable constraints (e.g., vessel availability) that may be encountered while executing the decommissioning activities. Therefore, activity schedule windows have been included to account for this uncertainty. The commencement of offshore decommissioning activities will depend on commercial agreements and commitments. EnQuest will examine the possibility of including the offshore work in a wider campaign of subsea works to reduce costs.



Notes / Key

Activity window extended as per NSTA strategy which aspires to combine multiple scopes in a single campaign;

Activity window to allow commercial flexibility associated with well decommissioning and decommissioning activities;

1. Jacket & topsides' decommissioning subject to separate Decommissioning Programmes. The topsides' Decommissioning Programme was approved 22 July 2021;
2. Decommissioning activities at Ninian Central cannot be completed until the pipeline and umbilicals crossing over PL9 are out of use; decommissioning at Ninian Central will be carried out a later date in discussion and agreement with the respective operator;
3. Post decommissioning surveys to follow completion of decommissioning activities;
4. Close out report within 1 year of completion of offshore activities.

Figure 3.5.1 Proposed project schedule

3.6 Decommissioning Activities

This section outlines the proposed decommissioning activities for the Heather infrastructure. The activities described within include activities that are out with the scope of this EA, however they are included within this section to provide an overview of all decommissioning activities.

3.6.1 Preparation for Decommissioning

3.6.1.1 Well Decommissioning

Well decommissioning is not within the scope of this EA. It has been, or will be, assessed as part of well intervention and marine licence applications. A description is included herewith to describe the activities leading up to the point that the decommissioning activities that are assessed here begin.

All wells decommissioning activities will be subject to permitting application via the Portal Environmental Tracking System ('PETS') and decommissioned to current industry standard. Each well will be systematically and permanently closed in accordance with well decommissioning best practice. Well decommissioning is determined under a different process to the Decommissioning Programme, called WONS.

3.6.1.2 Flushing and Cleaning Operations

Flushing and cleaning operations are not within the scope of this EA as they have been assessed as part of the ongoing operations of the facilities and are subject to permitting application via the PETS. A description is included herewith to describe the activities which have occurred leading up to the point that the decommissioning activities begin.

EnQuest will flush all the infield production pipelines with seawater, followed by plugs of gel or foam called 'pigs' propelled through the lines. This activity is designed to remove mobile hydrocarbons and achieve an agreed acceptable level of cleanliness, back to the topsides. These fluids will be subject to the PETS permitting system and if required, will be skipped and shipped back to shore. Chemical injection lines will be subjected to a turbulent seawater flush to displace all contents.

Following isolation from the wells, gas (nitrogen) will be passed through the platform processing systems to ensure that minimal hydrocarbons remained in the system prior to the final cleaning and disconnect. During the final cleaning and disconnect activities, all the processing systems on the platform will be progressively depressurised, purged with gas (nitrogen) and rendered safe for removal operations. All bulk chemicals surplus to requirement will be backloaded onshore for disposal. The pipework and tanks will be visually inspected where possible and may be further treated should any sources of potential spills of oils and other fluids be identified.

3.6.2 Subsea Infrastructure Decommissioning

3.6.2.1 Overview

A subsea contractor will mobilise vessels with a range of crane capabilities for lifting objects of different sizes and weights off the seabed, vessels that can support underwater operations including Remotely Operated Vehicle ('ROV') deployment, diving, cutting, excavation and placement of rock, survey vessels and guard vessels. The vessels will deploy ROVs (or divers when necessary) to cut both the risers and pipelines. The vessels' cranes will lift the subsea structures to the vessel and/or a barge.

3.6.2.2 Pipelines, Umbilicals and Cables

There are several 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; or
- Cut surface laid sections into discrete lengths and recover multiple sections using subsea baskets to lift the sections onto vessels.

The cutting equipment used to cut the pipeline ends, the pipeline and the umbilicals will typically be either a diamond wire saw ('DWS') 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.

3.6.2.3 Removal of Protection and Support Material

As per the OPRED guidance, the base case for mattresses is full removal, with the exception of any protection structures associated with crossing points and any third-party infrastructure. EnQuest plan to fully recover any exposed sand and cement bags and concrete mattresses. Any mattresses or sand and cement bags used to remediate spans or buried under deposited rock will be decommissioned *in situ*. If any mattresses are found to have insufficient integrity to be removed, then EnQuest will engage with the Regulator regarding decommissioning these mattresses *in situ*. The ESDV protection frame will be completely removed and returned to shore for reuse or recycling.

There are approximately 107 mattresses, 3,274 sand and cement bags and one ESDV protection frame supporting pipeline infrastructure within the Heather decommissioning area. The number of sand and cement bags is not specified within the 'as-built' data or IRM data and is therefore only indicative, except where noted on the schematics. The burial status of the concrete mattresses and pipeline protection covers will be determined when decommissioning activities are being carried out, however, it is currently proposed that approximately 75 mattresses and 360 sand and cement bags will be removed where it is practicable to do so. In the event of any difficulties, EnQuest will have contingency measures in place within the work programme to accommodate for the removal of degrading protection and support material. Should any material be unrecoverable, OPRED will be consulted. Those remaining *in situ* are either used in order to remediate spans or are buried under drill cuttings.

3.6.3 Post-decommissioning Surveys

Following the decommissioning of the Heather 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 [4].

A post-decommissioning survey regime will be discussed and agreed 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 SSS and ROV surveys. Any oil field debris identified shall be recovered and recycled or disposed of accordingly.

3.7 Waste Management

The management of waste during decommissioning is a highly regulated activity, which potentially requires compliance with both national and international legislation, depending on the destinations identified for dismantling and treating any wastes generated.

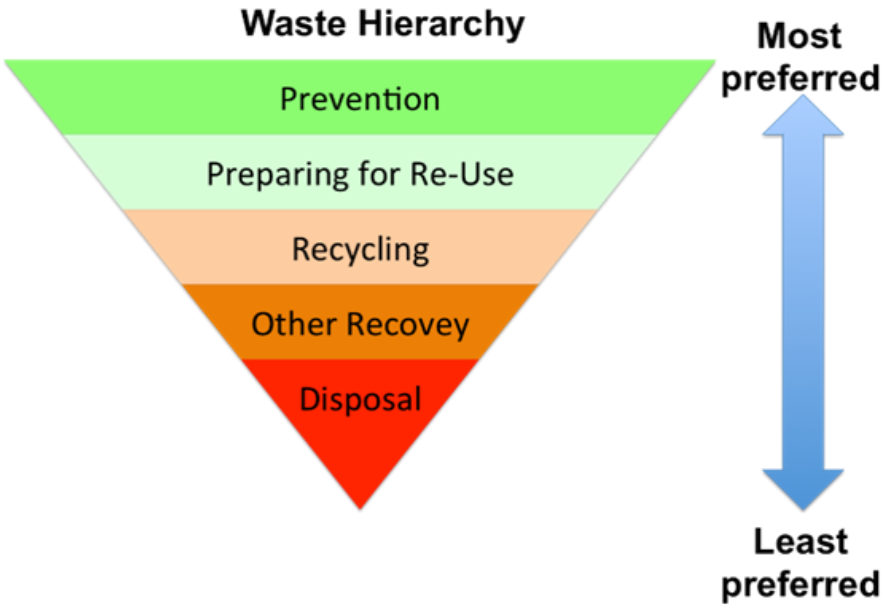


Figure 3.7.1 Waste hierarchy

Decommissioning the Heather pipelines will generate a quantity of waste. EnQuest is committed to establishing and maintaining environmentally acceptable methods for managing wastes in line with the Waste Framework Directive and principles of the Waste Hierarchy (Figure 3.7.1).

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 and concrete will be recycled. It is expected that more than 95% of material will be recycled, and the remaining material will be sent for disposal.

There may be instances where infrastructure returned to shore is contaminated (marine growth, hydrocarbons, paints etc) and cannot be recycled, but the weight / volume of such material is not expected to result in substantial landfill use.

Table 3.7.1 summarises the various waste management processes for different waste streams that EnQuest will follow.

Table 3.7.1 Waste stream management process

Waste Stream	Removal and disposal method
Bulk liquids	It unlikely that any bulk liquids will be present in the sections of infrastructure that is being recovered to shore, however, should any be found, these will be dealt with and disposed of in accordance with guidelines and company policies. Further cleaning and decontamination of materials recovered to shore will take place onshore prior to recycling / re-use or disposal.
Marine growth	Where necessary and practicable to allow access, some marine growth will be removed offshore. The remainder will be brought to shore and disposed of according

Table 3.7.1 Waste stream management process	
Waste Stream	**Removal and disposal method**
	to guidelines and company policies.
Naturally Occurring Radioactive Material ('NORM')	Tests for NORM will be undertaken offshore and any NORM encountered will be dealt with and disposed of in accordance with guidelines and company policies.
Asbestos	It unlikely that asbestos will be present in the sections of infrastructure that is being recovered to shore. However, should any such material be found it will be dealt with and disposed of in accordance with guidelines and company policies.
Other hazardous wastes	Hazardous wastes will be recovered to shore and disposed of according to guidelines and company policies and will also take place under appropriate permits.
Onshore dismantling sites	Appropriately licensed sites will be selected for dealing with materials recovered to shore. The dismantling site must demonstrate proven disposal track record and waste stream management throughout the deconstruction process and demonstrate their ability to deliver re-use and recycling options.

Table 3.7.2 and Table 3.7.3 provide a summary of the quantities of materials that will be recovered and/or decommissioned *in situ* for the chosen CA option for decommissioning of the Heather pipelines and the breakdown for material type. While Figure 3.7.1 depicts the total percentage breakdown of the Heather pipeline materials (excluding deposited rock).

Table 3.7.2 Material weights removed to shore and decommissioned *in situ*			
Inventory	**Total inventory (Te)**	**Planned tonnage to shore (Te)**	**Planned left *in situ***
Heather Pipelines (incl. stabilisation features)	12,089	183	11,906
Deposited rock	4,863	0	4,863

Table 3.7.3 Material inventory of the Heather Pipelines			
Material type	**Mass of material (Te)**	**Planned tonnage to shore (Te)**	**Decommissioned *in situ* (Te)**
Steel	7,019.9	54.1	6,965.80
Plastic/Rubber	275.1	12.8	262.3
Non-Ferrous	209.9	1.2	208.7
Grout/Sand	4,582.3	115.2	4,467.10
Hazardous	1.3	0	1.3
Non-Hazardous	0	0	0
Deposited Rock	4,863	0	4,863
Total	**16,651.5**	**183.3**	**16,768.3**

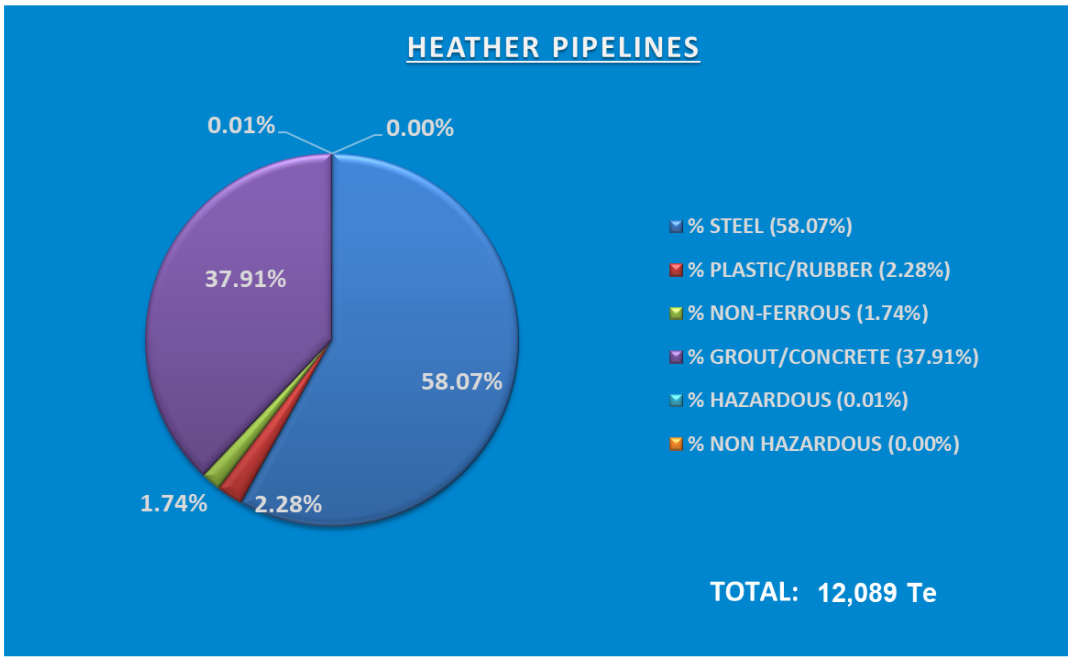


Figure 3.7.1 Pie-chart of estimated material inventory (excluding deposited rock)

3.8 Approach to the Environmental Management

EnQuest implements and operates an integrated Health, Safety, Environment and Assurance ('HSE&A') management system which was audited in 2022 and was granted verification as meeting the requirements of an Environmental Management System ('EMS') in relation to OSPAR Recommendation 2003/5.

The HSE&A Policy and Principles is an integral part of the overall management system. It is laid down in policies, procedures, standards and work instructions. Its general purpose is to prevent EnQuest activities from putting people, the environment, property or the reputation of the company at risk. EnQuest's HSE&A Policy and Principles is shown in Appendix D.

4. ENVIRONMENTAL AND SOCIETAL BASELINE

4.1 Summary of Environmental Surveys

A number of recent environmental surveys have been undertaken within the Heather Field. These surveys have been used to describe the seabed environment for the Heather Field and are listed in Table 4.1.1. The locations of the environmental stations and sample points from these surveys are presented in Figure 4.1.1.

Table 4.1.1 Environmental survey data used to describe the Heather pipeline field

Survey Report	Description
Heather Field	
Environmental Baseline Report	Between August and October 2020, Benthic Solutions (on behalf of EnQuest), conducted a range of pre-decommissioning surveys around the Heather platform, including an Environmental Baseline Survey ('EBS'), Habitat Assessment and Cuttings Pile Survey [6][7]. Day grab samples (0.1 m^2) and camera transects of approximately 100 m in length were completed at 28 stations. Prior to sampling operations SSS and MBES (multibeam echo sounder) data were collected around the Heather platform in a 1 x 1 km grid, and at sampling locations at 2 km and 10 km north, south, east, and west of the platform. The cuttings pile assessment was carried out across 14 stations.
Habitat Assessment Report	

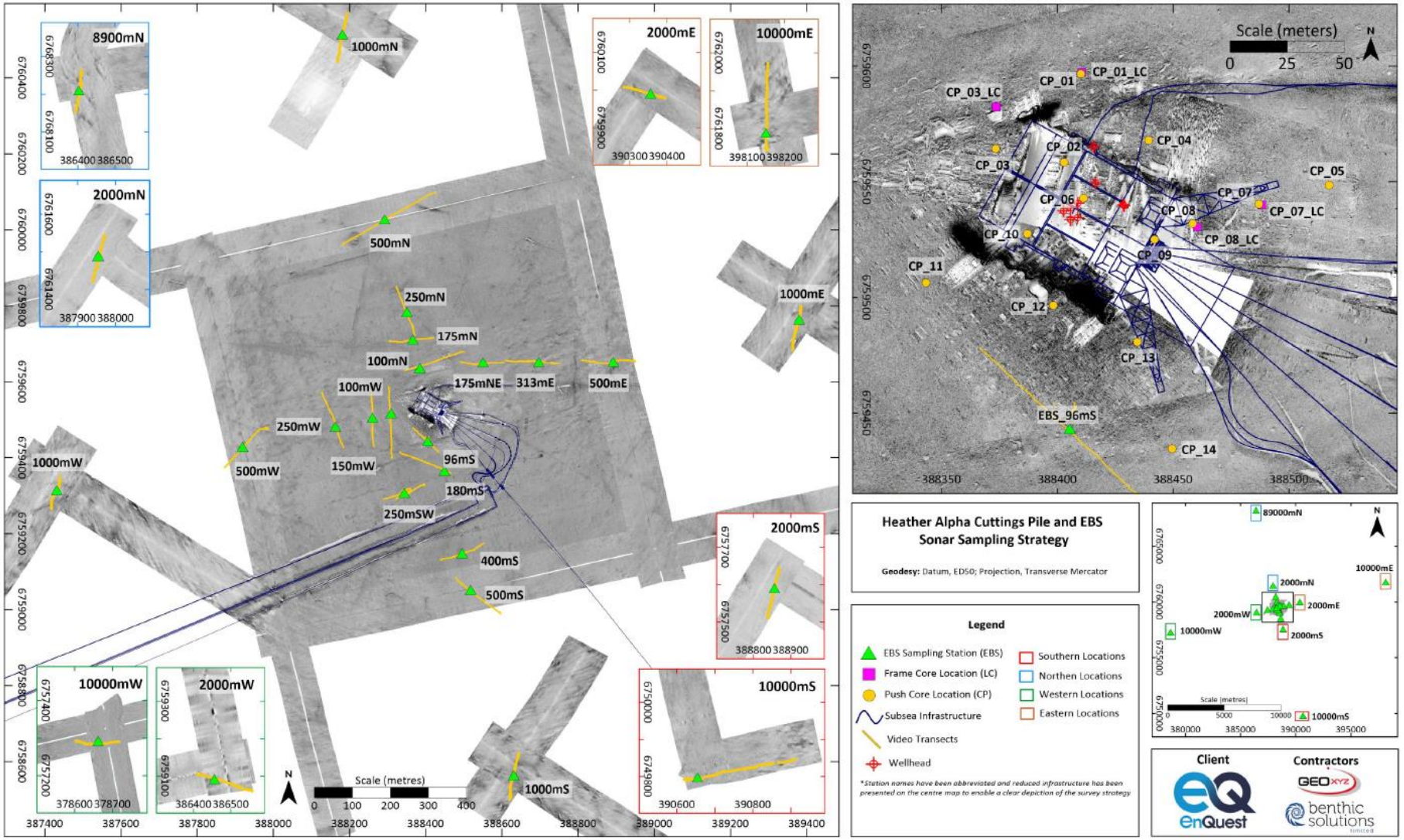


Figure 4.1.1 Environmental survey stations around the Heather installation decommissioning area

4.2 Summary of Receptors

The baseline environmental and societal receptors in the Heather pipeline decommissioning area (here after referred to as the "project area") are summarised in Table 4.2.1 and Table 4.2.2, respectively. For most receptors, the information provided below is considered sufficient to inform the environmental assessment of potential impacts of the DP. Receptors of potential concern identified during the ENVID (see Appendix B) are presented in more detail in Sections 4.3 to 4.6.

Table 4.2.1 Key environmental receptors for the project area

Environmental receptor	Description
Physical environment	
Weather and sea conditions	The mean residual current through the project area is approximately 0.05 to 0.1 m/s [72]. Wave energy at the seabed is 'moderate' (between 0.21-1.2 N/m^2) within the area [46]. The annual mean wave height within the area ranges from 2.41 -2.70 m and the annual mean wave power is 36.1-42.0 kW/m [2][52]. Heather Pipelines, PL9 and PL352 travel through Blocks 3/1, 3/2 and 3/3. The mean residual current through the pipeline areas is approximately 1.1-2.0 m/s (Reference). Wave energy. The annual mean wave height within the area ranges from 2.41 m-2.70 m and the annual mean wave power is 36.1-42.0 kW/m [53].
Key conservation interests	
Conservation sites and habitats	
Special Area of Conservation (SAC)	The nearest SAC to the project area is the Pobie Bank Reef SAC, located approximately 49 km southwest. It is protected for bedrock and stony reefs which provide a habitat to an extensive community of encrusting and robust sponges and bryozoans (*Ectoprocta*). These include encrusting coralline algae (*Corallinales*), cup sponges, and bryozoans in the shallower areas; and small erect sponges, cup corals (*Stryphnus ponderosus*) and brittlestars (*Ophiuroidea*)in the deeper areas [52].
Nature Conservation Marine Protected Area ('NCMPA')	The nearest NCMPA to the project area is the Fetlar to Haroldswick NCMPA, located approximately 94 km southwest. It is protected for black guillemot (*Cepphus grille*), circalittoral sand and coarse sediment communities, horse mussel beds, kelp and seaweed communities on sublittoral sediment, maerl beds and shallow tide-swept coarse sands with burrowing bivalves [51].
Special Protection Area (SPA)	The nearest SPA to the project area is the Hermaness, Saxa Vord and Valla Field SPA, located approximately 96 km southwest. This site is important for a number of breeding seabird species that nest on the cliffs and the heathland and grassland here. During the breeding season, the area regularly supports 152,000 seabirds including guillemots (*Uria aalge*), kittiwakes (*Rissa*), shags (*Phalacrocoracidae*), fulmars (*Fulmarus*), puffins (*Fratercula*), great skuas (*Stercorarius skua*) and gannets (*Morus*) [48].

Table 4.2.1 Key environmental receptors for the project area	
Environmental receptor	**Description**
Burrowed Mud/ Seapen and burrowing megafauna communities	Survey imagery identified evidence of bioturbation and burrowing megafauna communities indicating the presence of the 'burrowed mud' PMF. The seapen species *Virgularia mirabilis* and *Pennatula phosphorea* were observed [7]. Thus, it was concluded that the OSPAR Threatened and/or Declining Habitat 'Seapen and burrowing megafauna communities' may be present within the surveyed area.
Conservation species	
Pinnipeds – Harbour and Grey Seals	Pinnipeds (*Pinnipedia*) are not expected in significant numbers within the project area, given its distance from shore. Densities are currently estimated at approximately 0-1 individuals per 25 km^2 for both harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) [66][8]. This is due to the site being approximately 93 km offshore and even further from important seal haul outs. Both harbour and grey seals are listed as PMFs, EPS and are listed on the International Union for Conservation of Nature ('IUCN') Global Red List as species of lower risk.
Ocean Quahog	No adult specimens of ocean quahogs (*Arctica islandica)* were recorded in survey area. However, one juvenile individual was recorded in macrofauna analysis at a single Heather station. Ocean Quahog are listed as PMFs.
European Protected Species most likely to be present in the project area	
Harbour porpoise	The harbour porpoise (*Phocoena phocoena*) is a small, highly mobile species of cetacean that is the most commonly occurring cetacean in UK waters [64]. They are listed as PMFs, EPS are covered by OSPAR and the UKBAP and are listed on the IUCN Global Red List as species of lower risk. Harbour porpoise can be found in the waters of the proposed decommissioning area where particularly large numbers occur in the project area during the summer months, with a peak in numbers in July and August [61][33]. The density of harbour porpoise is roughly estimated at 0.3-0.4 animals/km^2 across the project area [33].
Atlantic white-sided dolphin	Atlantic white-sided dolphins (*Lagenorhynchus albirostris*) are usually sighted in large groups of up to 1,000 individuals in UK waters. However, within the project area only moderate numbers occur in June. The relative density of Atlantic white-sided dolphin is estimated at 0.021 animals/km^2 in the project area [33]. Atlantic white-sided dolphin are PMFs, EPS and are covered by OSPAR and the UKBAP. They are also listed on the IUCN Global Red List as species of lower risk.
Minke whale	Minke whales (*Balaenoptera acutorostrata*) are usually observed in pairs or in solitude, though groups of up to 15 individuals can be sighted feeding within their seasonal feeding grounds. The relative density of minke whales is estimated at 0.030-0.035 animals/km^2 in the project area [33]. Minke whale are PMFs, EPS and are covered by OSPAR and the UKBAP. They are listed on the IUCN Global Red List as species of lower risk.
White-beaked dolphin	White-beaked dolphins (*Lagenorhynchus albirostris*) are usually found in water depths of between 50 and 100m in groups of around 10 individuals, though groups of up to 500 animals have been seen. They are present in the UK waters throughout the year, however more sightings have been made between June and October. The relative density of white-beaked dolphin is estimated at 0-0.05

Table 4.2.1 Key environmental receptors for the project area	
Environmental receptor	**Description**
	animals/km^2 in the project area [33]. White beaked dolphin are PMFs, EPS and are covered by OSPAR and the UKBAP. They are listed on the IUCN Global Red List as species of lower risk.
Benthic environment	
Bathymetry and seabed features	The water depth ranged from 141.9 m below LAT in the southeast corner to 145.3 m below LAT in the northwest corner, producing a gradient of -0.11°. The seabed is relatively featureless with the exception of some potential pockmarks or seabed depressions and some anthropogenic debris [7]. Ground-truthing of the survey area did not identify any methane derived authigenic carbonates ('MDAC') and concluded that there was no presence of the Annex I 'Submarine structures caused by leaking gases' habitat [7].
Seabed type	The predicted EUNIS habitats in the vicinity of Heather included 'Deep circalittoral sand' (A5.27) and 'Deep circalittoral coarse sediment' (A5.15). SSS indicated medium reflectivity attributed to the muddy sand sediment [7]. PSA identified the sediment to be mainly composed of sand with lesser contributions of fines and gravels. Most stations were assigned to the categories of 'muddy sand' (37% of the total) and 'gravelly mud' (25% of the total) [7]. Samples taken at the cuttings pile contained a greater percentage of gravelly shelly material – relating to loose muddy cuttings material [7]. Following PL9 to Ninian Central, the pipeline travels through Deep circalittoral sand' (A5.27) habitat into Deep circalittoral mud (A5.37) before returning to Deep circalittoral sand at the Ninian Central location. The sediment type found throughout the NCP area generally showed low variation with mean diameters ranging from 113 to 176 µm and were classified as fine to very fine sands [14].
Benthic fauna	Annelid species made up 45.2% of the total infaunal species recovered. The annelid species *Glycera lapidum*, *Spiophanes kroyeri* and *Spiophanes wigley* were found uniformly distributed throughout the survey area. This is expected considering the sediment type. Within the limits of the cuttings pile, Nematoda dominated at all but one station [7]. No adult specimens of ocean quahogs (*Arctica islandica)* were recorded; however, one juvenile individual was recorded in macrofauna analysis at a single station. No evidence of *A. islandica* siphons was seen on any of the video footage [7]. A low diversity of epifauna was found across the site due to the nature of the sediment which reduces attachment opportunities, however, survey imagery did identify evidence of bioturbation and burrowing megafauna communities. Additionally, the presence of seapen species such as *Virgularia mirabilis* and *Pennatula phosphorea* was observed. It was concluded that the UK BAP 'Seapen and burrowing megafauna communities' habitat was present at a number of stations in the surveyed area [7].

Environmental receptor	Description
Water column	
Plankton	In both the northern and central regions of the North Sea, the phytoplankton community is dominated by dinoflagellates of the genus *Ceratium* (*fusus*, *furca*, *lineatum*) and diatoms such as *Thalassiosira* spp. and *Chaetoceros* spp. In recent years the dinoflagellate *Alexandrium tamarense* and the diatoms *Pseudo-nitzschia* (known to cause amnesic shellfish poisoning) have been observed in the area [20]. 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 [20]. *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 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 [23]. 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 [67]. 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 [3][31]. *C. finmarchicus* has largely been replaced by boreal and temperate Atlantic and neritic (coastal water) species and a relative increase in the populations of *Calanus helgolandicus* has occurred [20][21][3].
Fish – spawning and nursery grounds	
Spawning grounds	The project area is located within a high concentration spawning area for Norway pout (*Trisopterus esmarkii*) and the spawning grounds of cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), saithe (*Pollachius virens*), sandeel (*Ammodytidae spp.*) and whiting (*Merlangius merlangus*) [14][30]. Norway pout, cod, saithe, sandeel and whiting are PMF species in offshore waters. Cod are also listed as vulnerable on the IUCN Global Red List.
Nursery grounds	The project area is located within a high nursery intensity area for blue whiting (*Micromesistius poutassou*). In addition, the following species have nursery grounds near the project area: anglerfish (*Lophius piscatorius*); European hake (*Merluccius merluccius*); haddock; herring (*Clupea harengus*); ling (*Molva molva*); mackerel (*Scomber scombrus*); Norway pout; spurdog (*Squalus acanthias*); sandeel, and whiting [14][30]. Anglerfish, herring, ling, Norway pout, sandeel and whiting are also PMF species in offshore waters.
Probability of 0 age group fish aggregation	Aires *et al.,* provides modelled spatial representations of the predicted distribution of 0 age group fish [1]. The modelling indicates the presence of juvenile fish (less than one year old) for multiple species: anglerfish, blue whiting, European hake, haddock, herring, mackerel, horse mackerel, Norway pout, plaice, sprat, and whiting. Across the project area the probability of juvenile fish aggregations occurring is very low for most species (<0.2), except for hake for which the probability is up to medium [30].

Environmental receptor	Description											
Fish spawning and nursery times												
Species	Jan	Fe	Ma	Ap	Ma	Jun	Ju	Au	Se	Oc	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	S	S*	S*	S								
European hake	N	N	N	N	N	N	N	N	N	N	N	N
Haddock	N	S*	S*	S*	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	N	N	N	N	N	N	N	N
Norway Pout	SN	S*	S*	SN	N	N	N	N	N	N	N	N
Saithe	S*	S*	S	S								
Sandeel	SN	SN	N	N	N	N	N	N	N	N	SN	SN
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	N	SN	SN	SN	SN	SN	N	N	N	N	N	N
Key	S = Spawning, S* = Peak spawning, N = Nursery, Species = High concentration spawning as per Coull *et al.* (1998) [12], Species = High intensity spawning as per Ellis *et al.* (2012) [30]											

Seabirds

The following species could be found within the project area: northern fulmar (*Fulmarus glacialis*), razorbill (*Alca torda*), lesser black-backed gull (*Larus fuscus*), European storm-petrel (*Hydrobates pelagicus*), northern gannet (*Morus bassanus*), great skua, black-legged kittiwake (*Rissa tridactyla*), great black-backed gull (*Larus marinus*), common gull (*Larus canus*), herring gull (*Larus argentatus*), common guillemot (*Uria aalge*), little auk (*Alle alle*) and Atlantic puffin (*Fratercula arctica*) [42].

Birds are attracted to offshore infrastructure as they offer a variety of opportunities for refuge, roosting, loafing foraging and for nesting. A long-term bird monitoring programme in the North Sea (Norwegian waters), has recorded 159 different bird species utilising platforms. Black-legged kittiwake, having a maximum foraging range of 120 km, have been recorded nesting on offshore platforms before, as have herring gulls and black legged kittiwake [40].

SOSI identifies areas at sea where seabirds are likely to be most sensitive to surface pollution [71]. Seabird sensitivity to oil within the Heather Pipeline area (Blocks 2/5, 3/1, 3/2 and 3/3) is low throughout the year [71]. Along the PL9 and PL352 sensitivity is variable with the areas experiencing a slightly higher sensitivity compared to the Heather jacket for the months of September and October. The risk of an oil spill from the proposed operations at the project area is considered remote and therefore the overall risk to birds is considered negligible.

SOSI for Heather pipeline area and surrounding Blocks												
Block	**Month**											
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
210/2o	2	5	5	5*	3*	3	5	5	5	5*	5*	5
210/3	5	5	5	5*	5*	5	5	5	5	5*	5*	5
211/2	5	5	5	5*	5*	5	5	5	5	5*	5*	5
211/2	5	5	5	5*	5*	5	5	5	4	4*	5*	5
211/2	5	5	5	5*	N	5*	5	5	4	4*	5*	5
211/2	5*	5	3	3*	5*	5	5	5	5*	N	5*	5
2/4	5	5	5	5*	3*	3	5	5	5	5*	5*	5
2/5	**5**	**5**	**5**	**5***	**5***	**5**	**5**	**5**	**5**	**5***	**5***	**5**
2/9	5*	5	3	3*	5*	5	5	5	5*	N	5*	5
2/10	5	5	3	3*	5*	5	5	5	5	5*	5*	5
3/1	**5**	**5**	**5**	**5***	**5***	**5**	**5**	**5**	**5**	**5***	**5***	**5**
3/2	**5**	**5**	**5**	**5***	**5***	**5**	**5**	**5**	**4**	**4***	**5***	**5**
3/3	**5**	**5**	**5**	**5***	**5***	**5**	**5**	**5**	**4**	**4***	**5***	**5**
3/4	5	5	5	5*	N	5*	5	5	5	5*	5*	5
3/5	5	5	5	5*	4*	4	5	5	5*	N	N	5*
3/6	5	5	2	2*	5*	5	5	5	5	5*	5*	5
3/7	5	5	3	3*	5*	5	5	5	5	5*	5*	5
3/8	5	5	5	5*	5*	5	5	5	5	5*	5*	5
3/9	5	5	5	5*	N	5*	5	5	5	5*	5*	5
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											

<table>
<tr><th colspan="5">Table 4.2.2 Key societal receptors for the project area</th></tr>
<tr><th>Societal receptor</th><th colspan="4">Description</th></tr>
<tr><td colspan="5">Commercial fishing</td></tr>
<tr><td colspan="5">The project area is in ICES rectangle 50F0 and 50F1. ICES Rectangle 50F0 is predominantly targeted for demersal fish, with demersal fisheries landing 75% of the total value and 64% of the total weight of fish landed in this area in 2020 (Table 4.4.1) [68]. ICES Rectangle 50F1 is also predominantly targeted for demersal fish, with demersal fisheries landing 98% of the total value and 99% of the total weight of fish landed in this area in 2020 [68]. VMS data from 2009-2013 indicates that fishing intensity within Block 2/5 is low for shellfish species, moderate for pelagic species (mackerel/herring), and high for demersal species [41].

In 2020 fishing effort in ICES rectangle 50F0 was highest in October, accounting for 18% of the total number of days fished, followed by November contributing for 15% of fishing effort. In August, September, October and November the effort was highest, accounting for 51% of annual fishing effort. In April, July and December the effort was lower, together accounting for 12% of the annual effort [68]. ICES rectangle 50F1 was highest in June and January accounting for 26% of the total number of days fished, followed by the period running July to August contributing 23% of fishing effort (Table 4.4.2). In September, November and December the effort was lower, accounting for 15% of the annual effort [68] Trawls were the most utilised gear in rectangle 50F0 accounting for 77% of the total number of days fished and rectangle 50F1 accounting for 90% of the total number of days fished. Other gear type utilised include hooks and lines, seine nets and gill nets and entangling nets [68][4]. The five top landed species in rectangle 50F0 in 2020 in terms of weight included hake, saithe, mackerel, herring, and whiting [68], while the top landed species in rectangle 50F1 in 2020 in terms of weight included saithe, whiting, haddock, hake, and cod.</td></tr>
<tr><td colspan="5">Other sea users</td></tr>
<tr><td>Shipping activity</td><td colspan="4">Shipping activity is assessed to be low in Blocks 2/5, 3/1, 3/2 and 3/3 [20][55].</td></tr>
<tr><td rowspan="9">Oil and Gas</td><td colspan="4">The project area is located in the NNS within an area of extensive oil development. There are numerous oil and gas surface installations within 40 km of the project area as described below:</td></tr>
<tr><td>Installation</td><td>Installation Type</td><td>Operator</td><td>Distance & direction</td></tr>
<tr><td>Cormorant Alpha</td><td>Platform</td><td>TAQA</td><td>18 km NNE</td></tr>
<tr><td>Ninian North</td><td>Jacket only</td><td>CNR</td><td>26.5 km E</td></tr>
<tr><td>Ninian Central</td><td>Platform</td><td>CNR</td><td>30.6 km E</td></tr>
<tr><td>Western Isles</td><td>FPSO</td><td>Dana</td><td>30.7 km NNW</td></tr>
<tr><td>Ninian Southern</td><td>Platform</td><td>CNR</td><td>32.2 km ESE</td></tr>
<tr><td>Cormorant North</td><td>Platform</td><td>TAQA</td><td>33.7 km N</td></tr>
<tr><td>Tern</td><td>Platform</td><td>TAQA</td><td>35.7 km NNW</td></tr>
<tr><td>Tele-comms and power cables</td><td colspan="4">There is one historic power cable passing approximately 17 km northeast of the project area, which was owned by OceanWise. It appears to connect to the Cormorant Alpha installation. Another historic cable owned by OceanWise connected Ninian North to Brent Alpha; it is located approximately 30 km southeast of Heather. Though disused, sections of these cables may remain on the seabed [52]. The nearest telecommunications cable is the Tampnet Oseberg to Troll cable which is currently active; it is located approximately 105 km east of Heather [44].</td></tr>
<tr><td>Military activities</td><td colspan="4">Blocks 2/5, 3/1, 3/2 and 3/3 lie within training ranges which are areas of concern to the MoD [56].</td></tr>
</table>

Table 4.2.2 Key societal receptors for the project area	
Societal receptor	**Description**
Renewable energy	There are no renewable energy sites within 100 km of the project area [19]; [52].
Wrecks	The nearest wreck to Block 2/5 is located approximately 10 km northeast of the project area and it is classified as a non-dangerous wreck [2]; [52]. Block 3/2 has a non-dangerous wreck situated 6km southeast of PL352 cable which is the nearest wreck for Blocks 3/1 through to 3/3.

4.3 Seabed Habitats and Benthos

4.3.1 Physical Characteristics

The predicted EUNIS habitats in the vicinity of Heather included 'Deep circalittoral sand' (A5.27) and 'Deep circalittoral coarse sediment' (A5.15; Figure 4.3.1). Stations sampled as part of the EBS predominantly comprised of sedimentary sands across all stations sampled and ranged from 8.0% to 89.9% of samples. Mean sediment size varied from 0.014 to 0.408 mm and the mean particle size of EBS samples was 0.182 mm [7]. The general water depth within the analogue survey area showed little variation, ranging from 141.9 m below LAT in the southeast to 145.3 m below LAT in the northwest with a natural slope of -0.11°. The Heather cuttings pile is the main seabed feature within the area, rising to approximately 17 m above the seabed [6]. Some other habitats of anthropogenic origin were identified at certain stations in the form of infrastructure and debris [7]. Following PL9 to Ninian Central, the pipeline travels through Deep circalittoral sand' (A5.27) habitat into Deep circalittoral mud (A5.37) before returning to Deep circalittoral sand at the Ninian Central location. The sediment type found throughout the NCP area generally showed low variation with mean diameters ranging from 113 to 176 µm and were classified as fine to very fine sands [14].

Video footage taken from a transect at station H_EBS_500mN (Figure 4.3.2) showed evidence of a large seabed depression (approximately 60 cm deep and up to 34 m wide). The depression contains gravel and relic mussel shells. Two similar smaller pockmarks approximately 500 m east and 400 m southeast of the Heather installation were also observed. Based on the size and circular shape of these depressions they appear to be unit (or small) pockmarks. MDAC are often formed within larger pockmarks which can form the Annex I habitat 'Submarine structures made by leaking gases. No such formations were identified within these ground-truthed depressions. As such, it was concluded that this Annex I habitat is not present in the Heather Field [7].

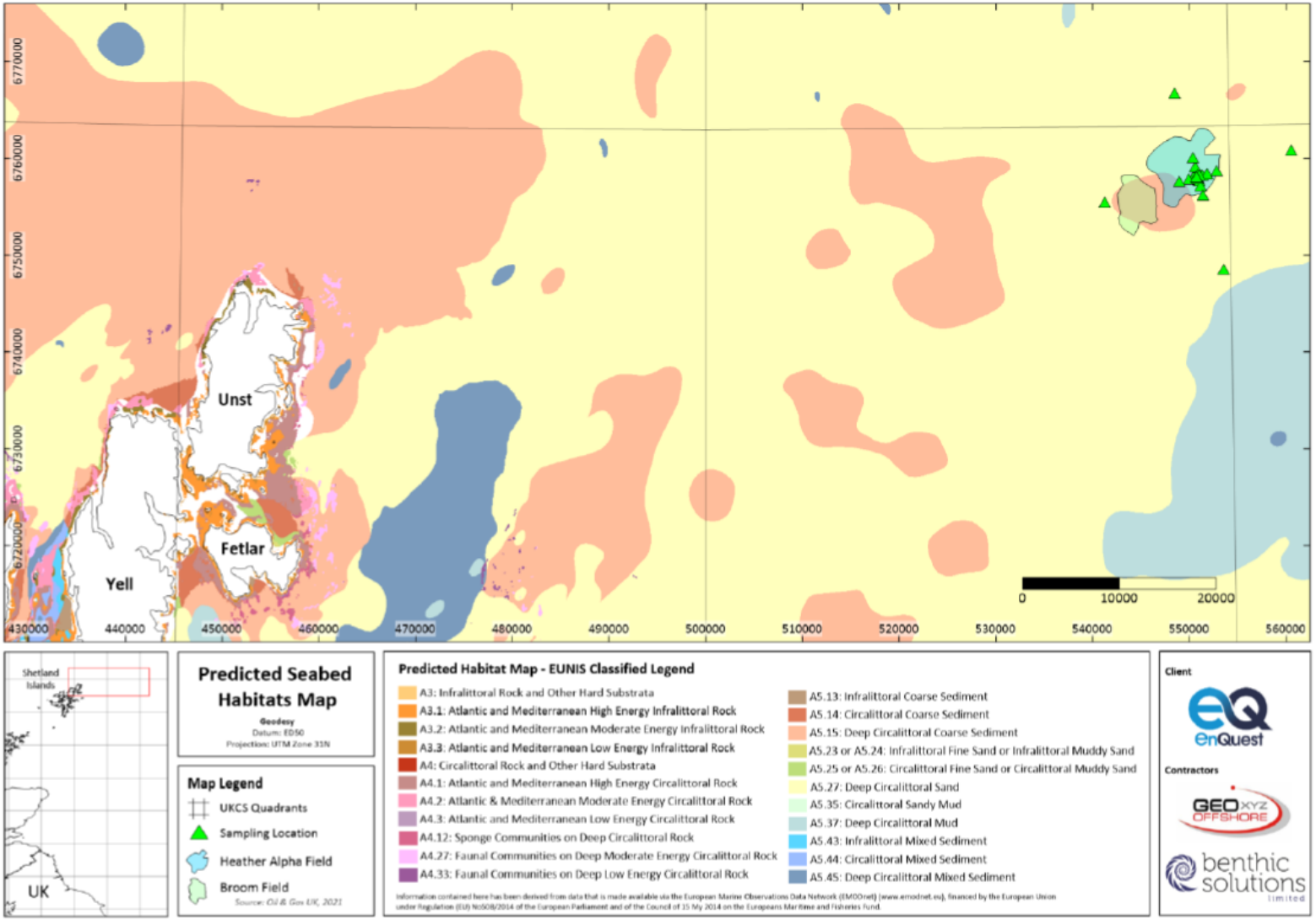


Figure 4.3.1 EUNIS Predicted Habitats

4.3.2 Chemical Characteristics

Total Organic Carbon ('TOC') levels at stations outside the Heather cuttings pile were low, reflecting ambient NNS conditions (mean 0.30%±0.08SD). Levels of total organic matter ('TOM') across EBS stations >180 m from the platform ranging between 1.2% - 1.9%; this falls below the UKOOA (United Kingdom Offshore Operators Association 95th percentile for the NNS (2.0%)[6]. Organic enrichment was more apparent at stations with a higher sedimentary fines content, as contaminants attach themselves to the greater surface area available within finer sediments.

Total Hydrocarbon Content ('THC') varied among the 25 EBS (Figure 4.1.1) stations, five of which sampled outside the physical cuttings pile recorded THC levels exceeding the UKOOA 95th percentile for the NNS (20.3 mg/kg $^{-1}$). The THC chemical impact was found to extend as far as 400 m south of the Heather platform (57.1 mg/kg $^{-1}$). Predictably, THC levels were higher closer to the platform, with peak THC concentration within the cuttings pile [6].

Total n-alkane concentration was highly variable across the survey area, with concentrations that fell below the UKOOA 95th percentile for the NNS (0.09 mg/kg^{-1}) at all EBS stations [7].

Petroleum hydrocarbon is one source of Polycyclic Aromatic Hydrocarbons ('PAHs'). These are typically lighter more volatile PAHs, such as Naphthalene, Anthracene and Dibenzothiophene ('NPDs'), and their presence is often associated with localised drilling activities. A strong petrogenic signature was identified within the physical pile limit of the cuttings pile, with NPDs contributing over 37.5% of the total PAHs at almost every station[7]. All remaining stations sampled outside the physical cuttings pile displayed minor levels of contamination of NPDs with percentages ranging from 9.6 to 59.9%. Stations that fell within 500 m but remain outside the physical pile highlighted higher levels of %NPD indicating a contamination gradient with increasing distance from the platform[7].

Natural barium (Ba) levels ranged from 205 mg/kg^{-1} at station H_EBS_10000mW on the periphery of the survey area, to 24,500 mg/kg^{-1} within the cuttings pile. Natural Ba levels were found to exceed the UKOOA 95th percentile (577.3 mg/kg^{-1}) for the NNS at most stations sampled within 500 m of the Heather platform due to the proximity to areas affected by drilling-related activities [6][7].

Most other metal concentrations on the periphery of the survey area were benign, in line with background NNS concentrations. Elevated concentrations were recorded at H_EBS_1000mS for nickel ('Ni') and zinc ('Zn'), with concentrations of 36.3 mg/kg^{-1} and 125 mg/kg^{-1}, respectively. Even though levels at station H_EBS_1000mS exceeded the NOAA ('National Oceanic and Atmospheric Administration') Effect Range Low ('ERL') for Ni (20.9 mg/kg^{-1}) and the CCME (Canadian Council of Ministers of the Environment) Threshold Effect Level ('TEL') for Zn (124 mg/kg^{-1}), the origin of the low-level contamination is assumed to be a result of natural variation and is not due to contamination from any infrastructure [7].

Arsenic ('As') concentrations were variable across the survey area with most stations outside the physical pile limit falling below the NOAA ERL threshold (8.2 mg/kg^{-1}), except for stations H_EBS_175mNE and H_EBS_180mS which also experienced elevated levels of other heavy metals (Vanadium ('V') and Zn) [7]. Overall, heavy metal concentrations highlighted decreasing levels of contamination with increasing distance from the Heather platform. Samples taken at the periphery of the survey area displayed metal concentrations consistent with uncontaminated sediment and background levels typical of the NNS [6].

4.3.3 Benthos

Of the infaunal species, Annelida were represented by 178 taxa and as a result was the most diverse and abundant phylum in the survey. Due to the soft sediment nature of the seabed,

suspension and deposit feeders were particularly abundant. The most common and abundant polychaete species was the oweniid *Galathowenia oculata* with 1,286 individuals recorded in 52 samples. The family Spionidae recorded 22 taxa, the most abundant of which were *S. kroyeri*, *S. bombyx* and *S. wigleyi* along with *Aonides paucibranchiata* and *Prionospio cirrifera*. The Terebellomorpha showed the highest diversity with 27 different taxa recorded amongst 3 different families, Ampharetidae, Terebellidae and Trichobranchidae [7].

Arthropods were also well represented in the survey. 105 taxa were identified, including Pycnogonida, Leptostraca, Amphipoda, Isopoda, Tanaidacea, Cumacea and Decapoda. The most abundant amphipod species was *Urothoe elegans*. The most abundant mollusc species were the bivalves *Thyasira flexuosa*, *Axinulus croulinensis* and *Adontorhina similis* which are all in the family Thyasiridae. These species are very adept to survive in enriched deposits and artificial sources of sulphide, which can sometimes occur due to offshore drilling activities [7].

The minimum average species richness (15 species/0.1 m^2) was recorded at H_EBS_96mS with the maximum average species richness noted at H_EBS_175mN (82 species/0.1 m^2). Stations recording higher species richness values are thought to be largely unaffected by drilling-related discharges. Station H_EBS_96mS was significantly impacted by drilling fluids and cuttings, indicated by the elevated levels of THC (28,631 mg/kg^{-1}), which was thought to be responsible for the low diversity but high abundance of opportunistic benthic taxa such as those belonging to the polychaete genus *Capitella* (132 ind./0.1 m^2). A community dominated by only a few tolerant species is considered indicative of point-source organic pollution [7].

A. islandica is a very slow growing mollusc which is on the OSPAR List of Threatened and/or Declining Species and is also classified as a PMF. No adult specimens of ocean quahogs were recorded in the entire survey area; however, a single juvenile was recorded at station H_EBS_10000mS. Video footage taken during the survey did not identify any *A. islandica* siphons [7].

The key identifying feature of the OSPAR Threatened and/or Declining Species & Habitats 'Seapen and burrowing megafauna communities', is the presence of burrowing macrofauna. Survey imagery identified evidence of bioturbation and burrowing megafauna communities within the Heather survey area. The burrows were variably present throughout the survey area; with their density in some locations considered 'frequent', according to the Joint Nature Conservation Committee ('JNCC') Superabundant, Abundant, Common, Frequent, Occasional, Rare ('SACFOR') classification scheme. At one station (H_EBS_10000mS) a density of 1.9 large burrows (3 to 15 cm) per $10m^2$ was observed. Along two transects burrow density was 'rare'. However, it is important to note that the number of burrows could be overestimated by counting multiple burrow openings which may in fact relate to a single burrow/individual. In addition to the presence of burrows, the presence of seapen species such as *V. mirabilis* and *P. phosphorea* was observed during the survey [7].

Example images, depicting the seabed and benthic environment at the Heather location, can be seen in Figure 4.3.2. The green laser markings present within these images are laser generated dots which provide a reference of scale set at 10 cm apart.

North of Heather

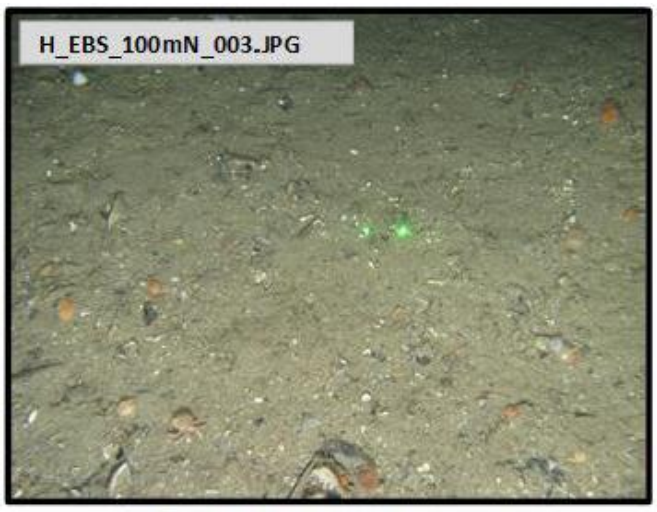


Photo Position: 388362 mE, 6759634 mN

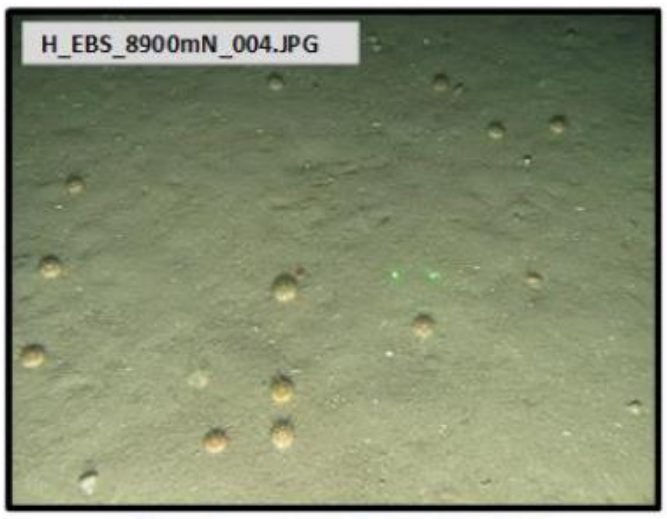


Photo Position: 386397 mE, 6768169 mN

South of Heather

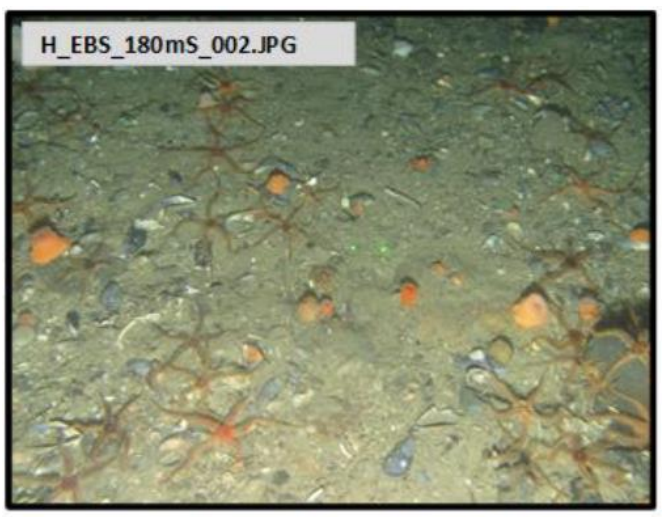


Photo Position: 388343 mE, 6759408 mN

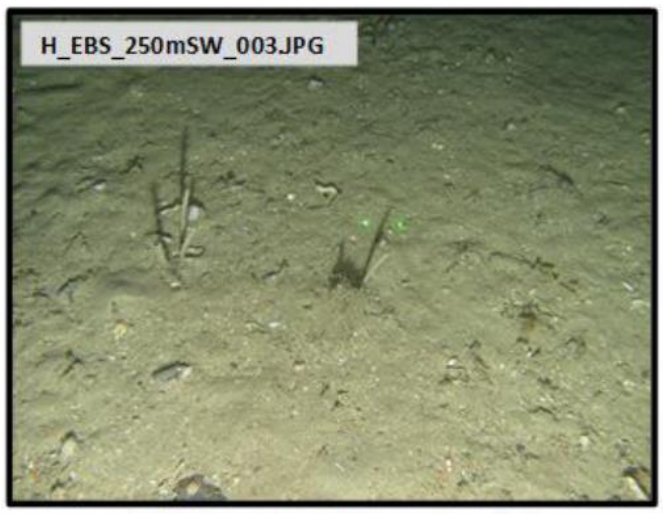


Photo Position: 388355 mE, 6759312 mN

East of Heather

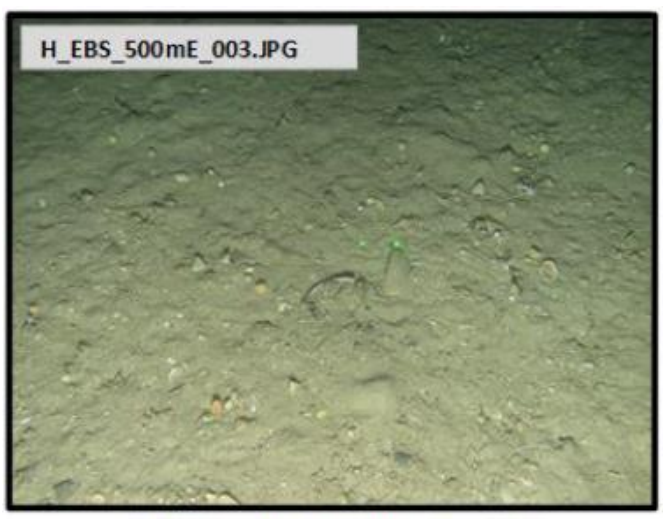


Photo Position: 388898 mE, 6759654 mN

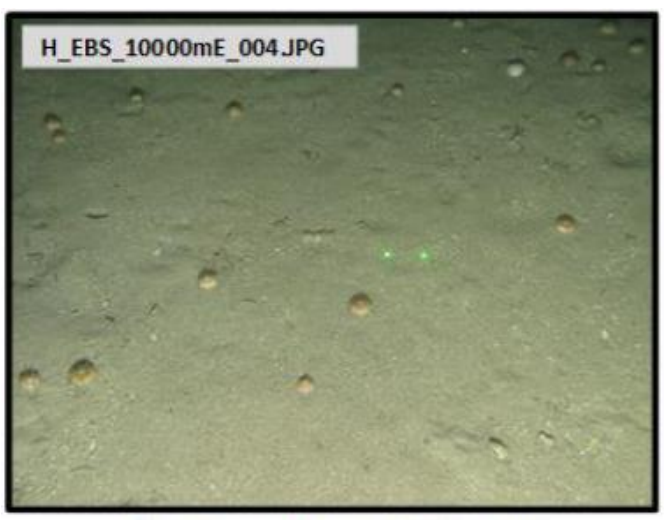


Photo Position: 398152 mE, 6761838 mN

West of Heather

Photo Position: 388260 mE, 6759462 mN

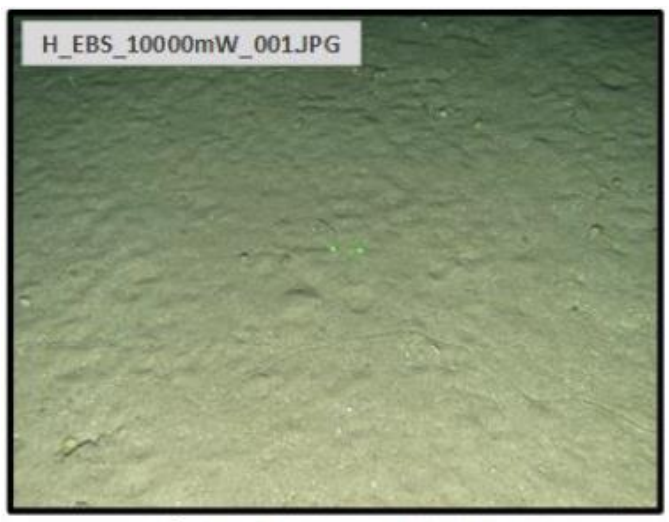


Photo Position: 378639 mE, 6757284 mN

Figure 4.3.2 Seabed photograph examples from the Heather EBS [7]

4.3.4 Heather Drill Cuttings Pile

The Heather cuttings pile has been assessed and detailed within the Heather Alpha Drill Cuttings Comparative Assessment [29] and Jacket Environmental Appraisal [27] and will not be further assessed within this report.

4.4 Commercial Fisheries

The project area is in ICES rectangle 50F0, with PL9 and PL352 passing through rectangle 50F1. The ICES rectangle 50F0 is predominantly targeted for demersal fish, with demersal fisheries landing 75% of the total value and 64% of the total weight of fish landed in this area in 2020 (Table 4.4.1). The five top landed species in rectangle 50F0 in 2020 in terms of weight included hake, saithe, mackerel, herring and whiting.

ICES rectangle 50F1 is also predominantly targeted for demersal fish, with demersal fisheries landing 98% of the total value and 99% of the total weight of fish landed in this area in 2020. (Table 4.4.1). Pelagic species have only recorded landings and therefore value in ICES 50F1 during the years 2016, 2017, 2018 and 2019, however these values are negligible accounting for <0.05% of the average landing's values from 2016 to 2020. The top five landed species in rectangle 50F1 in 2020 in terms of weight included saithe, whiting, haddock, hake, and cod.

VMS data from 2009-2013 indicates that fishing intensity within Block 2/5 is low for shellfish species, moderate for pelagic species (mackerel/herring), and high for demersal (mobile) species [41]. Landing's value and weight for Rectangles 50F0 & 50F1 in 2016-2020 were low for pelagic fish in comparison to other areas in the NNS.

In 2020 fishing effort in ICES rectangle 50F0 was highest in October, accounting for 18% of the total number of days fished, followed by the period running from August to November contributing for 51% of fishing effort (Table 4.4.2). In April, July and December the effort was lower, together accounting for 12% of the annual effort [68].

Fishing efforts for ICES rectangle 50F1 was highest in June and January, accounting for 26% of the total number of days fished, followed by the period running July to August contributing 23% of fishing effort (Table 4.4.2). In September, November and December the effort was lower, accounting for 15% of the annual effort [68].

Average value and effort for all gear types used within the project area and the wider NNS can be seen in Figure 4.4.2 and Figure 4.4.1.

Trawls were the most utilised gear in rectangle 50F0 accounting for 77% of the total number of days fished. Trawls were also the most utilised gear in rectangle 50F1 accounting for 90% of the total number of days fished. Other gear type utilised include hooks and lines, seine nets and gill nets and entangling nets [68][4].

Fishing vessels in the Heather Field are primarily of non-UK origin (53.4%), with UK vessels accounting for 46.6% of fishing vessels. The non-UK origin fishing vessels are predominantly French (22.7%) and Norwegian (14.9%). The remainder of the sightings comprise vessels from Denmark, Germany, Netherlands, Ireland and Sweden [4]. Due to the proposed timescales of the project and the current political situation regarding Brexit, there is potential for the fishing patterns and activity displayed here to be heavily affected and altered prior to the potential decommissioning date for the Heather pipelines.

Table 4.4.1 Commercial fisheries landings in ICES Rectangle 50F0 & 50F1 in 2016 – 2020 [49]											
ICES Rectangle	Fisheries type	2016		2017		2018		2019		2020	
		Landed weight (Te)	Value (£)	Landed weight (Te)	Value (£)	Landed weight (Te)	Value (£)	Landed weight (Te)	Value (£)	Landed weight (Te)	Value (£)
50F0	Demersal	3,721	7,729,103	2,828	5,455,385	4,384	7,541,203	3,085	5,479,171	2,304	3,747,327
	Pelagic	879	422,458	194	89	150	56,392	744	949,833	1,321	1,199,118
	Shellfish	4	15,950	6	21,453	7	29,080	10	37,900	11	31,832
Total		**4,604**	**8,167,511**	**3,028**	**5,476,927**	**4,541**	**7,626,675**	**3,839**	**6,466,904**	**3,636**	**4,978,277**
50F1	Demersal	1,616	2,490,034	947	1,568,556	1,508	2,883,904	1,517	2,726,650	1,192	2,108,872
	Pelagic	420	462,522	55	47,307	0.1	62	0.3	784	0	0
	Shellfish	2	5,200	2	6,250	2	9,942	4	32,809	7	29,973
Total		**2,038**	**2,957,756**	**1,004**	**1,622,113**	**1,510.1**	**2,893,908**	**1,521.3**	**2,760,243**	**1,199**	**2,138,845**

Table 4.4.2 Days of fishing effort within ICES Rectangles 50F0 and 50F1 from 2016-2020 [68]														
ICES Rectangle	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
50F0	2016	25	28	22	22	37	23	27	28	5	24	133	125	**499**
	2017	28	11	26	12	17	46	45	35	31	83	122	13	**469**
	2018	25	38	26	63	54	44	56	67	68	150	114	44	**749**
	2019	41	43	45	49	40	19	17	67	54	62	93	18	**547**
	2020	42	28	41	28	43	17	22	45	44	87	74	15	**486**
50F1	2016	13	19	31	21	26	25	29	D	10	16	D	D	**190**
	2017	D	D	18	8	33	18	11	D	D	D	D	D	
	2018	32	15	10	32	22	28	27	23	22	28	7	27	**273**
	2019	18	21	28	35	43	24	30	19	27	16	17	D	**278**
	2020	33	15	22	21	13	33	32	27	13	18	12	12	**251**

Note: Days of fishing effort within ICES Rectangles 50F0 and 50F1 from 2016-2020: D = Disclosive data (indicating very low effort), green = 0 – 100 days fished, yellow = 101 – 200, orange =201-300

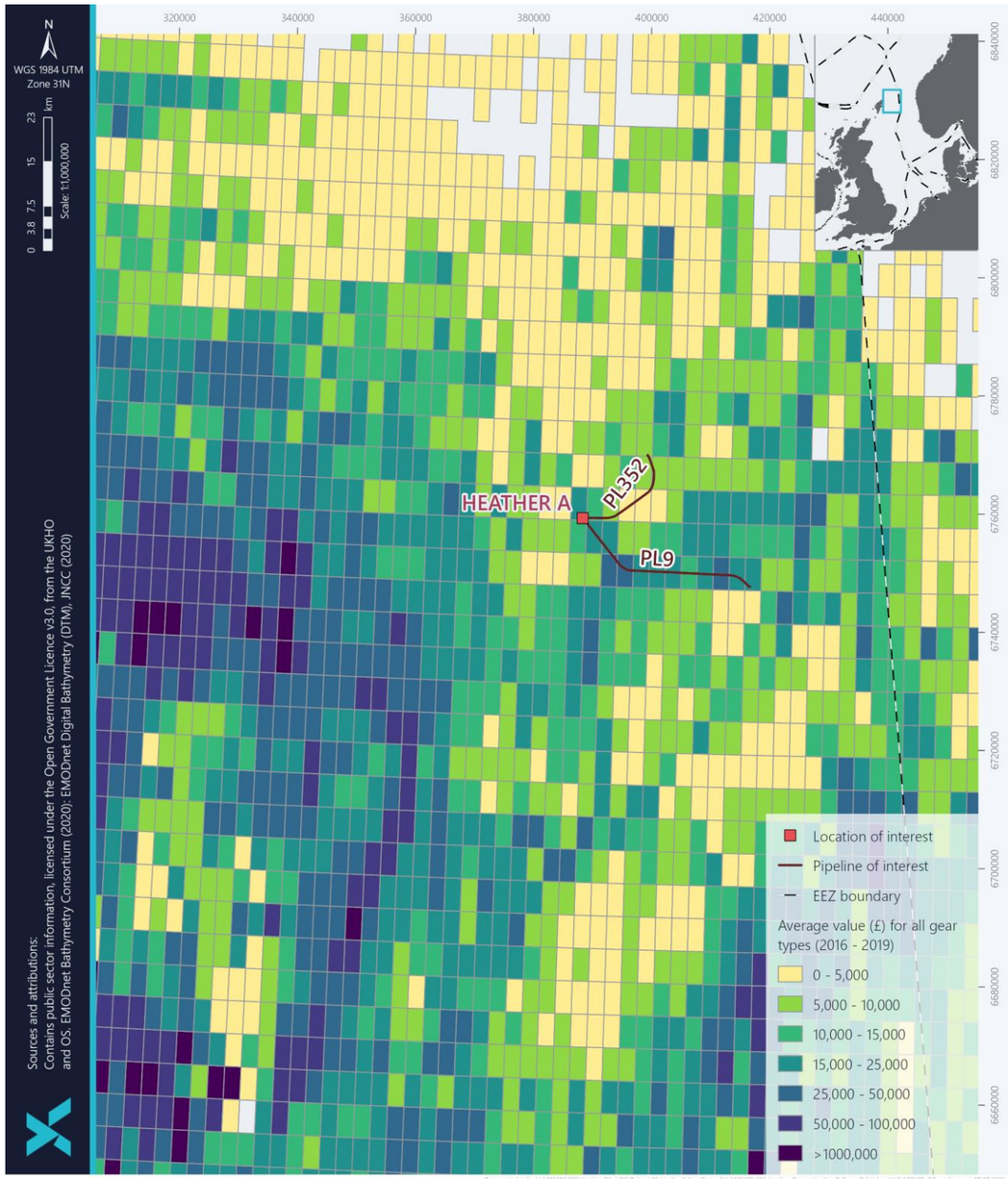


Figure 4.4.1 Average fishing value for all gear types in the project area

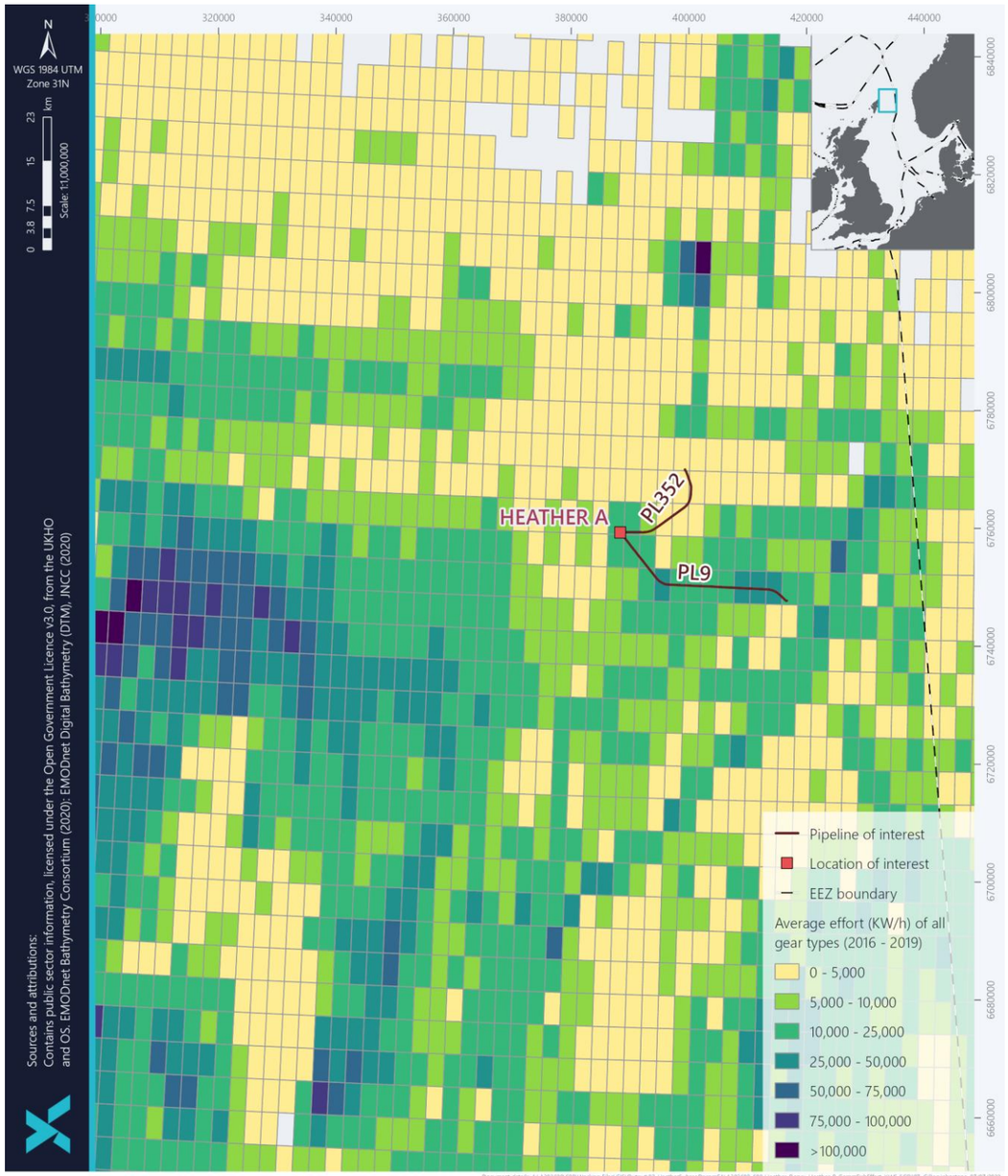


Figure 4.4.2 Average fishing effort of all gear types within the project area

4.5 Sites and Species of Conservation Importance

4.5.1 Offshore Conservation

There are no protected areas within 40 km of the project area. The closest protected area is the Pobie Bank Reef SAC, located approximately 49 km southwest of the Heather Field [20]. The site is protected for bedrock and stony reefs which provide a habitat to an extensive community of encrusting and robust sponges and bryozoans. These include encrusting coralline algae, cup sponges, and bryozoans in the shallower areas; and small erect sponges, cup corals and brittle stars in the deeper areas. Protected sites in the wider vicinity of Heather are shown in Figure 4.5.1, which include the Fetlar to Haroldswick NCMPA (123 km), Hermaness Saxa, Vord and Valla Field SPA (94 km), Bluemull and Colgrave Sounds SPA (104 km) and the Fetler SPA (95 km).

4.5.2 Onshore Conservation

The project area is located approximately 94 km from the northeast coast of Shetland. The closest onshore conservation site is the Hermaness, Saxa Vord and Valla Field SPA, located approximately 95 km southwest [52]. Due to this distance, there will not be interactions with onshore conservation sites from operations taking place within the project area.

4.5.3 Protected Species

Four species listed under Annex II of the EU Habitats Directive are found in UK waters: harbour porpoise, bottlenose dolphin, grey seal and harbour seal. Grey and harbour seals are unlikely to be observed near the project area with any regularity. Harbour porpoise and minke whale are the two Annex II species which could be present near the project area.

All species of cetacean recorded within the proposed operations area are listed as EPS and are also PMFs. Other marine species listed as EPSs include turtles and sturgeon (*Acipenser sturio*), which are not likely to be present within this area of the North Sea.

The most likely sensitive habitats (Annex I, UKBAP and OSPAR) are biogenic reefs formed by the cold-water coral *Lophelia pertusa* or mussels (*Modiolus modiolus* or *Mytilus edulis*), cobble reefs – as a result of glacial deposits, and carbonate mounds or structures produced from leaking gas (i.e. around active pockmarks).

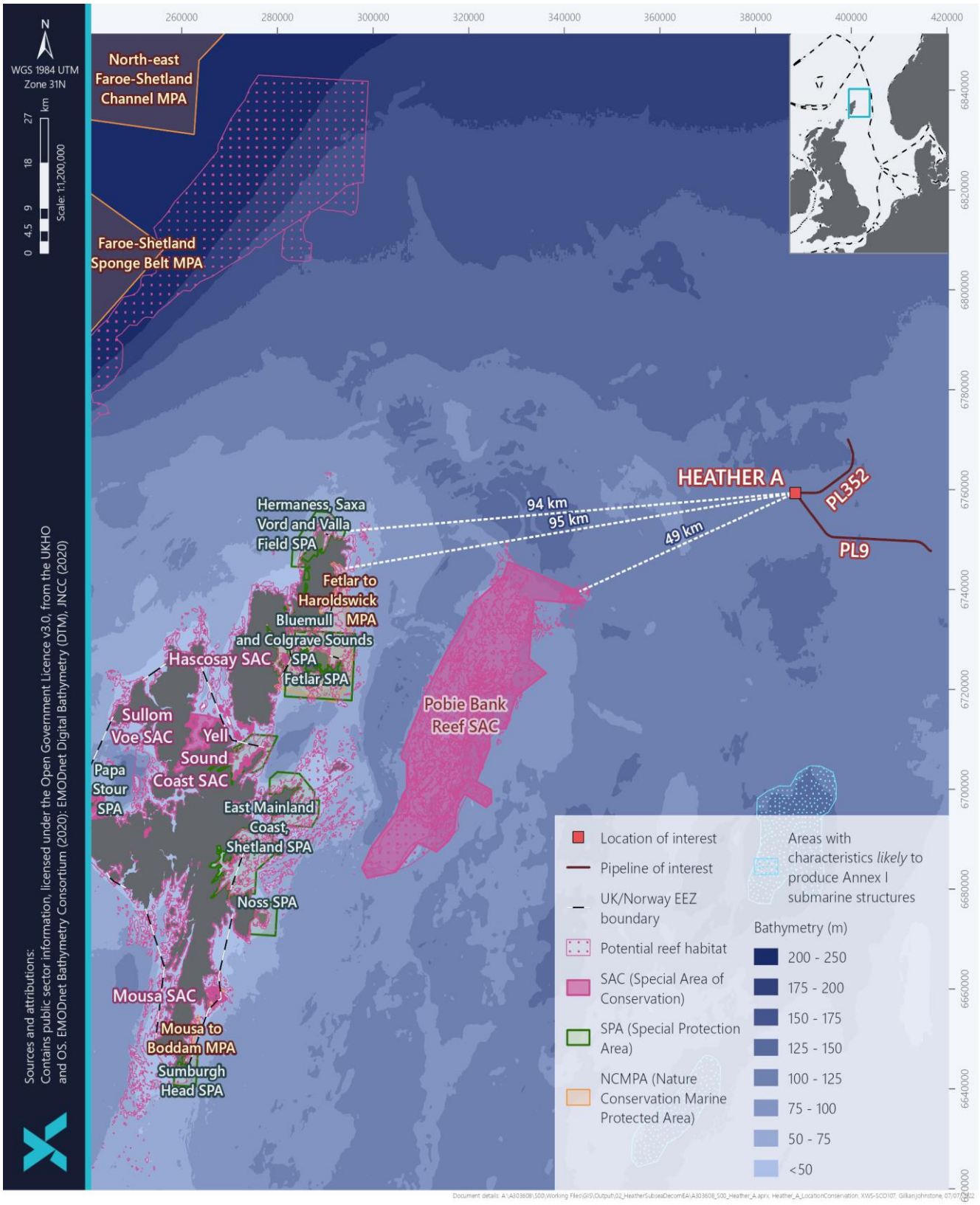


Figure 4.5.1 Protected sites around Heather

4.6 Oil and Gas Activity

There are several installations and pipelines located within the vicinity of the Heather decommissioning area. The locations of these activities and related infrastructure within the Heather area are illustrated in Figure 4.6.1.

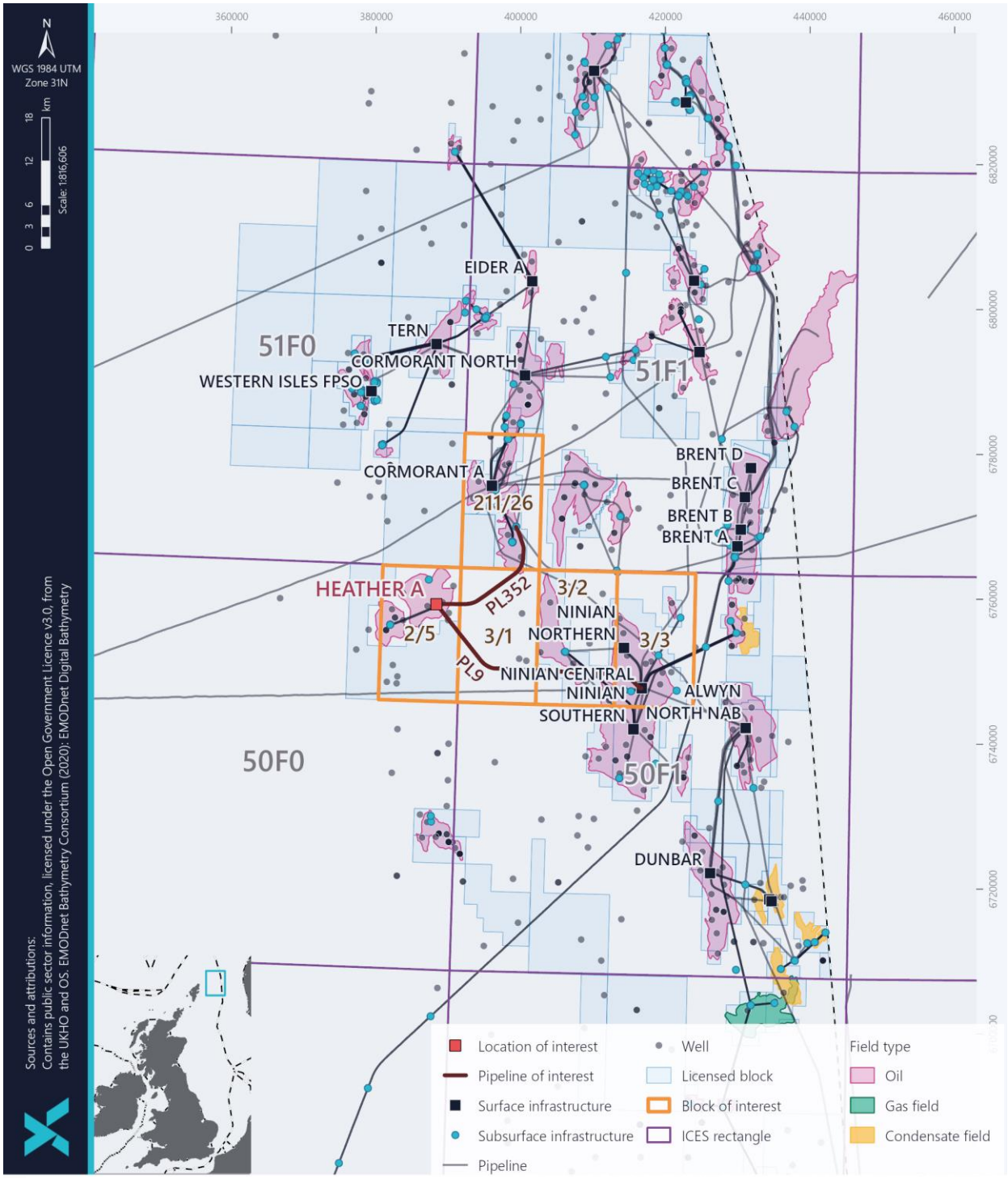


Figure 4.6.1 Location of Oil and Gas infrastructure within 40 km of the project area

4.7 National Marine Plan

In addition to adhering to the suite of marine policies, regulations, and guidance for the offshore oil and gas industry, this project considers the objectives set by the Scottish NMP. The 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 NMP's objectives and policies, specifically GEN 1, 4, 5, 9, 12, 14 and 21 and OIL AND GAS 2, 3 and 6.

Assessment of compliance against relevant policies has already been achieved through the ENVID process. The proposed operations do not contradict any of the marine plan objectives and policies. EnQuest will ensure they comply with any new policies that have been introduced; with particular attention being made to the following existing policies:

GEN 1 – General Planning and Principle

Development and use of the marine area should be consistent with the NMP, ensuring activities are undertaken in a sustainable manner that protects and enhances Scotland's natural and historic marine environment. EnQuest will ensure that any potential impacts associated with the Heather pipeline decommissioning operations will be kept to a minimum.

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. EnQuest will ensure that any potential impacts on other sea users associated with the proposed Heather pipeline 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 (GHGs'). EnQuest will ensure that every effort will be made to reduce and minimise emissions and GHGs associated with Heather pipeline decommissioning operations.

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.

EnQuest will ensure that any potential impacts to protected species and sites associated with Heather pipeline decommissioning operations will be kept to a minimum.

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. EnQuest will ensure that any potential impacts to water quality associated with Heather pipeline decommissioning operations will be kept to a minimum.

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 considered and mitigation measures adopted, if necessary, to allow an activity to proceed within these limits. EnQuest will ensure that any potential impacts to air quality with Heather pipeline decommissioning operations will be kept to a minimum.

GEN 21 – Cumulative Impacts

Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation. EnQuest will ensure that any potential cumulative impacts to air and water quality and biological communities with Heather pipeline decommissioning operations will be kept to a minimum.

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. EnQuest will ensure that any material returned to shore as a result of the Heather pipeline decommissioning activities adheres to the Waste Hierarchy.

OIL AND GAS 3 - Minimising environmental and societal 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 societal constraints. EnQuest will ensure that the required onshore resources and impacts to fisheries and other sea users for the Heather pipeline decommissioning activities will be minimised.

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. EnQuest have the relevant risk reduction measures and environmental management systems in place for the decommissioning of the Heather pipelines and infrastructure.

5. IMPACT ASSESSMENT SCREENING AND JUSTIFICATION

5.1 Assessment of Potential Impacts

An ENVID was undertaken to discuss the proposed decommissioning activities and any potential impacts these may pose. The discussion identified nine impacts that either have the potential to arise based on the proposed removal methods or required inclusion and further discussion due to current regulatory and industry interest. 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 (Appendix B). The potential impacts are tabulated in Table 5.1.1 together with justification statements for the screening decisions and proposed mitigation. Physical presence of infrastructure decommissioned *in situ* in relation to other sea users and seabed disturbance were scoped in for further assessment and are discussed in Section 6.

EnQuest will follow routine environmental management activities, for example appropriate project planning, contractor management, vessel audits, activity permitting and legal requirements to report discharges and emissions, such that the environmental and societal impact of the decommissioning activities will be minimised. EnQuest will ensure that lessons learnt from previous decommissioning scopes will be reviewed and implemented as appropriate to all aspects of the Heather pipeline DP.

Table 5.1.1 Impact assessment screening

Potential impact	**Emissions to air**	**Further assessment?**	**No**
Rationale			
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 asset 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 work scope suggests that emissions relating to decommissioning will be small relative to those during the lifetime of production. The estimated CO_2 emissions to be generated by the selected decommissioning options are 17,821 Te, this equates to 0.14% of the total UKCS emissions in 2018 (13,200,000 Te; OGUK, 2019). These emissions have been calculated assuming a worst case of approximately 68 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, placement of rock and a post-decommissioning monitoring. The total emissions estimate also includes the emissions associated with the re-manufacture of steel decommissioned *in situ* (316,355 Te CO_2). See Appendix C 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 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) [53]. EnQuest is dedicated to minimising greenhouse gas emissions from decommissioning operations, as far as is reasonable for each project. EnQuest 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.			
Mitigation measures			
• Vessel management in accordance with EnQuest's marine procedures; • Minimal vessel use/movement; • Carbon and Energy Plan; • Vessel sharing where possible; and • Engine maintenance.			
Potential impact	**Seabed disturbance**	**Further assessment?**	Yes
Rationale			
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 protection structures and the surface laid pipelines and umbilicals, 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 from 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 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 and 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. EnQuest 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 6.2.			
Mitigation measures			
• See Section 6.2.4.			
Potential impact	**Physical presence of vessels in relation to other sea users**	**Further assessment?**	**No**
Rationale			
The presence of a small number of vessels for pipeline and umbilicals and subsea protection structure decommissioning activities will be relatively short-term in the context of the life of the Heather 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 Heather platform and at Ninian Central 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 Heather pipelines, umbilicals and subsea structures is estimated to require up to three 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.

Mitigation measures

- Minimal vessel use/movement; and
- Notification to Mariners.
- Opening up of 500 m safety exclusion zones following close-out.

Potential impact	**Physical presence of infrastructure decommissioned *in situ* in relation to other sea users**	**Further assessment?**	**Yes**

Rationale

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.

The pipelines and umbilicals to be decommissioned *in situ* are those trenched and buried for most of their length. Where free spans are present these will be remediated with rock cover, as will any exposed pipeline ends following cutting activities. In order to plan for worst case scenario, this EA will assess the placement of rock on the total length of both exposures and spans.

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.

EnQuest is committed to leaving a clear, safe seabed. The clear seabed will be validated by an independent verification survey and survey method agreed 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 6.1.

Mitigation measures

- See Section 6.1.5.

Potential impact	Discharges to sea	Further assessment?	No

Rationale

Discharges from vessels are regulated activities that are managed on an ongoing basis through existing legislation and compliance controls.

All subsea infrastructure in the project area will have been drained and flushed at CoP. This is a pre-decommissioning activity which has been permitted as appropriate, and therefore, falls outside the scope of this EA. Any discharges from infrastructure occurring during decommissioning activities will similarly be assessed in more detail as part of the environmental permitting process (e.g., through Master Application Templates/Subsidiary Application Templates). Controls will be in place, as relevant, through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations. Residual liquids, containing hydrocarbons, present during the decommissioning of pipelines and subsea infrastructure will be treated before being discharged to sea, such that the discharge will comprise treated water.

Pipelines will be flushed to achieve a hydrocarbon concentration in flush fluids of less than 30 mg/l and filled with seawater. All residual solids will be shipped to shore for disposal.

Considering the above, discharges to sea during decommissioning activities are not assessed further herein.

Mitigation measures

- MARPOL compliance;
- Bilge management procedures;
- Vessel audit procedures;
- Monitoring and treatment of pipeline fluids being flushed; and
- Contractor management procedures.

Potential impact	Underwater noise	Further assessment?	No

Rationale

There is potential for localised injury and disturbance to marine mammals and fish through noise from cutting operations and vessels across the project area, however, recent research findings regarding noise levels emitted during DWS procedures determined they were not easily discernible above the background noise levels (mostly attributed to vessel activity)[61]. In the absence of recorded field measurements, it seems likely that this form of cutting would not generate a great deal of noise and may not be detectable above other sources operating simultaneously (i.e. vessels) within the project area.

The need for geophysical surveys undertaken for post-decommissioned infrastructure left *in situ* will be determined in the future and assessed through the process of permit applications as appropriate. Multibeam echosounder survey equipment is likely to be used for imaging and identification of pipeline exposures. The JNCC (2020) Guidelines will be employed for mitigation of noise impacts to marine mammals for future survey work involving seismic survey equipment [39].

As presented in the ENVID exercise, the activities associated with the decommissioning of the Heather pipelines are likely to be minor and are unlikely to generate significant noise levels. As the project is not

located within a marine mammal protection area and EAs for offshore oil and gas decommissioning projects generally show no potential injury or significant disturbance associated with the non-survey decommissioning activities. Further assessment of the impact of the decommissioning on this receptor is therefore not required.

Mitigation measures

- Vessel management;
- Minimal vessel use/movement;
- Vessel sharing where possible; and
- Cutting activities will be minimised and carried out in isolation where possible.

Potential impact	**Resource use and waste**	**Further assessment?**	**No**

Rationale

Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Any opportunities for increasing fuel efficiency and reducing use of resources will be identified and implemented by EnQuest where possible.

The estimated total energy usage for the project is 357,563 GJ. This number accounts for all operations, material recycling, and the resource loss associated with decommissioning items *in situ*. This is considered very low, compared to the resources utilised during the production phase of the project. A summary breakdown of energy use associated with the project is available in Appendix C.

The onshore treatment of waste from the Heather pipeline decommissioning activities will be undertaken according to the principles of the waste hierarchy, a conceptual framework which ranks the options for dealing with waste in terms of sustainability. The waste hierarchy is a key element in OSPAR Decision 98/3 and BEIS, OPRED 2018 Guidance Notes [4].

Waste material will be treated using the principles of the waste hierarchy, focusing on the reuse and recycling of wastes where possible. Raw materials will be returned to shore with the expectation to recycle the majority of the returned non-hazardous material. Other non-hazardous waste which cannot be reused or recycled will be disposed of to a landfill site. Typically, around 90% of the materials from decommissioning projects can be recycled [56].

There may be instances where infrastructure returned to shore is contaminated (e.g., by NORM, hazardous, and/or special wastes) and cannot be recycled. In these instances, the materials will require disposal. Hazardous waste resulting from the dismantling of the Heather pipelines will be pre-treated to reduce hazardous properties or render it non-hazardous prior to recycling or disposing of it to a suitable landfill site. Under the Landfill Directive (The Landfill (Scotland) Regulations 2003), pre-treatment is necessary for most hazardous wastes destined to be disposed of to a landfill site. However, the weight and/or volume of such material is not expected to result in substantial landfill use.

The recycling and disposal of wastes are covered by EnQuest's Waste Management Strategy, which is compliant with relevant regulations relating to the handling of waste offshore, transfer of controlled, hazardous (special) waste and TFSW ('Trans-Frontier Shipment of Waste'). The Waste Management Strategy is guided by EnQuest HSEA Policy (Appendix D) and commitments to best practice in waste management. This includes the mapping and documenting of waste management arrangements for ongoing monitoring of waste procedures and performance review against target Key Performance Indicators ('KPIs').

It should be noted that, only licenced contractors which can demonstrate they are capable of handling and processing the material to be brought ashore will be considered for onshore activities and this will form an integral part of the commercial tendering process. Due diligence audits will take place of waste

contractors/sub-contractors to ensure that all necessary handling and reporting measures (including tracking of wastes, accounting and identification of wastes, wastes generated per asset and waste segregation) are taking place. Specific audit/monitoring schedules will be set up as part of the disposal yard contract award.

No further assessment of resource use or waste is necessary.

Mitigation measures

- Adherence to the Waste Hierarchy;
- Waste Management Strategy and active waste tracking;
- Selection of suitably licenced landfill/disposal sites (if applicable);
- Communication with relevant Regulator(s) (e.g., Scottish Environmental Protection Agency ('SEPA')) established;
- Vessel management;
- Minimal vessel use/movement;
- Vessel sharing where possible;
- Engine maintenance; and
- EEMs (Environmental and Emissions Monitoring System) tracking and close-out reporting.

Potential impact	**Accidental events**	**Further assessment?**	**No**

Rationale

Well decommissioning is outside of the scope of this specific impact assessment, since it not dependent on approval of the DP. The possibility of a well blowout therefore does not require consideration in this assessment (it is assessed as part of separate well intervention and marine licence applications). Pipelines and umbilicals will have been flushed and cleaned prior to the decommissioning activities described herein being carried out. Release of a hydrocarbon and chemical inventory is therefore also out of scope of this assessment.

Therefore, the most likely origin of an accidental event would be from an unplanned instantaneous diesel release from the largest vessel employed in the decommissioning activities. The worst-case scenario would be a heavy lift vessel ('HLV') with a maximum fuel capacity of approximately 1,569 m^3. The fuel inventory of the HLV vessel is likely to be split between several separate fuel tanks, significantly reducing the likelihood of an instantaneous release of the full inventory. Any spills from vessels in transit or participating in decommissioning activities are covered by a Communication and Interface Plan ('CIP') of the EnQuest Northern North Sea Offshore Oil Pollution Emergency Plan ('OPEP') [25], and by separate Shipboard Oil Pollution Emergency Plans ('SOPEPs'). EnQuest will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP.

There is a very low likelihood of vessel-to-vessel collision occurrence, an estimated one collision in 685 years. Considering this, and in line with the mitigation measures in place, a vessel collision scenario does not require further assessment here. Vessel collision with any of the surface installations is in some cases an order of magnitude less likely.

In addition to the mitigation measures outlined in the individual vessel SOPEPs, EnQuest requires manned bridges, navigational aids and monitoring of safety zones. Only project vessels will be present when activity is taking place within 500 m safety exclusion zones.

Dropped object procedures are industry-standard and will be employed. All unplanned losses in the marine environment will be attempted to be remediated and notifications to other mariners will be sent

out. The post-decommissioning clear seabed verification survey will aid in the identification of in-field dropped objects.

All lift operations will happen within safety zones therefore there is minimal risk from dropped objects on live third-party infrastructure from these activities. During transport the infrastructure will be transported on deck with suitable sea fastening as per safe vessel operating procedures. As a result, there will be minimal risk from significant dropped objects during transport. Should such an event occur, the likely destination ports would mean transport over gas or condensate lines only which would result in a low-risk hydrocarbon release which could be managed by offshore spill procedures with minimal environmental impact.

Dropped object procedures are industry standard and there is a very remote probability of any interaction with any live infrastructure. When planning for such transport efforts will be made to minimise the transit over live infrastructure.

In line with the mitigation measures in place, accidental events are not assessed further herein.

Mitigation measures

- OPEP in place for operations;
- SOPEP on all vessels;
- Navigational warnings in place;
- 500 m zones operational until seabed clearance certified;
- Spill response procedures;
- Contractor management and communication;
- Lifting operations management of risk;
- Dropped object recovery and debris clearance surveys;
- PON2 submission; and
- Careful planning, selection of equipment, management and implementation of activities.

Potential impact	**Disturbance of seabirds**	**Further assessment?**	No

Rationale

It is expected that activities associated with the decommissioning of the Heather pipelines will likely resort in some level of disturbance to the offshore seabird behaviour within the project area.

Birds can interact with offshore oil and gas developments in various ways. This interaction can be with day-to-day operations or potentially with accidental large oil spills.

Marine birds are particularly vulnerable to oil pollution due to their distribution, foraging and breeding behaviour. Petroleum exposure alters feather microstructure, resulting in loss of water-proofing, thermal insulation and buoyancy, as well as flight impairment. Ingestion of oil from preening and feeding can have further physiological health effects, leading to organ failures. While major accidental releases of petroleum at sea can have profound effects on marine bird populations, chronic exposure to smaller amounts of petroleum can also lead to poor health conditions. As detailed within Section 4, SOSI within the Heather pipelines area is mostly 'Low' throughout the year with only September and October being 'Medium' in Blocks 3/2 and 3/3.

Day-to-day decommissioning operations can also have impacts on marine birds. For example, some bird species are particularly sensitive to disturbance caused by vessel and helicopter traffic, which can result in displacement from their preferred foraging habitats. Other bird species can be attracted to or disoriented by light sources, which can result in collision with infrastructure. The operations and activities associated

with the Heather pipelines decommissioning project will be relatively short in duration and only require 3 vessels over approximately 69 days. This quantity is unlikely to significantly alter the shipping activity within the area, thus having minimal additional effect to the seabird disturbance currently experienced.

In recent years, there has been an increase in the number of seabirds utilising offshore infrastructure for nesting. Opportunistic species such as kittiwake and herring gull are utilising artificial nest locations and successfully rearing chicks. In some instances, colonies of several hundred birds have established and return each year. Although for most offshore platforms, the number of breeding birds remains very low.

As the scope of this EA deals solely with the subsea element of Heather infrastructure and due to the fact disturbance to nesting seabirds was assessed within the Heather Jacket EA [27], it will not be assessed here further.

Mitigation measures

- Non-lethal deterrent methods;
- Pre-removal bird survey;
- If possible and if birds are expected to be present at the Heather jacket, EnQuest will endeavour to conduct any jacket removal works outside of the stipulated nesting season;
- Ornithologist support if required; and
- Disturbance licence in discussion with OPRED if required.

5.2 Aspects Taken Forward for Further Assessment

Based on the ENVID results (Appendix B) which informed the screening process in Section 5, the physical presence of infrastructure decommissioned *in situ* and seabed disturbance have been identified as requiring further assessment within the EA.

Both these potential impacts are addressed in detail within Section 6.1 and Section 6.2.

6. IMPACT ASSESSMENT

6.1 Physical Presence of Items Decommissioned *In Situ* for Other Sea Users

6.1.1 Approach

The proposed Heather pipeline decommissioning activities have the potential to impact upon other users of the sea, namely commercial fisheries. This may happen during the decommissioning activities themselves or after decommissioning 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. The following issue was 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 process and is assessed against the receptor throughout the rest of this section.

6.1.2 Effects on Sensitive Receptors

The long-term presence of subsea infrastructure decommissioned *in situ* has the potential to interfere with other sea users that may use the area. In particular, exposures or even free spans associated with infrastructure decommissioned *in situ,* which may arise during initial decommissioning and long-term degradation, introduce a snagging risk to some fisheries. In addition to the physical presence of the pipelines decommissioned *in situ*, seabed depressions, local placement of rock, mattresses and sand and cement bags also increase the potential for interaction with fishing gear.

Demersal fishing gear which interacts with the seabed are vulnerable to snagging. Snagging may lead to the loss or damage of catch or fishing gear and in extreme circumstances may result in vessel destabilisation. There have been reports of 15 fishing vessels sinking due to snagged gear between 1989 and 2014 which resulted in 26 fatalities on the UKCS [46]; [63]. Generally, the pattern of interactions between oil and gas infrastructure and fishing gear are spatially concentrated in the muddy NNS where demersal fisheries are generally concentrated [63] as opposed to the Southern North Sea. On review of demersal trawling activity on the UKCS, it was determined that a low percentage (0.93%) of demersal trawling trips specifically targeted oil and gas pipelines compared with surrounding areas [63].

Annual fishing effort in the project area (ICES rectangle 50F0 and 50F1) is low-moderate; in 2020 there were 486 days of effort in 50F0 and 252 in 50F1, which are both lower than preceding years (Table 4.4.1). Within ICES 50F0 demersal species made up 64% of the catch by weight and approximately 75% of the value of landings. In ICES 50F1 demersal fisheries made up 99% of the catch by weight and 98% of the total value. The remainder of catch is mostly comprised of pelagic species for 50F0 and shellfish for 50F1 (Table 4.4.1). Demersal catch includes trawl gears which interact with the seabed. Trawls were the main gear type used in both rectangles, making up 77% and 90% of the effort in 2020. Hooks and lines and seines are also used in the area but to a lesser extent [68]. Due to the proposed timescales of the project, and the current political situation regarding Brexit, there is potential for the fishing patterns and activity experienced to date to be affected quite heavily and could be subject to change in the period leading up to the decommissioning activity window for the Heather pipelines.

6.1.3 Physical Presence of Subsea Infrastructure Decommissioned *In Situ* Posing a Potential Snagging Risk

The long-term presence of infrastructure decommissioned *in situ* has the potential to interfere with other sea users that may use the area. The proposed Heather pipeline decommissioning activities that are deemed to represent a potential impact are the removal of short surface laid sections of PL9, PL9A, PL352 and ESDV umbilical, leaving large sections of each to be decommissioned *in situ* on the seabed. At the time of installation, with the exception of PL9A, PL9, PL352 and the ESDV umbilical were trenched and left to back fill naturally overtime. On the approaches to the Heather installation, the pipelines and umbilical are all buried within the drill cuttings pile. Over the years, the pipelines have been extensively surveyed (Refer to Appendix E) with remedial works periodically being required to reduce the length of pipeline spans to maintain the operational integrity of the pipeline and to ensure that they remained in a safe condition. Remedial works that were conducted usually involved the deposition of sand and cement bags along with concrete mattresses, although in 2010 such remedial works on PL9 involved the deposition of ~1 km of rock at a number of locations along the pipeline

6.1.3.1 PL9

Within the latest survey (2021), it can be seen in Figure 6.1.1 that the PL9 has experienced multiple exposures and spans along much of its length. In total, there are 552 exposures and 211 spans.

A summary of the historical data obtained is presented in Table 6.1.1. The exposure data for 2015 appear to be anomalous. An assessment of the historical exposures and span data would suggest that the extent of exposures and spans associated with PL9 has been reducing over time.

Table 6.1.1 PL9 historical exposures and span summary

YEAR	NO. Of EXPOSURES	Σ LENGTH (M)	MIN EXP LENGTH (M)	MAX EXP LENGTH (M)	NO. Of SPANS	Σ LENGTH (M)	MIN SPAN LENGTH (M)	MAX SPAN LENGTH (M)
1987	n/a	n/a	n/a	n/a	52	1,701.0m	16.0m	96.0m
1988	n/a	n/a	n/a	n/a	52	1,636.0m	11.0m	98.0m
1989	n/a	n/a	n/a	n/a	48	1,640.0m	20.0m	97.0m
1990	n/a	n/a	n/a	n/a	51	1,603.0m	14.0m	93.0m
1991	n/a	n/a	n/a	n/a	51	1,582.0m	15.0m	86.0m
1992	n/a	n/a	n/a	n/a	52	1,622.0m	12.0m	99.0m
1993	n/a	n/a	n/a	n/a	56	1,611.0m	12.0m	88.0m
1995	n/a	n/a	n/a	n/a	53	1,451.0m	12.0m	100.0m
1997	n/a	n/a	n/a	n/a	54	1,606.0m	10.0m	89.0m
2000	n/a	n/a	n/a	n/a	48	1,482.0m	10.0m	95.0m
2010	583	18,556.3m	0.0m	514.4m	139	1,625.4m	4.7m	38.3m
2012	589	17,150.5m	0.7m	474.8m	79	771.7m	5.1m	19.1m
2015	5	424.0m	23.0m	141.0m	5	115.0m	16.0m	36.0m
2018	633	13,609.3m	0.5m	317.3m	214	1,772.1m	0.8m	27.0m
2021	551	13,982m	1.0m	476m	211	2,009m	2m	36m

Notes:

1. n/a – data not available.
2. Limited exposure data available up to 1995.

3. The exposure and span data for 2015 appear to be anomalous; no burial data available for the years prior to 2010 or for 2015.

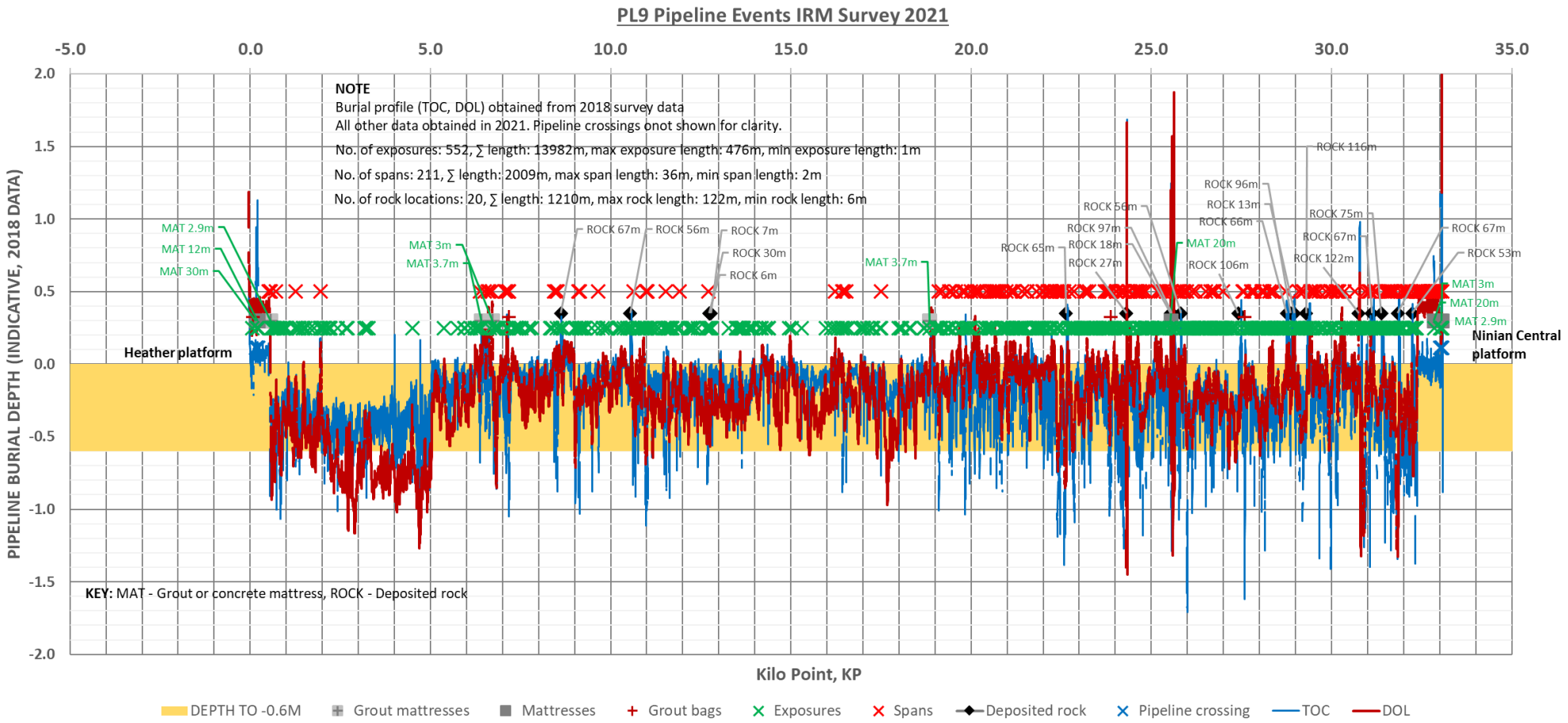


Figure 6.1.1 PL9 2021 Burial profile

6.1.3.2 PL352

The design intent of PL352 was that the pipeline be trenched with a 1 m minimum cover, with the trench being left to backfill naturally. Past surveys have shown that most of the pipeline generally has a good depth of cover although over the years it has experienced multiple exposures and occasional spans along its length. The latest survey conducted in 2018 is represented in Figure 6.1.2 showing that there is a total of 29 exposures and 8 spans.

A summary of the historical data obtained is presented in Table 6.1.2. The exposure data for 2015 appear to be anomalous[6], but an assessment of the historical exposures and span data would suggest that the number and extent of exposures and spans associated with PL352, similar to that of PL9, has been reducing over time. The approach to decommissioning might either be to remediate the exposures or spans as they are at the time of decommissioning or continue to monitor the pipeline on the assumption that the exposures and spans will eventually disappear.

Table 6.1.2 PL352 historical exposures and span summary

YEAR	NO. Of EXPOSURES	Σ LENGTH (M)	MIN EXP LENGTH (M)	MAX EXP LENGTH (M)	NO. Of SPANS	Σ LENGTH (M)	MIN SPAN LENGTH (M)	MAX SPAN LENGTH (M)
1987	n/a	n/a	n/a	n/a	8	214.0m	13.0m	46.0m
1988	n/a	n/a	n/a	n/a	8	202.0m	13.0m	36.0m
1989	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1990	n/a	n/a	n/a	n/a	8	160.0m	15.0m	31.0m
1991	n/a	n/a	n/a	n/a	8	155.0m	12.0m	27.0m
1992	n/a	n/a	n/a	n/a	6	102.0m	8.0m	26.0m
1993	n/a	n/a	n/a	n/a	6	95.0m	3.0m	26.0m
1995	n/a	n/a	n/a	n/a	5	84.0m	7.0m	25.0m
2010	37	288.5m	n/a	30.0m	7	78.2m	5.8m	24.2m
2014	28	221.0m	0.9m	54.9m	11	61.1m	1.3m	15.7m
2015	3	58.2m	13.2m	29.0m	4	41.5m	6.7m	16.0m
2018	29	106.9m	n/a	27.1m	8	30.4m	0.0m	13.3m

Notes:

1. n/a – data not available.
2. Limited exposure data available up to 1995.
3. The exposure and span data for 2015 appear to be anomalous; no burial data available for the years prior to 2010 or for 2015.

6.1.3.3 ESDV Umbilical

As previously stated, the ESDV Umbilical is laid in the same trench as PL352. As per PL352, the umbilical has experienced exposures and spans over the years and data would suggest that the number and extent of exposures has been reducing over time. For the purposes of this assessment, it is assumed that the occurrence of exposures and spans between Heather and the ESDV skid and protection frame, are the same for both PL352 and the ESDV umbilical.

Using the 2018 survey data for PL352, the ESDV umbilical experienced a total of 4 exposures with a total length of 45 m (c.f. 70 m in 2010), the longest exposure was <1 m (c.f. 32 m in 2010). At the same time, 5 spans were recorded with a cumulative length of 20 m, the longest of which was <1 m. Individual survey data conducted in 2010 can be seen Appendix E.3.

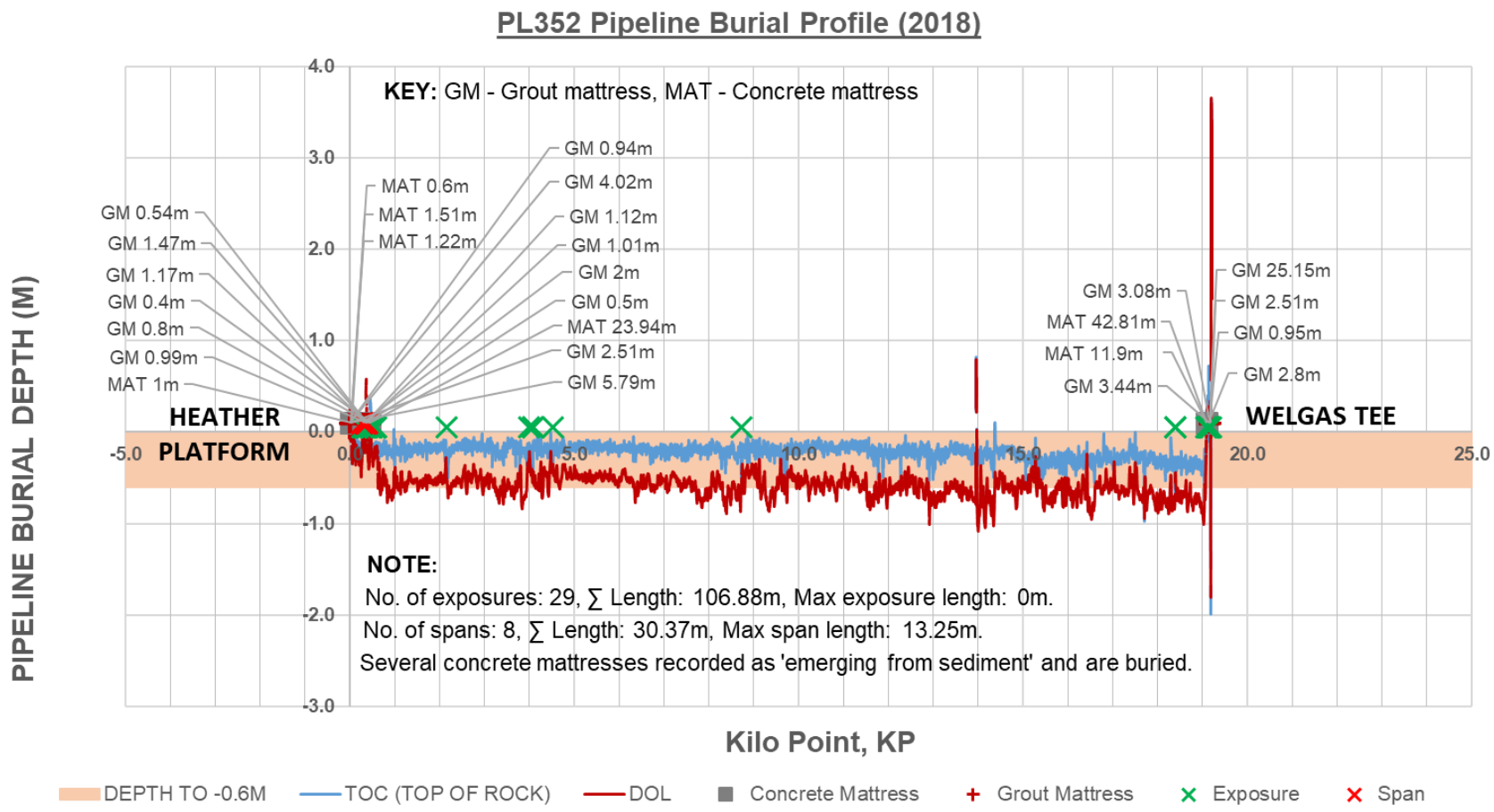


Figure 6.1.2 PL352 2018 burial profile

Based on 2018 survey data, approximately 25% (13,716.2 m) of the Heather pipelines and umbilicals are exposed and 4% (1,802.5 m) is in span, the remainder of the pipeline is achieving full burial/cover. At present, the proposed approach for the Heather pipelines is to decommission the majority of the pipeline length *in situ*.

The surface-laid sections located near the Heather and Ninian Central platforms (approximately 790 m) will be removed and approximately 2 km of spans and any cut ends/locations, will be remediated with the placement of rock. Thereafter, the pipeline burial status should continue to be monitored using a Risk Based Inspection Regime.

As a contingency this EA will account for the deposition of rock on ~14 km of exposures (the total length of exposures) however, this is a worst-case scenario. The approach to decommissioning both spans and exposures may also differ at the time of decommissioning should immediate remediation be required

For the infrastructure decommissioned *in situ* on the seabed, EnQuest will ensure all Heather areas are left over-trawlable without snagging risks and that any placement or rock required will be appropriately graded with a 1:3 slope which allows fishing gear to trawl across it without snagging. The method of determining snag risk removal will be determined with OPRED and non-intrusive methods will be used in the first instance.

Following decommissioning, a post decommissioning survey campaign will be agreed and arranged in accordance with OPRED to monitor any change in burial status and any spans or exposures that may arise. If any remediation is required, this will be discussed and agreed with OPRED.

6.1.4 Cumulative and Transboundary Impacts

There are no other similar activities known to be occurring in the nearby area within the same timeframe (for a schedule of activities see Section 3.5). As a result, there are not likely to be any snagging-related cumulative impacts on commercial fisheries, resulting from activities coinciding with the decommissioning. EnQuest will, however, continue to maintain a thorough understanding of decommissioning activity and programmes occurring within the NNS region during the course of this operation schedule and will make sure that any activities are aligned accordingly.

The Heather Field is located approximately 50 km from the UK/Norway border. Automatic Identification System ('AIS') tracks of the average weekly density of fishing vessels between 2012 and 2017 show a low transiting density (2-10 transits per week) [52] which suggests that, despite proximity to an international border, there is limited vessel movement associated with fishing vessels around the project area.

As described in Section 4.4, UK vessels account for 46.6% of fishing vessels. The non-UK origin fishing vessels are predominantly French (22.7%) and Norwegian (14.9%). The remainder of the sightings comprise vessels from Denmark, Germany, Netherlands, Denmark, Irish and Sweden [5].

There are no negative cumulative impacts expected as a result of the decommissioning. As the decommissioning activities proceed, new areas of sea/seabed will become available to fisheries and other sea users, reducing the overall cumulative impact and resulting in a positive impact to these users. These include removal of the 500 m safety zones within the Heather area. In terms of

the scale of the decommissioning activities with regards to other sea users, there are an estimated 651 safety zones in the within the UKCS, as of 2015 [58]. Since the decommissioning of the Heather area will see the removal of safety zones resulting in approximately 0.785 km^2 of occupied sea area being returned to navigable water. This will assist in reducing the areas of the currently unavailable to commercial fisheries and in reducing the potential for cumulative impact from decommissioning of structures.

Despite the likely presence of foreign fishing fleets within the Heather Field, the snagging risk remains small. All EU fisheries will also be informed of the presence of the infrastructure via Kingfisher notification. Therefore, there is no transboundary impact on commercial fisheries as a result of the decommissioning of the Heather Pipeline.

6.1.5 Mitigation Measures

The following measures will be adopted to ensure that snagging risks to commercial fisheries and as a result of the Heather pipelines being partially decommissioned *in situ*, are minimised to a level that is as low as reasonably practicable ('ALARP'):

- Prior to commencement of operations, the appropriate notifications will be made, and maritime notices posted;
- UK Hydrographic Office, FishSAFE and Kingfisher will be informed of any remaining infrastructure decommissioned *in situ*. This information will be divulged to EU member parties fishing within UK waters;
- The 500 m safety exclusion zone will remain in operation during the decommissioning activities reducing risk of non-project related vessels entering into the area where substructure decommissioning activities are taking place;
- Ongoing consultation with fisheries representatives;
- Post-decommissioning, a clear seabed verification survey will be undertaken for the area. The method of verification will be confirmed with the regulator in due course; and
- EnQuest commit to a post-decommissioning monitoring campaign, the frequency and number of which will be agreed with the regulator and appropriate stakeholders.

6.1.6 Residual Impacts

Of all sea users, commercial fisheries are most likely to be affected by the proposed decommissioning activities. Impacts to fisheries mainly arise from the potential for snagging generated by the decommissioning *in situ* of pipelines.

Residual impacts from the degradation of the Heather pipelines decommissioned *in situ* will be managed through continued monitoring and communications with other sea users and are not expected to have any long-term impacts on the access or functioning of currently exploited fishing grounds.

While the impact magnitude may be considered 'High' owing to the potential severity of a snagging event, the frequency of such an event is highly unlikely due to the notification and navigational warnings which will be in place, and thus considered to be 'Low' risk. The probability is measured as 'Low' due to the relatively localised area of remaining infrastructure and monitoring schedule in place to alert of any potential changes in burial depth. The 'Low' probability of the proposed decommissioning operations generating a snagging risk, combined

with the management and control measures that will be in place to mitigate against such risk, conclude that the decommissioning of the Heather pipelines will not adversely impact upon commercial fisheries operating within the project area. For these reasons, impacts to commercial fisheries was assessed as low.

6.2 Seabed Disturbance

6.2.1 Introduction

This section discusses the potential environmental impacts associated with seabed interaction resulting from the proposed Heather pipeline decommissioning activities.

The decommissioning activities have the potential to impact the seabed in the following main ways:

- Direct impact through:
- Removal of subsea infrastructure including, subsea protection structures and stabilisation materials;
- Removal of pipeline ends; and
- Rock-placement for pipeline ends and exposures (where required).
- Indirect impact through:
- Re-suspension and re-settling of sediment; and
- Footprint of remaining infrastructure.

Direct disturbance, the physical disturbance of seabed sediments and habitats has the potential to cause temporary or permanent changes to the marine environment, depending upon the nature of the associated activity. Indirect disturbance 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. Indirect disturbance is considered temporary in all instances. For calculation of the temporary indirect impact to the seabed, the area is double the direct impact area.

Vessels utilising DP will be deployed to carry out the decommissioning activities, therefore there are no additional seabed impacts associated with anchors and mooring lines. A jack-up rig may be utilised to complete well decommissioning activities however, these activities fall outside the scope of this EA. The appropriate permits will be applied for in support of well decommissioning activities via the BEIS PETS. An application to decommission the wells will be made via the online WONS on the NSTA Energy Portal.

6.2.2 Description and Quantification of Impacts

6.2.2.1 Pipeline and Cable Decommissioning

Following the removal of the pipeline ends, the remaining pipelines, umbilicals, cables and stabilisation materials will either be partially removed/decommissioned *in situ*. Table 6.2.1 presents the approximate footprint of seabed affected by decommissioning the pipelines and umbilicals (or components of) both *in situ* and partial removal.

The length of the ends to be cut from each pipeline/umbilical varies according to the length of each trench transition (Table 6.2.1). Where the pipeline will be partially removed, a 10 m corridor

centred (5 m each side) around each pipeline/umbilical has been assumed. Any associated placement of rock at the cut ends or for remediation of exposures/spans is also calculated separately as a source of permanent impact (Table 6.2.2).

6.2.2.2 Pipeline Stabilisation Materials

There are a total of 107 mattresses, an estimated 3,274 sand and cement bags and 1,032 m of deposited rock supporting pipeline infrastructure within the Heather decommissioning area. The burial status of the concrete mattresses and sand and cement bags will be determined when decommissioning activities are being carried out, however, it is currently proposed that 360 sand and cement bags and 75 mattresses are removed. The mattresses remaining *in situ* are mostly associated with remediation of spans and those buried under deposited rock also used to remediate spans. The number of sand and cement bags is not specified within the 'as-built' data or IRM data and is therefore only indicative; except where noted on the schematics. The aim is to recover all exposed sand & cement bags to shore for recycling and disposal except for where they were used for remediation of pipeline spans. These will be left *in situ* and buried under deposited rock used to remediate pipeline spans.

The dimensions have been used to calculate an area for all stabilisation materials which is shown in Table 6.2.3. The method of calculation assumes that all mattresses and sand and cement bags will be laid on the seabed in a single layer, however it is important to note that this is highly unrealistic. Mattresses and sand and cement bags are used to stabilise and support infrastructure therefore they are more likely to be piled on top of one another, or even on top of certain items/structures. As such the numbers presented are conservative estimates (Table 6.2.3).

6.2.2.3 Pipeline Protection Structures

The PL352 ESDV protection structure has no associated stabilisation features (Figure 2.2.4) and measures 24 m^2. The structure is not piled and is situated within the pipeline trench.

It is currently proposed that the structure will be fully removed from the seabed and returned to shore. The dimensions have been used to calculate an area for seabed disturbance (Table 6.2.1).

Table 6.2.1 Seabed footprint related to the decommissioning of pipelines and umbilicals								
Field	**Item**	**Total length (m)**	**Decommissioning Approach/ length (m)**		**Expected duration of disturbance**	**Total (Note 1)**		
						Temporary Direct disturbance area (km^2)	**Temporary Indirect disturbance area (km^2)**	**Long-term disturbance area (km^2)**
Heather	PL9	33,176	Remove ends	470	Temporary	0.0047	0.0094	
			Decommission *in situ*	32,706	Long-term			0.327
	PL9A	139	Remove ends	70	Temporary	0.0007	0.0014	
			Decommission *in situ*	69	Long-term			0.0007
	PL352	19,394	Remove ends	200	Temporary	0.002	0.004	
			Decommissioning *in situ*	19,194	Long-term			0.192
	ESDV Umbilical	570	Remove ends	50	Temporary	0.0005	0.001	
			Decommissioning *in situ*	520	Long-term			0.0052
					Total	**0.008**	**0.016**	**0.525**

Note:

1) Assumes a 10 m wide disturbance corridor centred (5 m each side) around each pipeline/umbilical.

An estimated 25 Te (covering an area of 50 m^2) of rock is thought to be required per cut end. It is assumed that the placement of rock will be required at all pipeline ends. Remediation via the placement of rock, of the exposures on PL9 (14 km) is calculated as a worst-case scenario, however it is deemed that it will be required on PL9 spans (2 km). As before, the indirect impact area is double the direct impact area (Table 6.2.2).

Table 6.2.2 Seabed footprint related to the requirement for remedial rock placement

Field	Pipeline(s)	Rock Location	Rock Dimensions	Quantity of rock (Te)*	Total	
					Permanent direct disturbance area (km^2)	Temporary indirect disturbance area (km^2)
Heather	PL9	Exposures	14 km for exposures running along PL9 x 10 m corridor (total 140,000 m^2)	30,800	0.14	0.28
		Pipeline end	50m^2 x 2 (pipeline ends)	50	0.0001	0.0002
	PL9A	Pipeline end	50m^2 x 2 (pipeline ends)	50	0.0001	0.0002
	PL352	Pipeline end	50m^2 x 2 (pipeline ends)	50	0.0001	0.0002
	ESDV Umbilical	Pipeline end	50m^2 x 2 (pipeline ends)	50	0.0001	0.0002
				Total	**0.1404**	**0.2808**

Table 6.2.3 Seabed footprint related to the pipeline stabilisation and protection materials								
Field	Location	Stabilisation type	No.	Dimensions (m)	Disposal route	Total		
						Temporary direct disturbance area (km2)	Temporary indirect disturbance area (km2)	Long-term disturbance area (km2)
Heather	PL9 infield between Heather & Ninian Central	Deposited rock	1	1,032	Decom *in situ*			0.001032
		Sand and cement bags	2,590	0.5 x 0.5	Decom *in situ*			0.000648
	PL9 at Ninian Central	Concrete Mattresses	7	3 x 1.5	Remove	0.000032	0.000064	
	PL352 at Heather	Concrete Mattresses	20	3 x 1.5	Decom *in situ*			0.00009
		Concrete Mattresses	21	3 x 1.5	Remove	0.000095	0.00019	
		Sand and cement bags	274	0.5 x 0.5	Decom *in situ*			0.000069
		Sand and cement bags	300	0.5 x 0.5	Remove	0.000075	0.00015	
	PL352 at Welgas Tee	Concrete Mattresses	26	3 x 1.5	Remove	0.000117	0.000234	
		Sand and cement bags	50	0.5 x 0.5	Remove	0.000013	0.000026	
		Sand and cement bags	50	0.5 x 0.5	Decom *in situ*			0.000013
	ESDV Umbilical	Concrete Mattresses	12	3 x 1.5	Decom *in situ*			0.000054

		Concrete Mattresses	21	3 x 1.5	Remove	0.000095	0.00019	
		Sand and cement bags	10	0.5 x 0.5	Remove	0.000003	0.000006	
	PL352 ESDV	Protection structure	1	7.7 x 4.2	Remove	0.000032	0.000064	
					Total	**0.000462**	**0.000924**	**0.001906**

6.2.2.4 Summary

Table 6.2.4 **Seabed footprint summary**provides a summary of the estimated potential seabed disturbance associated with the various decommissioning activities outlined in Section 3.6.

The overall expected temporary area of disturbance associated with all the decommissioning activities is 0.31 km^2, A further 0.14 km^2 of permanent impact, exclusively attributed to the placement of rock is also expected. The long-term impact associated with decommissioning infrastructure *in situ* accounts for 0.53 km^2.

Table 6.2.4 Seabed footprint summary

Activity	Temporary direct disturbance (km^2)	Temporary indirect disturbance (km^2)	Permanent direct disturbance (rock) (km^2)	Long-term disturbance (decommission *in situ*) (km^2)
Pipeline and umbilical and decommissioning	0.008	0.016		0.525
Placement of rock		0.2808	0.1404	
Pipeline stabilisation and protection materials decommissioning	0.005	0.009		0.002
Total	**0.0085**	**0.2877**	**0.14**	**0.527**
Temporary Total	**0.306**			

6.2.3 Effects on Sensitive Receptors

Decommissioning activities are expected to lead to two types of physical disturbance. The first is temporary disturbance, which will result from the removal of the pipelines, umbilicals and stabilisation materials from the seabed. The sediment will be disturbed by the action of retrieving equipment from the seabed and placement of rock, but once decommissioning is complete, the affected areas will be free of anthropogenic material. 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 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.

6.2.3.1 Temporary disturbance

As noted in Table 6.2.4 **Seabed footprint summary** approximately 0.31 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 less than six hours to cover the anticipated direct disturbance area [31].

Two main factors minimise the impacts of seabed disturbance:

1. Biological communities are in a continual state of flux and can either adjust to disturbed conditions or rapidly re-colonise areas that have been disturbed.
2. The moderate dynamic nature of much of the seabed environment will aid the recovery of disturbed areas.

The seabed is inhabited by numerous organisms, including mobile fauna (e.g., crustaceans) which may be able to vacate an area following a disturbance and less mobile, or sessile fauna. Past surveys of this area indicate that it is typical of the wider area; characterised by various sessile benthic species associated with specific sediment types. For instance, finer areas are colonised by the heart urchin (*Spantangus purpureus),* common starfish *(Asteria rubens),* hermit crab (*Pagurus bernhardus)* and sea star (*Astropectin irregularis)*, and coarser areas are inhabited by common brittlestars (*Ophiothrix fragilis)*. Direct mortality of such limited mobility seabed organisms and direct loss of habitat would be expected.

The predicted EUNIS habitats in the vicinity of Heather included 'Deep circalittoral sand' (A5.27), 'Deep circalittoral coarse sediment' (A5.15) and Deep circalittoral mud (A5.37); Figure 4.3.1). SSS indicated medium reflectivity attributed to the muddy sand sediment. PSA identified a mixed sediment which was comprised mostly of sand, with fines and gravels contributing varyingly.

Spawn is usually deposited demersally, on marine vegetation or on a substrate with a high percentage of gravel and a low fine sediment component [46]. This habitat would therefore support the high intensity spawning grounds of Norway pout and high intensity blue whiting nursery grounds [30], which are identified in this area of the NNS. Seabed disturbance could therefore also present a risk to fish and shellfish species which use the seabed for spawning and/or nursery grounds.

Given the very localised area of decommissioning activities and the transient nature of the disturbance to benthic sediments in this area with good recovery potential, disturbance to fish and shellfish is not expected to be significant. Fish are highly mobile organisms and are likely to avoid areas of re-suspended sediments and turbulence during the activities and these spawning and nursery grounds will be 'recolonised' over time [14]. Therefore, the proposed activities are unlikely to have an impact on fish and shellfish species populations or their long-term survival.

Post-disturbance recovery of the seabed is dependent both on the strength of the seabed soils and the ability of the hydrological regime to rework disrupted sediments and return the seabed to its original contours. It has been reported that offshore circalittoral mixed sediments have a high recoverability following disturbance [71] [8].

Indirect disturbance (being twice the area of direct disturbance) is projected to have an area of temporary impact of 0.31 km^2 with no permanent impacts anticipated and very quick recovery

expected. Sediments that are redistributed and mobilised as a result of the proposed decommissioning activities will be transported by the seabed currents before settling out over adjacent seabed areas. The natural settling of the suspended sediments is such that the coarser material (sands) will quickly fall out of suspension with the finer material being the last to settle. This natural process will ensure that all the suspended sediment is not deposited in one location. With the majority of the area being classified as EUNIS biotope complex A5.27 (Deep circalittoral sand) and A5.15 (Deep circalittoral coarse sediment) [24], it is likely that much of this sediment will fall out of suspension in a matter of minutes.

The re-settlement of sediments may result in the smothering of epifaunal species [33] with the degree of impact related to their ability to clear particles from their feeding and respiratory surfaces [63]. Infaunal communities are naturally habituated to sediment transport processes and are therefore less susceptible to the direct impact of temporarily increased sedimentation rates. Depending on the sedimentation rates, infaunal species and communities can also work their way back to the seabed surface through blanket smothering. Defra (2010) states that impacts arising from sediment re-suspension are short-term (generally over a period of a few days to a few weeks [20].

Following completion of the proposed activities, the natural physical processes of sediment transportation and natural backfilling are therefore expected to restore the disturbed seabed habitat to its equilibrium state within a year. This will be qualified by post-decommissioning surveys.

6.2.3.2 Permanent disturbance

Permanent direct disturbance will occur due to placing further rock cover on the seabed *in perpetuity*. Approximately 0.14 km^2 of seabed will be subject to permanent (yet localised) direct disturbance due to the introduction of rock protection material, as detailed in Table 6.2.2. As previously detailed the total quantity of rock placement is worst-case scenario and the likely amount of rock placement used will be less.

The proposed decommissioning activities will cause a direct impact to fauna living on and in the sediments. Mortality is more likely in non-mobile benthic organisms, whereas mobile benthic organisms are more sparsely distributed and may be able to move away from the area of disturbance. Whilst the introduction of a new substratum into the area may be influenced by scour from tides and mobile sediments and it may even become partially buried in places from time to time, it is likely that parts of it will eventually support a low diversity epifaunal community similar to that present on naturally occurring stones and boulders in the area. This will occur as a result of natural settlement by larvae and plankton and through the migration of animals from adjacent undisturbed benthic communities.

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. Rock remediation will be targeted and localised.

6.2.3.3 Impact on protected habitats

There are no protected areas within 40 km of the project area. The closest protected area is the Pobie Bank Reef SAC, located approximately 49 km southwest of the Heather Field [52]. The site is protected for bedrock and stony reefs which provide a habitat to an extensive community of

encrusting and robust sponges and bryozoans. These include encrusting coralline algae, cup sponges, and bryozoans in the shallower areas; and small erect sponges, cup corals and brittlestars in the deeper areas. Protected sites in the wider vicinity of Heather are shown in Figure 4.5.1.

Given the distance between the closest conservation sites and the proposed decommissioning activities, it is very unlikely that any impacts will be felt.

6.2.3.4 Long-term presence of infrastructure decommissioned *in situ*

Structural degradation of the Heather pipelines and umbilicals will be a long-term process caused by corrosion and the eventual collapse of the pipelines under their own weight and that of the overlying mattresses, 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;
- Coal tar enamel coating;
- Concrete coating; and
- Plastic coating.

Note: The pipelines will be flushed clean of hydrocarbons, then disconnected and flooded. As such they are not discussed further herein.

6.2.3.5 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 [42]. Concentrations of the metals are not expected to exceed acute toxicity levels at any time. 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. Inhibition of growth may also occur in crustaceans, molluscs, echinoderms, hydroids, protozoans and algae [42]. It is expected that any toxic impacts will be 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 and mattress protection 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 decades (of the order of 60 to 100 years [35]).

Along buried pipeline corridors, there may be accumulations of heavy metals in the sediments. Where present, 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 [48]. Much of the surrounding seabed is composed of sand and may therefore release any metals to the surrounding seawater, making them bioavailable, but also diluting them into the wider environment.

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. As a result, no likelihood of significant effect is expected to any of the designated sites within which a pipeline will be decommissioned *in situ*.

6.2.3.6 Naturally Occurring Radioactive Material

Marine organisms can potentially bioaccumulate radium from solution in seawater, from ingested seabed sediments or from their food. Studies of the impacts of ^{226}Ra released into the North Sea via produced water and natural processes indicate that it is unlikely that observed levels of radioactive substances entrained in sediments or found in seawater will cause effects on marine organisms [36]. NORM scale discharged from offshore installations is known to be insoluble in seawater and when produced water, rich in barium and radium, is discharged to sulphate rich seawater, the radium precipitates rapidly as a complex of barium, radium and sulphate which is also insoluble. ^{226}Ra therefore has a very low concentration in solution in seawater and has a low bioavailability to marine organisms. Dissolved cations in seawater, particularly calcium and magnesium, also inhibit the bioaccumulation of NORM [17].

Due to the highly localised nature of any degradation products and the potentially very low concentrations of NORM being released over an elongated period, it is highly unlikely that these will be detectable above current background conditions in the area. As a result, no likelihood of significant effect is expected on the environment generally or to any designated site.

6.2.3.7 Polycyclic Aromatic Hydrocarbons

The likely base material of some of the concrete coated pipelines is coal tar. There is no standardised formula for the composition of coal tar, but it is thought that its constituents are over 60% inert and may comprise up to 15% of PAHs [48].

The coal tar coating degrades when the internal pipeline steel corrodes or if the concrete coat is damaged. There are no known records of concrete durability, but it is expected that the concrete will decay at a very slow rate. It is presumed that PAH will be released once the coal tar layer is open to the seawater, and over time will be released into the surrounding environment. PAHs in marine sediments will have a low biodegradation potential due to low oxygen and low temperatures [12]. PAHs are almost insoluble and only become available to marine organisms through ingestion of particulate matter [48][17].

Two factors, lipid and organic carbon, control to a large extent the partitioning behaviour of PAHs between sediment, water, and tissue. Accumulation of PAHs occurs in all marine organisms;

however, there is a wide range in tissue concentrations from variable environmental concentrations, level and time of exposure, and a species' ability to metabolize these compounds. There are many variables, such as chemical hydrophobicity, uptake efficiency, feeding rate, and ventilatory volume, which may affect the outcome. The route of uptake may be an important issue for short-term events; however, under long-term exposure and equilibrium conditions between water, prey, and sediment, the route of uptake may be immaterial because the same tissue burdens will be achieved regardless of uptake routes [48]. Due to their poor solubility in water these substances will partition in organic material including plankton and marine snow (cell water release) and marine sediments (cell water and sediment release). All substances in this group are persistent with a half-time in the marine environment ranging from weeks (water column) to several years (sediments). Evidence of carcinogenicity, mutagenicity or teratogenicity attributable to PAHs in the marine environment is very limited and the amounts concerned are not thought to pose a threat to marine organisms [49]. Given that PAHs are expected to be released in very low concentrations during the deterioration of the coating over time, it is unlikely that marine organisms will accumulate them to a significant extent.

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 and no likelihood of significant effect is expected to any designated sites.

6.2.3.8 Plastics

Methanol and gas pipelines in the are generally coated with 3 Layer Polyethylene ('3PLE') and Fusion-bonded Epoxy ('FBE'). 3PLE and FBE are considered non-toxic in the marine environment [22]. However, as no micro-organisms have evolved to utilise the chemically resistant polymer chains as a carbon source, these plastics can be expected to persist in the environment for centuries [56]. As biodegradability in the marine environment (in particular when buried within sediment) is also low, it can be assumed that the environmental effect of leaving these plastics in place is negligible [49].

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 and no likelihood of significant effect is expected to any designated sites.

6.2.3.9 Blue carbon

Marine sediments are the primary store of biologically derived carbon (mostly inorganic carbon). Biogenic marine habitats are highly productive places, with a very high rate of assimilation of carbon into plant material (662 $gC/m^2/yr$), mostly in coastal areas. However, their overall contribution to the carbon budget is relatively small compared to sediments [9][10]. Carbon stored in organisms can be broadly defined as either 'transient', such as the carbon stored in seagrass beds, kelp and macroalgae; or 'long term', such as biogenic structures (e.g. coral reefs, serpulid reefs, mussel beds).

Carbon may be sequestrated in marine sediments as precipitated carbonates ('PCO') or as particulate organic carbon ('POC'). While it is known that sediment accumulation rates tend to be faster nearer to land (e.g. in sea lochs), it is unclear what processes maintain the accumulation basins, or whether any of the rich supply of organic material from phytoplankton in productive

shelf waters becomes refractory and remains there [9]. The principal threat to long term carbon burial in sediments is any process that stirs up the sediment, particularly the top few millimetres of sediment. Resuspension of sediment allows rapid consumption of buried carbon by organisms and its subsequent release as carbon dioxide. This effectively reduces the carbon burial rate significantly and reduces the blue carbon inventory.

Patterns of standing stocks and sequestration capacity of organic carbon follow the distribution of mud and mud-sand-gravel combinations. Most organic carbon and the largest capacity for sequestration of organic carbon appears to be in deep mud off the continental shelf [9].

The average percentage carbonate in the top 10 cm of superficial sediments in the offshore Heather area ranges from between 20% - 60%, which is above average for Scottish waters [9]. However, with the small area of total seabed disturbance resulting from the proposed decommissioning activities, the impact on any blue carbon stores is therefore expected to be negligible.

6.2.4 Mitigation Measures

Mitigation measures to minimise seabed impacts within the Heather area are detailed below:

- Cutting and lifting operations will be controlled by ROV to ensure accurate placement of cutting and lifting equipment and minimise any impact on seabed sediment.
- Lifting operations will be conducted around high tide and slack water to minimise the distribution of mobilised sediments.
- The requirements for excavation will be assessed on a case-by-case basis and will be minimised to provide access only where necessary.
- Vessels are most likely to be equipped with dynamic positioning rather than relying on anchors to remain in position which interact with the seabed.
- The rock mass will be carefully placed over the designated areas of the pipelines and seabed in order to ensure rock is only placed within the planned footprint with minimal spread over adjacent sediment, minimising seabed disturbance.
- Data collected in the area will be reviewed for potential sensitive seabed habitats prior to the commencement of operations.
- Post decommissioning debris clearance, surveys and monitoring shall be carried out using non-intrusive methodologies such as side scan sonar, using ROVs etc.

6.2.5 Cumulative Assessment

The decommissioning activities taking place within the Heather Field will not be occurring in close to any other third-party oil and gas installations; the closest installation is the Cormorant Alpha platform which is located 18 km from the proposed activities. The NCP, that is the tie-in point of PL9, will be decommissioned as part of the wider Ninian 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 Heather pipelines are located approximately 23 km from the UK/Norway median line at the closest point. Given this distance, and the area of indirect temporary disturbance being 0.31 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.

6.2.6 Residual Impact

Heather infrastructure decommissioning activities will result in temporary direct and indirect disturbance to the seabed. Temporary direct disturbance has the potential to impact approximately 0.14 km^2 of seabed. Temporary indirect disturbance has the potential to impact approximately 0.31 km^2. There will be a 0.14 km^2 area of permanent disturbance as a result of the placement of new rock (for pipeline ends and exposures/spans remediation) and 0.53 km^2 of long-term disturbance as a result of decommissioning infrastructure *in situ*.

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.

Direct loss of habitat and direct mortality of sessile seabed organisms that cannot move away from the contact area would be expected. Impacts arising from sediment re-suspension are expected to be short-term and mobile species will be able to avoid the area during the course of activities and 'recolonise' it in the future. Although substratum loss may cause a decline of species in the area of direct footprint, species that inhabit this type of benthic habitat are deemed to be highly recoverable.

While demersal fish species using the area as a nursery or spawning grounds may coincide with the decommissioning activities, given the very localised nature of decommissioning activities and the transient nature of the disturbance to benthic sediments, disturbance to fish and shellfish nursery and spawning grounds is not expected to be significant.

The long-term decommissioning of the pipelines and umbilicals *in situ* is expected to represent a footprint of approximately 0.53 km^2. As this infrastructure will remain buried, the release of primary degraded products such as plastics, NORM, PAHs and heavy metals are predicted to cause negligible impacts on the surrounding sediments.

The addition of rock is also unlikely to disturb the natural physical processes of the area. While the addition of rock will change the substrate, this covers such a small area in proportion to the area of available sandy habitat. There is potential that the colonisation of hard substrate may result in a habitat moderately comparable to that of a typical rocky reef. For these reasons, the impact consequence is considered low across all receptors.

Initial assessment of this aspect within the ENVID (Appendix B) yielded; 'Low' Consequence (spatial extent), 'Medium' Frequency, 'Medium' Magnitude and 'High' Probability. These scores gave an overall level of 'Medium'. However, following full assessment of this aspect, taking into consideration the benthic environment, seabed characteristics, commercial fishing, relatively small size of disturbance area along with industry and EnQuest mitigation measures, the overall assessment was reduced to 'Low'. While the Probability of this aspect could not be lowered, both Magnitude and Frequency were reduced to 'Low'. Overall, the impact of seabed disturbance due to the proposed decommissioning activities, in combination with consideration of mitigation measures, is not significant.

7. CONCLUSIONS

The decommissioning methods for the associated flushed and cleaned pipeline infrastructure were assessed against each other within a CA. The recommended decommissioning option was to fully remove the Heather gas import ESDV and associated protection frames. PL9, PL9A PL352 and the ESDV umbilicals buried sections will be decommissioned *in situ*. At the approaches, the ends of PL9 and PL352 will be cut at trench depth where they enter burial, and the associated surface laid sections will be removed. The exposed cut ends will be remediated with the placement of rock. Existing spans and exposed sections of the PL9 will also be remediated with the placement of rock. PL352V is to remain *in situ* following the removal of any short, exposed sections of the pipe. The remaining pipeline ends will be buried in deposited rock. This option was considered and assessed in line with a tried and tested EA method and the results detailed in Sections 5 and Section 6.

The Heather Field is located offshore in the NNS, away from coastal sensitivities and from any designated sites. Therefore, no significant impact to any protected sites is expected. The marine environment where the Heather pipelines are located is typical of the NNS. Whilst recognising there are certain times of the year when populations of seabirds, fish spawning and commercial fisheries are vulnerable to oil pollution, the area is not considered particularly sensitive to the proposed decommissioning activities.

Following detailed review of the project activities, the environmental sensitivities of the project area, industry experience with decommissioning activities and taking stakeholder concerns into account, it was determined that the potential environmental impacts are focussed on the impact of the physical presence of infrastructure being decommissioned in *situ* on commercial fisheries and seabed disturbance from decommissioning activities.

The potential impacts identified to commercial fisheries were limited to possible legacy impacts such as the snagging of fishing gears due to the physical presence of infrastructure decommissioned *in situ*. While the impact magnitude may be considered 'High' owing to the potential severity of a snagging event, the frequency of such an event is low therefore overall, the magnitude is considered 'Low/Medium'. The presence of the pipelines is 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. Overall, due to the small area of remaining infrastructure, the commitment to over-trawlability, the likelihood of a snagging event being 'Low' and the anticipated impact on commercial fisheries, considering all available mitigation measures, this impact was assessed as 'Low'.

The seabed disturbance resulting from the proposed Heather pipeline decommissioning activities has the potential to cause a direct loss of habitat, mortality of sessile organisms and a change in the natural physical processes of the area. Initial assessment of this aspect yielded an overall level of 'Medium'. However, taking into consideration the benthic environment, seabed characteristics, commercial fishing, relatively small size of disturbance area and along with industry and EnQuest mitigation measures, the overall assessment was reduced to 'Low'.

This EA has considered the Scottish NMP, adopted by the Scottish Government to help ensure sustainable development of the marine area. EnQuest considers that the proposed decommissioning activities are in alignment with its objectives and policies.

Based on the findings of this EA, including the application of appropriate mitigation measures and project management according to EnQuest's HSE&A Policy and Principles, it is considered that the proposed Heather pipeline decommissioning activities do not pose any significant threat to environmental or societal receptors within the UK.

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APPENDIX A EA METHOD

Appendix A.1 Method

The decision-making process related to defining if a project is likely to generate a significant impact on the environment is integral to the environmental impact assessment process; the methods used for identifying and assessing potential impacts should be transparent and verifiable.

The method utilised for the Heather jacket ENVID has been developed by reference to the Chartered Institute of Ecology and Environmental Management ('CIEEM') guidelines for marine impact assessment [12], The Marine Life Information Network ('MarLIN') species and ecosystem sensitivities guidelines [70] and guidance provided by NatureScot in their handbook on environmental impact assessment [69] and by The Institute of Environmental Management and Assessment ('IEMA') in their guidelines for environmental impact assessment [35][38].

EA 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.

For each impact, a systematic approach is applied to understand its significance on a receptor. The process considers the following:

- Assessment of the **consequence/extent** of the impact, defined by the nature and type of impact, and the spatial extent of the impact on the receptor;
- Identification of the **frequency and duration** of the effect of the receptor;
- Definition of **magnitude** of impact, based on the magnitude of the shift from the environmental baseline conditions; and
- Definition of the **probability** of impacts.

These different aspects are taken into consideration when determining an overall assessment of the impact significance.

In line with the CA method, the ENVID used a qualitative approach. Ultimately, any impacts which fall into the medium and high categories is carried forward for further assessment. Any impacts falling below this level (i.e., low or low / medium) are deemed to be ALARP and were scoped out of further assessment in the EA.

Appendix A.2 Consequence (Geographical Extent)

The impact consequence is based on the geographical extent, as described in the table below.

Appendix Table A.2.1 Impact Consequence		
Ranking	**Consequence**	**Criteria**
High	Major	Extent of change: Impact occurs over a large scale or spatial geographical extent.
Medium	Moderate	Extent of change: Impact occurs over a local to medium scale/spatial extent and/or has a prolonged duration.
Low/Medium	Minor	Extent of change: Impact occurs on-site or is localised in scale/spatial extent.
Low	Negligible	Extent of change: Impact is highly localised.

Appendix A.3 Frequency / Duration

The duration of effect is key to determining the final ranking of impact significance. This criterion considers the following:

- Duration over which the impact is likely to occur (e.g., days, weeks, etc.); and
- Frequency and/or intensity of impact (i.e., how often the impact is expected to occur).

These variables are defined below with the overall ranking method of duration of effects.

Appendix Table A.3.1 Impact frequency/duration		
Ranking	**Duration**	**Criteria**
High	Major	Frequency/intensity of impact: high frequency (occurring repeatedly or continuously for a protracted period) and/or at high intensity.
Medium	Moderate	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.
Low/Medium	Minor	Frequency/intensity of impact: low frequency (occurring occasionally/intermittently for short periods of time) and/or at low intensity.
Low	Negligible	Impact is very short term in nature (e.g. days/few weeks).

Appendix A.4 Magnitude

The impact magnitude requires an understanding of how far the receptor will deviate from its baseline condition because of the impact. The resulting effect on the receptor is considered under vulnerability and is an evaluation based on scientific judgement.

The table below defines the criteria for impact magnitude.

Appendix Table A.4.1 Impact magnitude		
Ranking	**Magnitude**	**Criteria**
High	Major	Total loss or major alteration to key elements/features of the baseline conditions.
Medium	Moderate	Partial loss or alteration to one or more key elements/features of the baseline conditions.
Low/Medium	Minor	Minor shift from the baseline conditions. Impact is localised and temporary/short term with minor detectable change to site characteristics or a minor change to a small proportion of the receptor population. Low frequency impact occurring occasionally or intermittently.
Low	Negligible	Very slight change from baseline conditions. Impact is highly localised and short-term resulting in very slight or imperceptible changes to site characteristics.

Appendix A.5 Probability

The probability of an impact is another factor that is considered in this impact assessment. This captures the probability that the impact will occur and the probability that the receptor will be present and is based on knowledge of the receptor and experienced professional judgement. The table below provides definitions of the different levels of probability of impact that will be used in the Heather pipeline decommissioning impact assessment.

Appendix Table A.5.1 Impact probability		
Ranking	**Probability**	**Criteria**
High	Major	The impact is likely to occur.
Medium	Moderate	The impact is moderately likely to occur.
Low/Medium	Minor	The impact is possible.
Low	Negligible	The impact is unlikely or highly unlikely.

APPENDIX B ENVID

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment							Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
Preparatory activities	Engineering down and cleaning	Discharges to Sea Flushing/ cleaning operations for pipelines- discharge targeted 30ppm Liquid discharge to sea - Water quality in immediate vicinity of discharge will be reduced slightly, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Potential NORM impacts.	• Controls will be in place, as relevant, through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations. • Work will be undertaken within permit consent agreement limits. • Any chemical and solids would be collected, skipped and shipped to shore for treatment and disposal.	Procedural cleaning and/or containment process. •Maintenance procedures. • Bulk handling procedures and personnel training. • Vessels will be selected which comply with IMO/MCA codes for prevention of oil pollution. • Preferred operational procedures to be in place onboard vessels including use of drip trays under valves, use of pumps to decant lubricating oils, use of lockable valves on storage tanks and drums. • Chemical storage areas contained to prevent accidental release of chemicals. • Pre-mobilisation audits will be carried out including a comprehensive review of spill prevention procedures • Arrangements in place to track spills. • Residuals at cut ends released into the marine environment (post-flushing - should be low).	L	L	L	L	L	These are routine operations and will be conducted within the agreed permit conditions and using EnQuest's procedural cleaning and containment processes. Any residual material will be in trace levels/volumes following the DFPV regime and will not pose any significant risk to water quality. Well cleaning is out with the scope of this EA and will be covered by its own permitting regime.	
Physical presence	Vessels	Disturbance to vessel operations offshore during operations (e.g. fisheries and other maritime users); disturbance to marine species	• Navigational updates • Notifications to mariners.	• Minimal vessel use/movement. • Vessel sharing where possible. • A SIMOPS plan for vessel activity in the field will be put in place.	L	L	L	L	L	Vessel traffic is low in Blocks 2/5, 3/1, 3/2 and 3/3. Activity in line with usual vessel presence.	Out
	Discharges	Vessel discharge of grey water, bilge water, etc.	• MARPOL compliance. • Bilge management procedures. • Vessel audit procedures. • Contractor management procedures.	Covered by existing controls and permitting	L	L	L	L	L	Discharges will not be constant.	Out
	Vessel engine noise	Underwater noise - behavioural modifications to marine mammals, turtles and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	• Adherence with vessel maintenance procedures	• Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • A SIMOPS plan for vessel	L/M	L	L/M	L/M	L/M	Vessel noise will not have significant sound levels unlikely to be far above ambient noise levels. Not within an area protected for marine mammals Particularly large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.3-0.4 animals/km2 across the project area.	Out

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment							Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
				activity in the field will be put in place.						Other European protected species (white-sided dolphin, minke whales and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities.	
Energy and emissions (all options)	Emissions	Gaseous emissions to atmosphere cause increased degradation of local/regional air quality (NOx and particulates). Transboundary air pollution. Contributing to global warming (CO2).	• Adherence with vessel maintenance procedures • Waste Hierarchy adherence	• Vessel management in accordance with EnQuest's marine procedures • Minimal vessel use/movement • Vessel sharing where possible	L/M	L/M	L/M	L/M	L/M	Emissions associated with vessel use, recycling and replacement of materials decommissioned *in situ* will contribute to this. This would likely be a very small contribution to UKCS CO2 emissions in a UKCS context.	Out
	Energy Use	Impact on climate change and reduction of resources of hydrocarbons. Products used for recycling.	• Adherence with vessel maintenance procedures • Waste Hierarchy adherence	• Vessel management in accordance with EnQuest's marine procedures • Minimal vessel use/movement • Vessel sharing where possible	L/M	L/M	L/M	L/M	L/M	Energy Use associated with vessels, recycling and replacement of materials decommissioned *in situ* will contribute to this. This would likely be a very small amount of fuel usage in a UKCS context.	Out

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment								Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
Resource use (landfill)	Onshore (Complete removal)	Use of landfill and landfill resource take (non-hazardous); special disposal (hazardous)	• Waste Management Plan • Active Waste Management Plan • Waste Hierarchy adherence • Transfrontier shipment of waste (if applicable)	•All wastes, including normal, hazardous/special wastes, will be shipped to shore for processing •Duty of Care •Management of contractors and relevant licences	L/M	M	L	M	L/M	Covered under waste management strategies Recognise that the addition of project waste to landfill will remain in perpetuity. The expectation is that a low volume of material recovered to shore would be destined to landfill with material being disposed in this way would likely to be limited to marine growth should it not be recycled.	Out
Pipeline Decommissioning	Cutting and Removal	Underwater noise - behavioural modifications to marine mammals and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	• Cutting operations will use industry standard methods and equipment where available.	• In this instance EnQuest would be reliant on the removal, contractors' methods, processes and procedures.	L/M	L/M	L/M	L/M	L/M	Diamond wire cutting noise will not have significant sound levels. Not within an area protected for marine mammals Particularly large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.3-0.4 animals/km2 across the project area. Other European protected species (white-sided dolphin, minke whales and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities.	Out
		Seabed disturbance - Disturbance to the seabed, including to features of conservation importance during removal Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	• Pre-decommissioning seabed surveys • Stakeholder consultation	• Review of survey data for potential sensitive habitats of seabed. • Cutting and lifting operations controlled by ROV. • Vessels are likely to be equipped with dynamic positioning (DP) rather than relying on anchors to remain in position.	L/M	L/M	L/M	H	L/M	No evidence of S. spinulosa, A. islandica or 'seapens and burrowing megafauna communities'/aggregations within the area. Deemed to be a minor risk and therefore insignificant. Potential concern due to large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.3-0.4 animals/km2 across the project area. Other European protected species (white-sided dolphin, minke whales and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities. Independently this is not significant however scope in under cumulative seabed disturbance.	In (Cumulative)

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment								Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
		Blue Carbon - (linked to seabed disturbance) - Disturbance to top layers of sediment during removal activities, leading to the release of a potential carbon store	• Pre-decommissioning seabed surveys • Stakeholder consultation	• Review of survey data for potential sensitive habitats of seabed. • Cutting and lifting operations controlled by ROV. • Vessels are likely to be equipped with dynamic positioning (DP) rather than relying on anchors to remain in position.	L	L	L	M	L	Area of disturbance will be minimal – but due to emerging stakeholder and regulatory interest it will be cumulatively assed under seabed disturbance.	In (Cumulative)
	Physical presence of free spans/ exposures	Other Users - Snagging risk to trawl and other demersal fisheries from pipelines and any sediment berms or depressions. Risk over time due to sediment movement and exposure.	• Seabed clearance certificate required before the 500 m safety zone is opened up for use. • Continued monitoring for an agreed period and remediation if required, accurate mapping of decommissioned *in situ* location and state • Following seabed clearance, the opening of the subsea 500m zones to other sea users will also have a positive impact. • Navigational updates • Notifications to mariners • FishSAFE system	• Remediation on free spans and monitoring or exposures. • The profile of the rock-placement allow fishing nets to trawl over the rock unobstructed. Suitably graded rock will be used to minimise the risk of snagging fishing gear. •Final visual and/ or overtrawl seabed survey will be undertaken following decommissioning. •Stakeholder engagement Long-term monitoring	M	L	H	L/M	M	Deemed to be a minor risk and therefore insignificant. Potential Stakeholder concern due to demersal fishery snagging risk, therefore scoped in to further assessment.	In
	Long term degradation of pipeline decommissioned *in situ* (offshore)	Seabed disturbance - Gradual breakdown of pipeline and release of contaminants. Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	• Continued monitoring for an agreed period and remediation if required, accurate mapping of decommissioned *in situ* location and state • The pipelines will be flushed clean of hydrocarbons and toxic materials, then disconnected and sealed • EnQuest would be obliged to carry out legacy surveys in perpetuity.	• Same as existing controls	L	L	L	L/M	L	Not an accute impact as breakdown of components will occur over decades, 100s of years Effects are usually minimised by rapid dilution in massive receiving body of water Deemed to be a minor risk and therefore insignificant. Scoped into further assessment due to cumulative impact.	In (Cumulative)

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment								Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
	Pipeline Remediation	Seabed Disturbance - Introduction of new substrate which may alter habitat architecture, influencing water movement, sediment accumulation and light conditions.	•Minimise introduction of material where possible	•A rock-placement vessel or ROV support vessel will be used. The rock mass will be carefully placed over the pipeline by the use of an ROV-controlled fall pipe equipped with cameras, profilers, pipe tracker and other sensors as required. •Implementation of EnQuests Environmental Management Strategy. •Visual surveys of the seabed where possible to locate obstructions and to localise (and minimise) any post-decommissioning overtrawl surveys that may be required	L	M	M	H	M	Deemed to be a medium risk and therefore potentially significant. Potential stakeholder concern due to proximity to multiple designated areas of conservation significance and impact on features of conservation importance including sessile and mobile organisms, therefore scoped in to further assessment	Yes
Dropped objects	Seabed Disturbance	Localised physical seabed disturbance resulting in community change and potential release of contaminants. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from potential bioaccumulation; physical abrasion; smothering of organisms following settlement of resuspended particles.	•PON2 submission	•Lifting operations management of risk •Dropped object recovery and debris clearance surveys •Careful planning, selection of equipment, subsequent management and implementation of activities	L	L	L/M	L	L	Everything will be endeavoured to be retrieved. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Debris clearance surveys will aid in the identification of any dropped objects.	Out
Significant Hydrocarbon release	Loss of containment	Catastrophic loss of containment Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	OPEP MAS Navaids SOPEP CIP	• All contracted vessels will have a ship-board oil pollution emergency plan (SOPEP) in place • A Collision Risk Management Plan will be developed and implemented • Agreed arrangements in place with oil spill response organisation for mobilising resources in event of a spill • Existing field OPEP in place to reduce the likelihood of hydrocarbon release and define spill response in place • Lifting operations will be planned to manage the risk • Vessel contactors will have procedures for fuel bunkering that meet EnQuest's standard • Where practicable, re-fuelling will take place during daylight hours only.	M	L	L/M	L	LM	Risk of collision is low given low vessel activity in Blocks 2/5, 3/1, 3/2 and 3/3. Well P&A is outside of the scope of this specific impact assessment, since it not dependent on approval of the DP. The possibility of a well blowout therefore does not require consideration here. Reduced to 'as low as reasonably practicable'	Out

APPENDIX C ENERGY USE AND ATMOSPHERIC EMISSIONS

Appendix Table C.1.1 Energy use and atmospheric emissions by project activity for decommissioning		
Planned activity	**Operations energy (GJ)**	**Operations CO^2 (Te)**
Onshore recycling of materials (Steel only)	541	53
New manufacture to replace recyclable materials	316,355	14,749
Offshore transport	40,667	3,019
Total	**357,563**	**17,821**

Appendix Table C.1.2 Offshore transport energy use and atmospheric emissions for decommissioning			
Vessel type	**Total Duration (days)***	**Operations energy (GJ)**	**Operations CO^2 (Te)**
CSV	12	40,667	3,019
FPV	47.51		
Survey vessel	8.46		

APPENDIX D ENQUEST HSEA POLICY

HSEA Policy

Health, Safety, Environment & Assurance

EnQuest is a production and development company, with operations in the UK and Malaysia. We are committed to operating responsibly and will not compromise our health, safety or environmental standards to meet our business objectives.

Through respect for our people, our contractors, our customers, our stakeholders and the environment, we will operate to achieve our principal aim: *safe results, with no harm to people and respect for the environment.*

To achieve this, we will manage our business such that we:

Safety Management
- Demonstrate strong safety leadership
- Provide trained and competent resources
- Maintain high-quality systems and processes
- Maintain the integrity of our assets over their life cycles
- Recognise, assess and manage HSE risks
- Plan and be prepared for potential emergencies

Environment
- Integrate environmental management into all aspects of our operations
- Manage and mitigate our impact on the environment, including emissions

Wellbeing
- Maintain safe and healthy workplaces
- Provide wellbeing awareness and support

Engagement
- Encourage open and honest communication
- Ensure our contractors and suppliers comply with our policies and procedures
- Comply with all applicable legislation and industry standards
- Recognise, assess and manage change

Sharing & Learning
- Investigate and learn from HSE events
- Strive for continual improvement in our HSE performance

Should operational results and this policy ever come into conflict, we all have a responsibility to our principal aim of *safe results, with no harm to people and respect for the environment* over operational results. This includes the responsibility to stop a job whenever activities may conflict with this policy.

Amjad Bseisu
Chief Executive Officer

Richard Hall
Richard Hall
Managing Director – Global Operations and Developments

ENQ-COR-HS-POL-00005 Rev C12 August 2022

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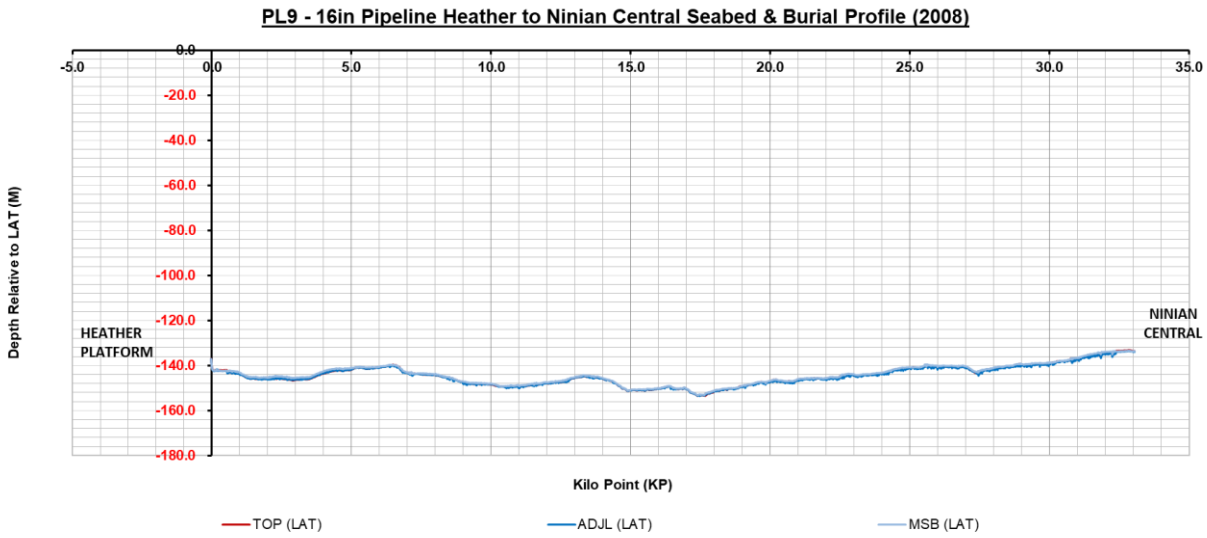
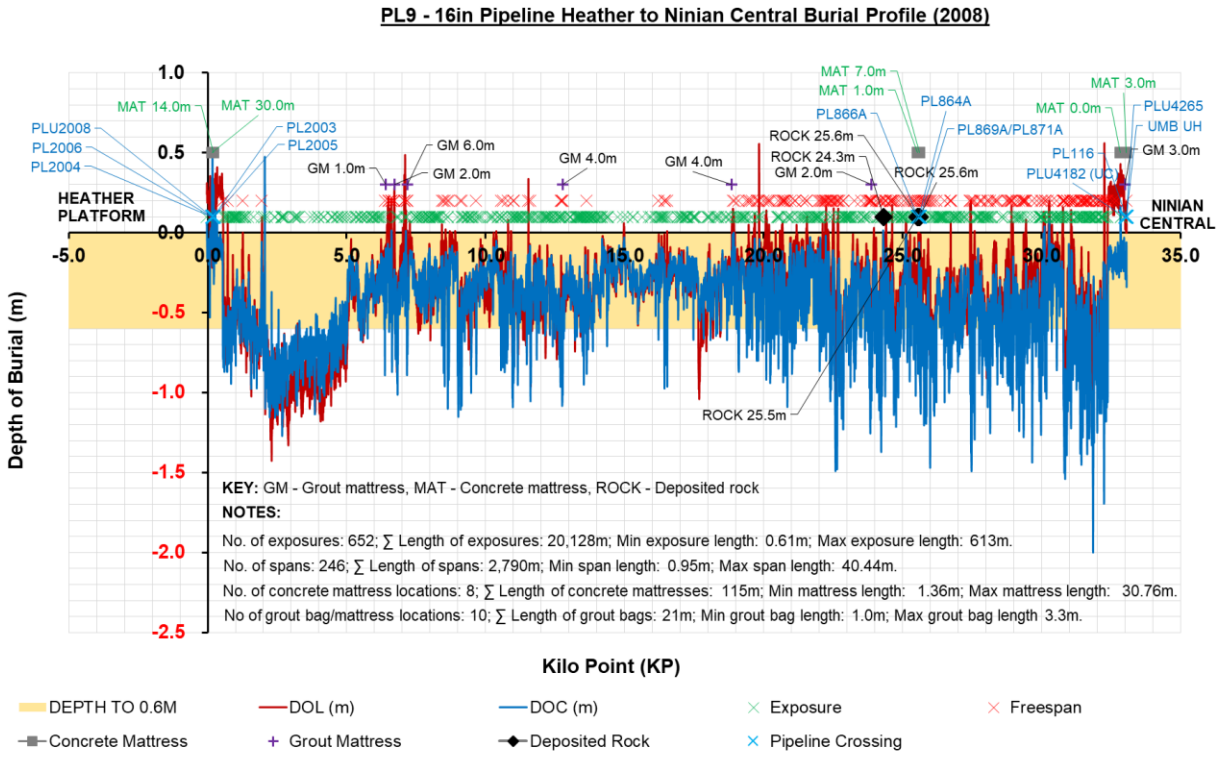
Appendix Figure D.1.1 EnQuest HSEA Policy

APPENDIX E DEPTH OF BURIAL AND PIPELINE EXPOSURES

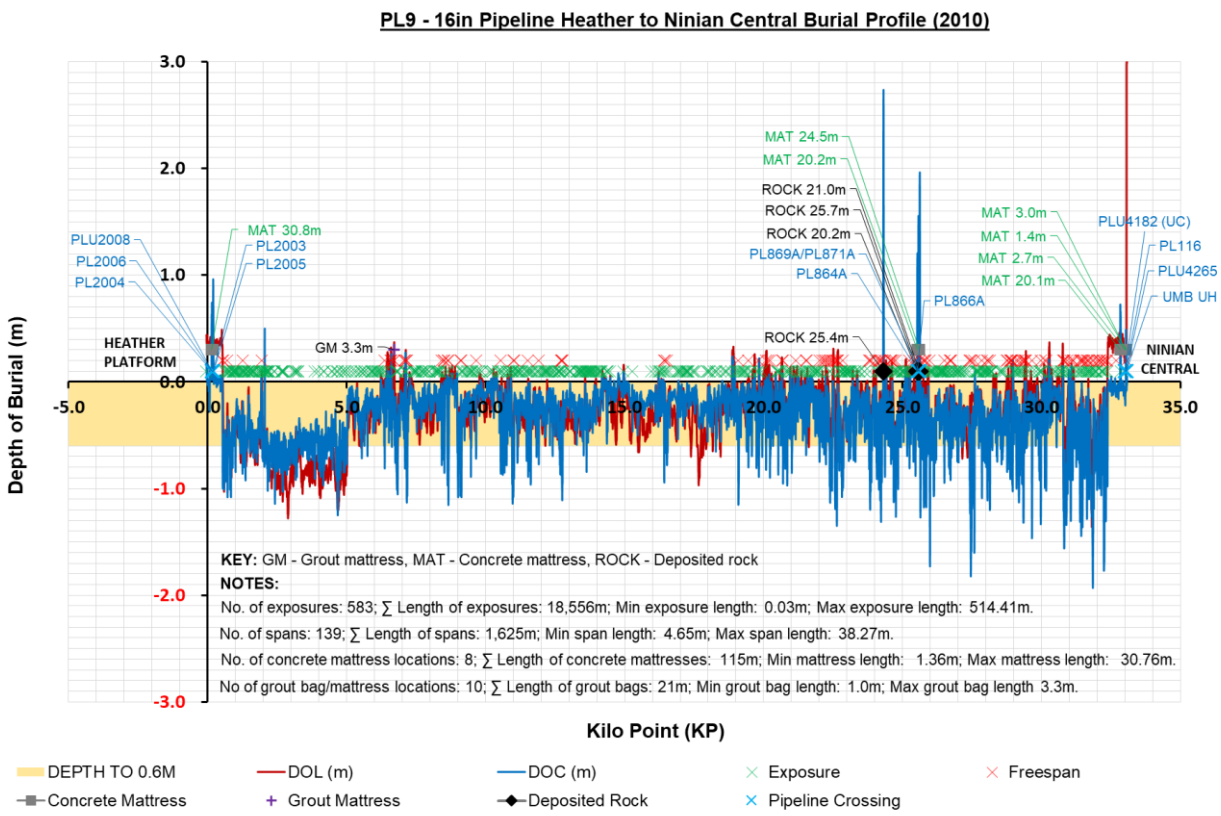
Appendix E.1 PL9



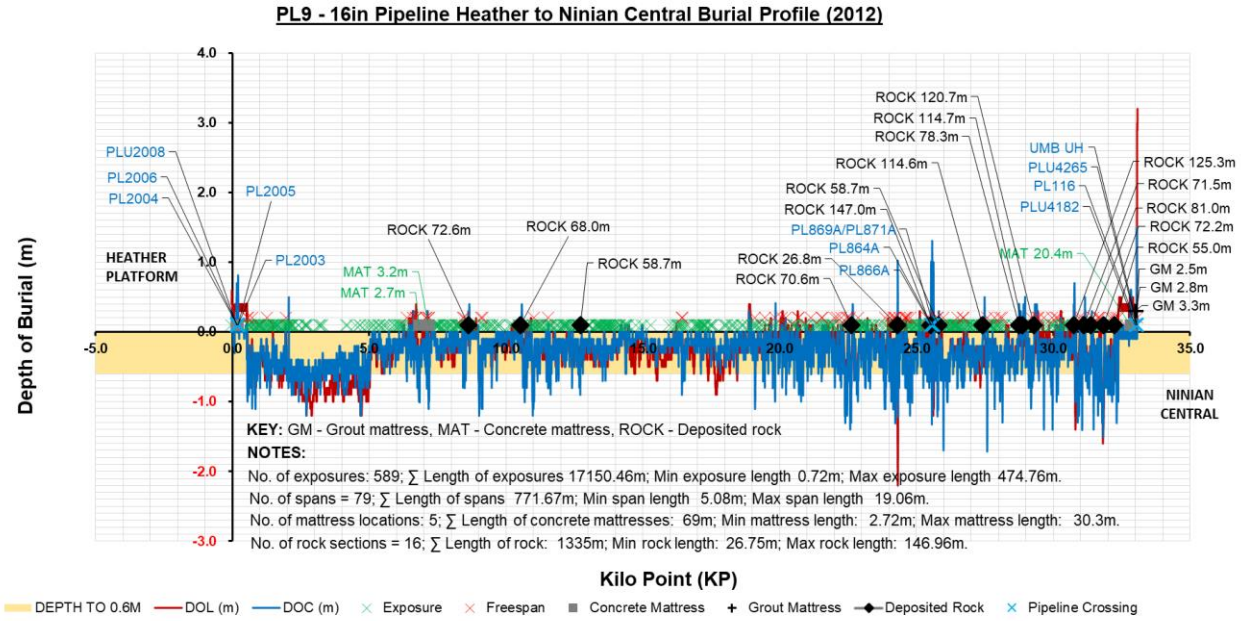
Appendix Figure E.1.1 Depth of Burial (2008)



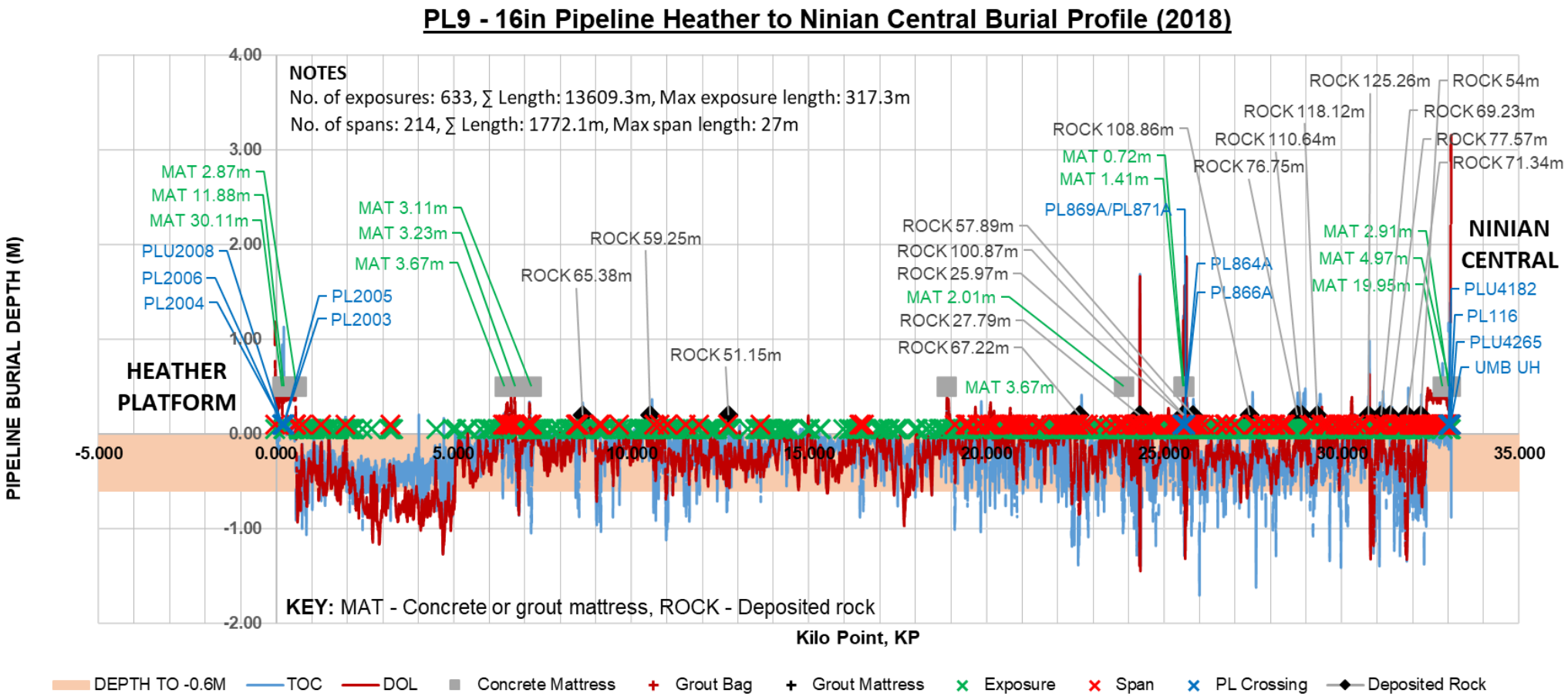
Appendix Figure E.1.2 PL9 - Burial Profile (2008)



Appendix Figure E.1.3 PL9 – Burial Profile (2010)

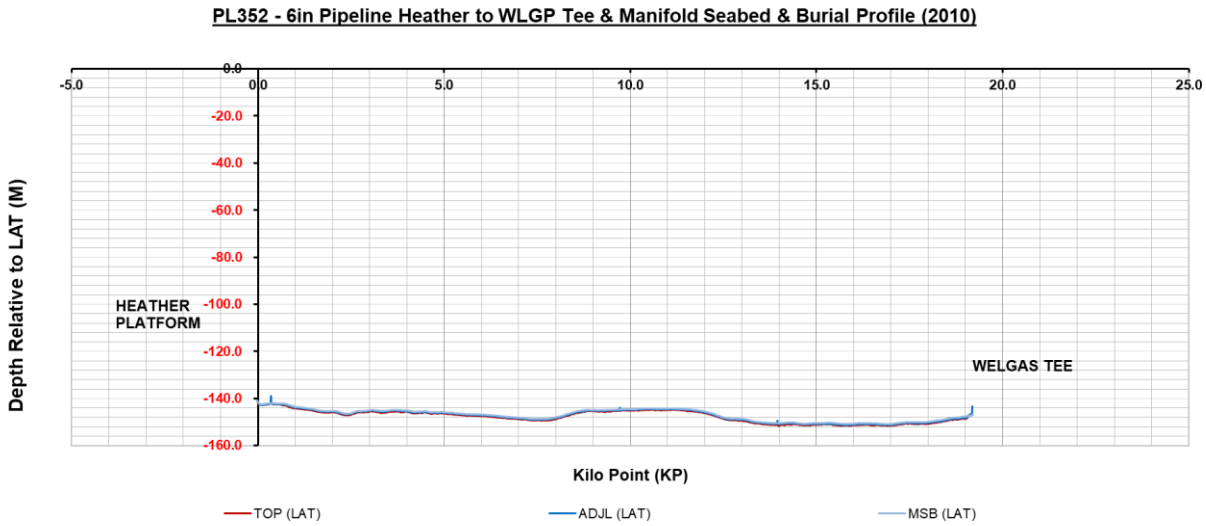


Appendix Figure E.1.4 PL9 - Burial Profile (2012)

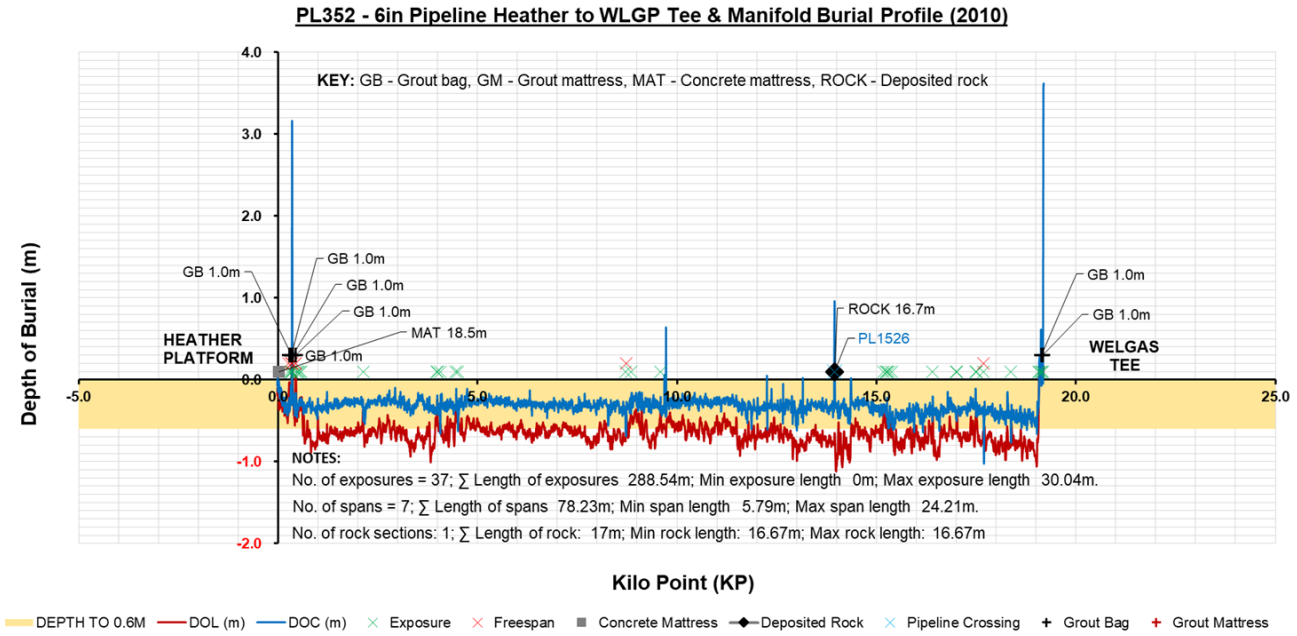


Appendix Figure E.1.5 PL9 - Burial Profile (2018)

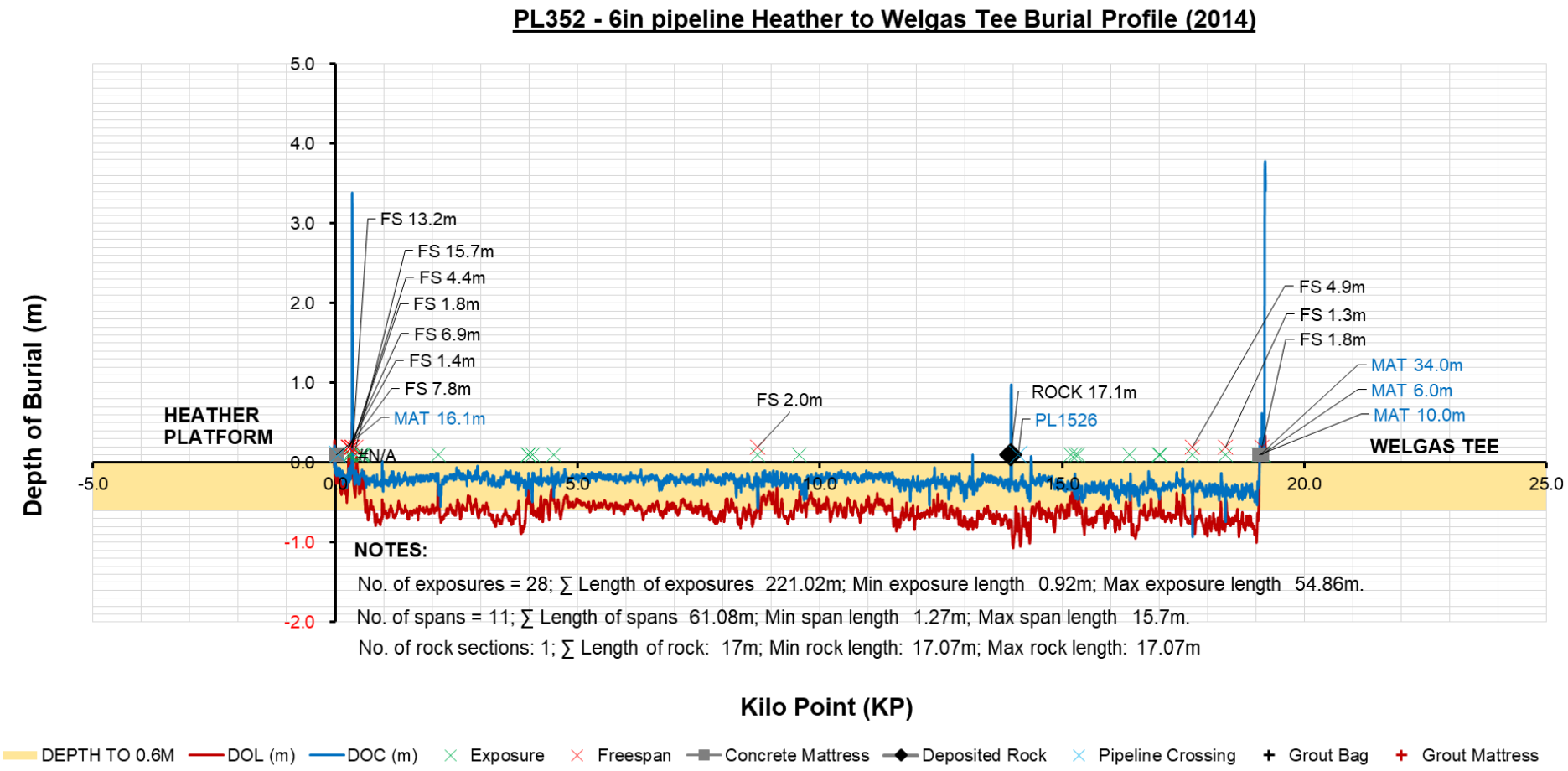
Appendix E.2 PL352



Appendix Figure E.2.2 PL352 – Depth of Burial (2010)

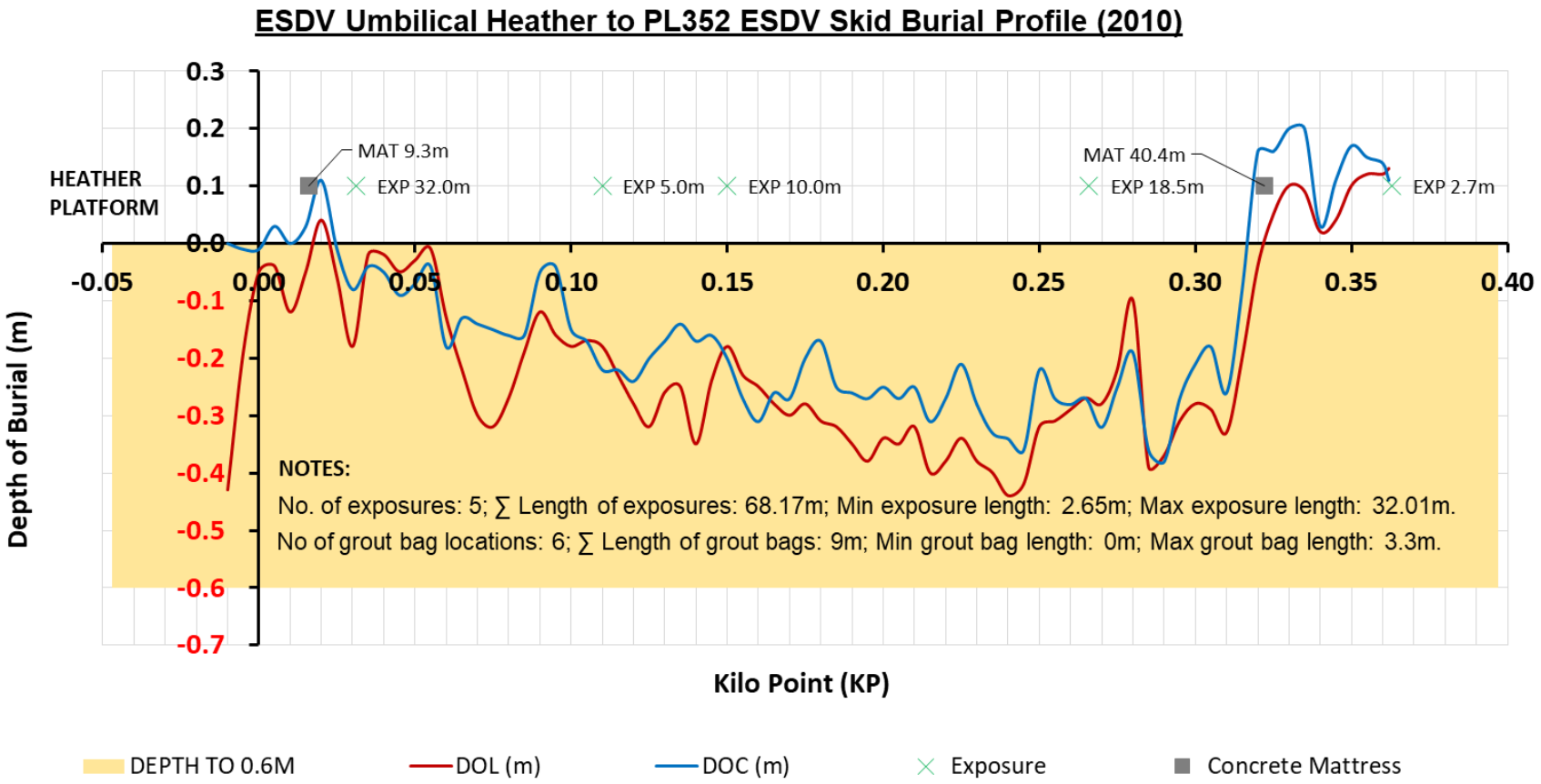


Appendix Figure E.2.1 PL352 – Burial Profile (2010)



Appendix Figure E.2.3 PL352 - Burial Profile (2014)

Appendix E.3 ESDV Umbilical



Appendix Figure E.3.1 ESDV Umbilical - Burial Profile (2010)