Western Isles Decommissioning Environmental Appraisal

May 2023

Consultation Draft

Document Control

Approvals

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Revision Control

Revision No	Reference	Changes/Comments	Issue Date
R01	**Issued for Review**	**For review**	**25th October 2022**
R02	**Issued for Approval**	**For approval**	**4th November 2022**
R03	**Re-issued for Approval**	**For approval**	**3rd March 2023**
R04	**Re-issued for Approval**	**For approval**	**19th March 2023**
A01	**Issued for Use**	**For use**	**16th May 2023**
A02	**Re-issued for Use**	**For use**	**17th May 2023**

Distribution List

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Preface

This is a report of the Environmental Appraisal undertaken as part of the Western Isles Decommissioning Project. The EA considers the potential environmental impact of the decommissioning the Western Isles subsea infrastructure and has been submitted for approval in combination with the Western Isles Comparative Assessment and Decommissioning Programmes.

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Abbreviation	Explanation
AET	Analytical Evaluation Threshold
AIS	Automatic Identification System
ALARP	As low as reasonably practicable
AWMP	Active Waste Management Plan
Ba	Barium
BAP	Biodiversity Action Plan
BEIS	Business, Energy, and Industrial Strategy
CA	Comparative Assessment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CFC	Chlorofluorocarbon
CH_4	Methane
CIP	Combined Interface Plan
CNS	Central North Sea
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CoP	Cessation of Production
CSV	Construction Support Vessel
DECC	Department for Energy and Climate Change
Dia	Diameter
DP	Decommission Programme
DSV	Diving Support Vessel
EA	Environmental Appraisal
EBS	Environmental Baseline Survey
EC	European Commission
ECA	Emission Control Areas
EEZ	European Economic Zone
EMS	Environmental Management System
EEMS	Environmental and Emissions Monitoring System
EIA	Environmental Impact Assessment
EIAPP	Engine International Air Pollution Prevention
EL.	Elevation; height relative to LAT
EMODnet	European Marine Observation and Data Network

ENE	East North-East
ENVID	Environmental Impact Identification
EPS	European Protected Species
ERL	Effect Range Low
ERMs	Effect Range Medians
ESE	East South-East
EU	European Union
EUNIS	European Nature Information System
E&P	Exploration and Production
FPSO	Floating Production Storage and Offloading facility
GHG	Greenhouse Gas
GJ	Gigajoule
GWP	Global Warming Potential
HLV	Heavy Lift Vessel
HSE	Health, Safety and Environment
IAPP	International Air Pollution Prevention
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organisation
in	Inches
INTOG	Innovation and Targeted Oil and Gas
IoP	Institute of Petroleum
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kg	Kilogram
km	Kilometre
km^2	Square Kilometre
KPIs	Key Performance Indicators
Kt	Kilotonnes
LAT	Lowest Astronomical Tide
m	Metre
m^2	Square Metre
m^3	Cubic Metre

mg/kg^{-1}	Milligram per kilogram
MarLIN	The Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echosounder
MoD	Ministry of Defence
MPA	Marine Protected Area
MW	Megawatt
N/m^2	Newtons/Square Meter
NAEI	National Atmospheric Emissions Inventory
NC MPA	Nature Conservation Marine Protected Area
NDC	North Drill Centre
NE	North East
NECA	Nitrogen Oxides Emissions Control Areas
NMP	National Marine Plan
NMPI	National Marine Plan Interactive
NNE	North-Northeast
NNS	Northern North Sea
NNW	North-Northwest
NORM	Naturally Occurring Radioactive Material
NORTH BUNDLE	PL3729.1, PL3729.2, PL3729.3, PL3729.4, and PLU3729.5
NOx	Nitrous Oxides
NPD	Naphthalene, Anthracene and Dibenzothiophene
NSTA	North Sea Transition Authority
O_3	Ozone
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Convention for the Protection of the Marine Environment of the Northeast Atlantic
OWF	Offshore Wind Farm
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PETS	Portal Environmental Tracking System
PMF	Priority Marine Feature
PON2	Petroleum Operations Notice
ppm	Parts Per Million
PSD	Particle Size Distribution

ROV	Remotely Operated Vehicle
ROVSV	Remotely Operated Vehicle Support Vessel
SAC	Special Areas of Conservation
SECA	Sulphur Oxides Emission Control Area
SDC	South Drill Centre
SEEMP	Shipboard Energy Efficiency Management Plan
SEPA	Scottish Environment Protection Agency
SO_2	Sulphur dioxide
SOUTH BUNDLE	PL3730.1, PL3730.2, PL3730.3, PL3730.4, and PLU3730.5
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SOx	Sulphur oxides
SPA	Special Protection Area
SSIV	Sub-surface Isolation Valve
SSS	Side Scan Sonar
Te	Tonnes
TEL	Threshold Effect Level
TFSW	Trans Frontier Shipment of Waste
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
Ug/g	Microgram/gram
UK	United Kingdom
UKAPP	UK Air Pollution Prevention
UKBAP	United Kingdom Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
V	Vanadium
VMS	Vessel Monitoring System
VOC	Volatile organic compounds
WHPS	Well Head Protection Structure
Zn	Zinc

Figures and Tables

1 NON-TECHNICAL SUMMARY

1.1 Introduction and Background

Dana Petroleum (E&P) Limited ('Dana') operates the Western Isles floating production, storage and offloading (FPSO) facility, which produces from the Harris and Barra fields, located in UKCS, Block 210/24a, situated 90 km to the northeast of Shetland, 58 km southwest of the UK / Norway EEZ boundary (Figure 1-1) and 12 km west of the Tern platform, which is the nearest fixed facility. The water depth across the field varies from approximately 150 m below Lowest Astronomical Tide (LAT) to 165 mLAT, averaging 155 mLAT.

Oil is exported by shuttle tanker and excess produced gas was initially exported through a dedicated pipeline to the Tern-North Cormorant gas pipeline. Later in the field life due to a reduction in the quantity of produced gas, it has been continuously imported to balance the fuel gas deficit. The subsea facilities are tied back to the FPSO by two subsea pipeline bundles and flexible risers. Water injection is required to maintain the reservoir pressure and gas lift is also required to assist production. Due to the nature of the reservoir, the production and injection wells are clustered around two drill centres: the North Drill Centre (NDC) and the South Drill Centre (SDC). The NDC and SDC bundle towheads both have eight slot, integral manifolds, allowing for up to 16 wells to be tied back. The NDC has five production and three water injection slots; the SDC has four production and four water injection slots (Figure 1-2).

Following public, stakeholder and regulatory consultation, this Environmental Appraisal (EA) is submitted in support of the Western Isles Decommissioning Programmes (DPs), which are submitted without derogation and in full compliance with Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) guidelines. This EA supports the DP for the subsea infrastructure remaining following FPSO sail away.

1.2 Regulatory Context

The decommissioning of offshore oil and gas infrastructure on the United Kingdom Continental Shelf (UKCS) is principally governed by the Petroleum Act 1998, as amended by the Energy Act 2008. The Petroleum Act sets out the requirements for a formal DP before the owners of an offshore installation or pipeline may proceed. The responsibility for ensuring that the requirements of the Petroleum Act 1998 are complied with rests with OPRED which sits within the Department for Business, Energy and Industrial Strategy (BEIS). The Guidance describes a proportionate process that culminates in a streamlined EA Report to support a DP, which focuses on screening out non-significant impacts and a detailed assessment of potentially significant impacts.

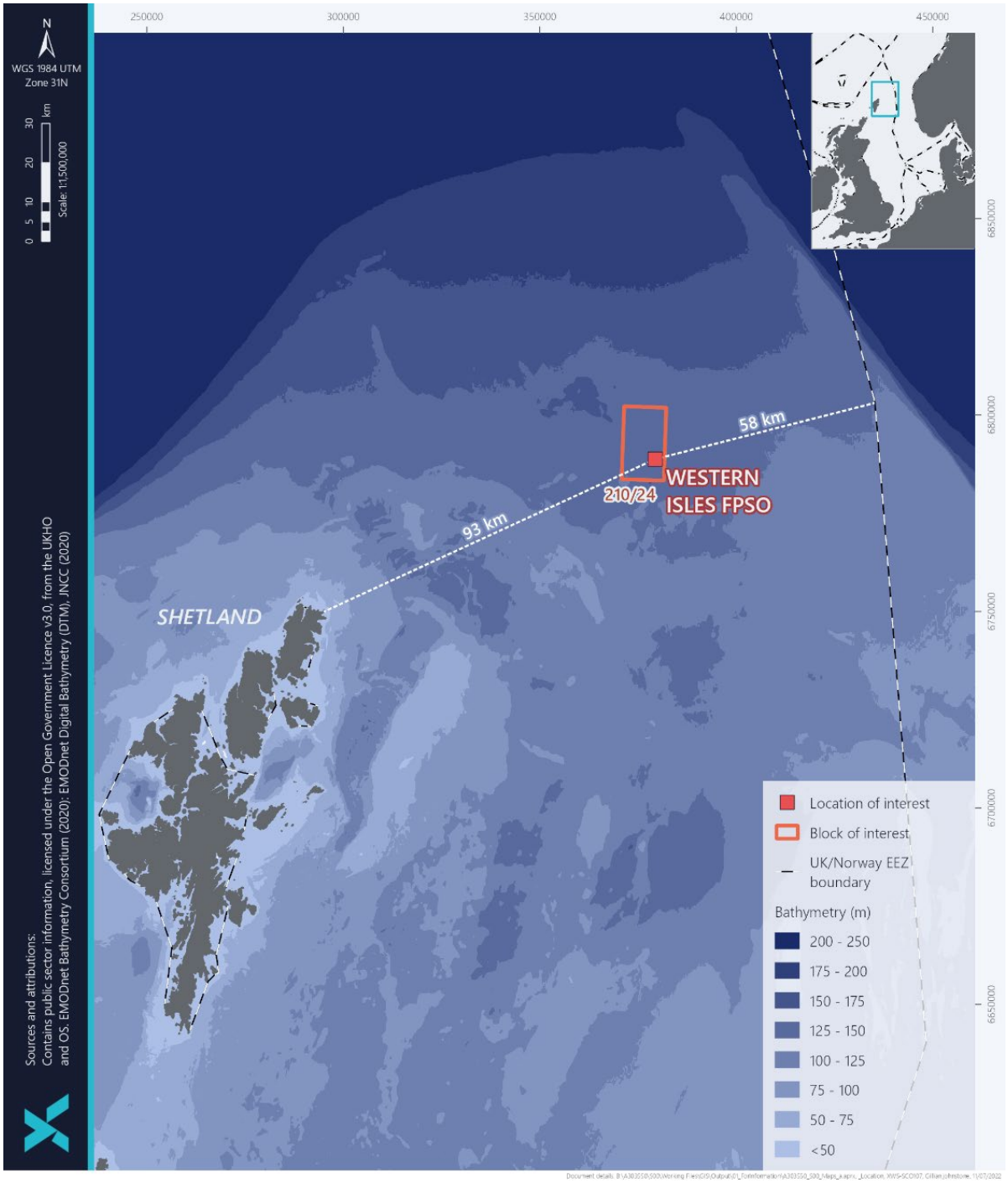


Figure 1-1 Location of the Western Isles Infrastructure

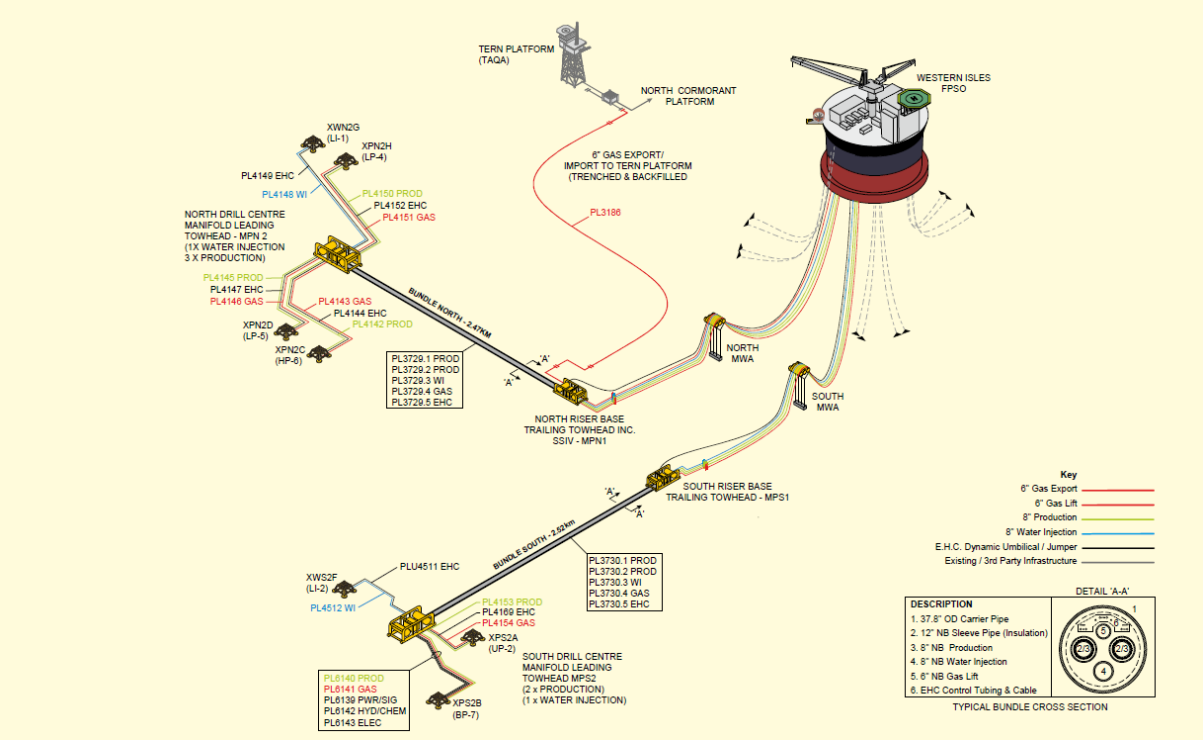


Figure 1-2 Western Isles facilities layout

The Guidance (BEIS, 2018) also states that surface installations (not subject to derogation) and subsea installations (e.g., manifolds, wellhead protection structures) must, where practicable, be completely removed for reuse, recycling or final disposal on land. With regards to pipelines (including flowlines and umbilicals), these should be considered on a case-by-case basis, and there are instances where pipelines could be decommissioned *in situ*. For example, pipelines that are adequately buried (minimum 0.6m), trenched or expected to self-bury could be considered as candidates for *in situ* decommissioning. Where an Operator is considering decommissioning pipelines *in situ*, the decision-making process must be informed by 'Comparative Assessment' (CA) of the feasible decommissioning options to arrive at a preferred decommissioning solution. Finally, the guidance states that mattresses and grout bags installed to protect pipelines should be removed for disposal onshore if their condition allows.

1.3 Decommissioning Overview

The decommissioning plans for the Western Isles (Barra and Harris) Field, hereby referred to as the project area, are described across three DPs, (1) installations; and (2) the subsea pipelines including the pipelines, bundles (including the pipelines carried within them), rigid tie-in spools, control jumpers and associated structures and stabilisation and (3) subsea pipelines associated with well BP7 including pipelines, spools, jumpers and associated structures and stabilisation. The items included in the subsea DPs:

1. Western Isles Section 29 Notice – Installations
    - All subsea equipment associated with the Western Isles (Barra & Harris) Fields
2. Western Isles Section 29 Notice – Submarine Pipelines
    - All subsea pipelines as detailed in section 2.2
3. Western Isles Section 29 Notice – Submarine Pipelines
    - All pipelines associated with well BP7

A separate Draft DP was submitted in March 2023 for statutory and public consultation on removal of the Western Isles floating production storage and offloading (FPSO) vessel and its associated mooring systems, risers and dynamic umbilicals.

The Western Isles FPSO DP and the Western Isles Subsea DP, as described in Table 1-1.

Table 1-1 Summary of Decommissioning Programmes

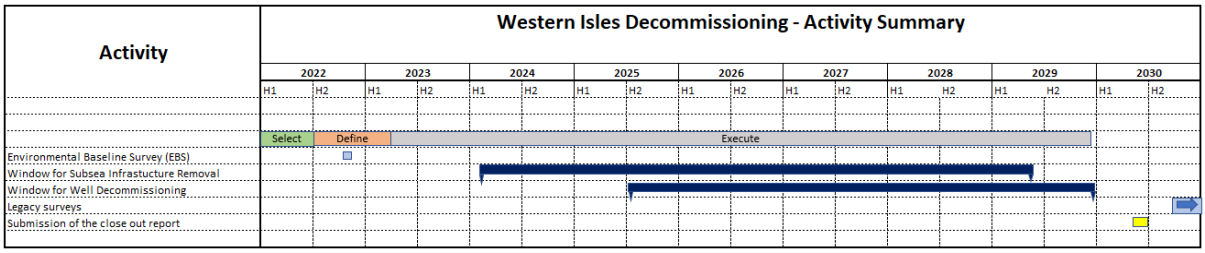
CA Group	Title	Proposed Decommissioning Solution	Associated DP	In / Out Scope of EA
1	FPSO	Full removal	FPSO	Out
2	Mooring Lines (Upper Section)	Full removal	FPSO	Out
3	Mid-water Arches	Full removal	Subsea	In
4	Dynamic Flexible Risers	Full removal	FPSO	Out
5	Dynamic Umbilicals	Full removal	FPSO	Out
6	Bundles	Decommission *in situ*	Subsea	In
7	Rigid Pipelines (Trenched and Backfilled)	Decommission *in situ*	Subsea	In
8	Spools	Full removal	Subsea	In
9	Jumpers	Full removal	Subsea	In
10	Structures	Full removal	Subsea	In
11	Protection Materials	Full removal	Subsea	In
12	Mooring Lines (Lower Chain & Anchor Piles)	Full removal	Subsea	In

This EA report covers the environmental impacts of the subsea decommissioning activities following FPSO float-off. Table 1-1 differentiates between the item groups covered by the Subsea DP (and consequently this EA) and the separate FPSO DP and associated permitting application via the Portal Online Tracking System (PETS).

1.4 Proposed Schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability of cost-effective removal services and contractual agreements. The potential activity window for the Western Isles subsea decommissioning activity is between 2024 and 2029 (Table 1-2).

Table 1-2 Project Schedule



1.5 Selected Decommissioning Options

In line with the Guidance (BEIS, 2018) all subsea installations will be removed for reuse, recycling or final disposal on land. Protection materials will be removed for disposal onshore if their condition allows.

To assess the preferred decommissioning options for the Western Isles pipelines, Dana undertook a CA determine the preferred decommissioning options for the Western Isles pipelines. Each decommissioning option was assessed against five criteria – Safety, Environment, Technical, Societal and Economic. The CA outlines the decommissioning options available for the pipeline types. All pipelines will be fully removed, with the exception of the two bundles and rigid pipeline which are proposed to be decommissioned *in situ*. All pipeline and bundle ends (including towheads) will be disconnected and removed along with all bundle venting appurtenances and ballast chains. Along with pipeline ends, any surface laid sections of the rigid pipeline up to the point of burial will also be removed. Protective rock cover will be placed over cut ends to eliminate any potential snagging risk.

1.6 Environmental and Societal Sensitivities

Table 1-3 Environmental and social sensitivities
Physical Environment
The Western Isles FPSO and associated infrastructure are located within Blocks 210/24 and 210/25 of the UKCS. Water depth across the field ranged from 150 mLAT and 165 mLAT. Along the pipeline route, the water depth ranged from 160 mLAT to 165 mLAT. The seabed in the field and along the pipeline is mostly relatively flat with some broad undulations across the site.
Conservation Sites
The Pobie Bank Reef Special Area of Conservation (SAC) is the nearest conservation site to the project area, located approximately 61 km away. The SAC is designated for the presence of Annex

I reef habitats (stony and bedrock reef (Annex I habitat type 1170 Reef)). All other protected areas are located over 90 km from the project area. The closest coastal designated site is the Hermaness, Saxa Vord and Valla Field Special Protection Area (SPA), approximately 93 km from the Western Isles FPSO.

Habitats and Species of Conservation Importance

Harbour porpoise, minke whales and Atlantic white-sided dolphin are likely to be seen in the project area. Harbour porpoise are frequently found throughout UK waters and are most likely to be observed in the project area in summer months in moderate numbers (their density in the area is estimated to be 0.402 animals/km^2). Minke whales are most likely to be observed in the project area in the summer months and in low numbers. Their density is predicted to be 0.0316 animals/km^2. Atlantic white-sided dolphins are only likely to be observed in the project area during July though in high numbers. The density of Atlantic white-sided dolphins in the project area is estimated to be 0.003 animals/km^2.

Both grey and harbour seals are unlikely to be observed in the project area. Their predicted at-sea density for both species within the project area is expected to be <0.01 individuals per 25 km^2. The percentage of both seal populations in the Western Isles area at any given time is ≤0.001%.

Benthic Environment

Four habitats were identified within the 2022 survey area and described as the EUNIS level 3 habitat types 'Atlantic offshore circalittoral coarse sediment' (MD32), 'Atlantic offshore circalittoral mixed sediment' (MD42), 'Atlantic offshore circalittoral sand' (MD52) and 'Atlantic offshore circalittoral mud' (MD62).

Burrows were observed in sufficient density to comprise the OSPAR listed Threatened and/or Declining Species and Habitat 'Sea pens and burrowing megafaunal communities' on two transects. The habitat Feature of Conservation Interest (FOCI) and priority habitat 'Subtidal sands and gravels' is also likely to be present.

There was no indication from the 2010, 2012 or 2022 surveys of the presence of any Annex I habitats along either of the survey corridors within the in-field area, along the two in-field routes, or along the pipeline route between the FPSO and Tern.

The 2012 survey identified that polychaetes were the dominant species group in the surveyed area, making up 69% of all individuals and 53% of all recorded taxa. Overall, the high number of taxa present at low abundances suggests that the survey area was undisturbed and with limited evidence of localised and low level contamination from drilling.

Fish

The project area is an area of high nursery intensity for blue whiting. Other species, including anglerfish (monkfish), European hake, haddock, herring, ling, mackerel, Norway pout, spurdog and whiting use the area as a nursery ground. Haddock, Norway pout, saithe and whiting potentially use the project area as grounds for spawning, with spawning efforts for these species being concentrated in the first half of the year (between January and June). Some of these species are classed as Priority Marine Features (PMF) these include Anglerfish, blue whiting, herring, ling, mackerel, Norway pout, saithe and whiting. Additionally, spurdog are an OSPAR listed Threatened and/or Declining Species.

Seabirds

The following species may utilise the project area and surrounding waters at points in the year: European storm petrel; long tailed skua; northern gannet; great skua; black-legged kittiwake; glaucous gull; great black-backed gull; herring gull; common guillemot; little auk; razorbill and Atlantic puffin (species highlighted in red are threatened or declining). The Seabird Oil Sensitivity

Index (SOSI) identifies areas at sea where seabirds are likely to be most sensitive to surface pollution. The SOSI within Blocks 210/24 and 210/25 and the surrounding area is typically low throughout much of the year except for December and January when sensitivity is extremely high.
Commercial Fisheries
The project area is located in ICES Rectangle 51F0 which is targeted primarily for demersal species. In 2021 (most recent data), the demersal catch live weight was 911 Te with a corresponding value of approximately £1.7 million. This accounts for approximately 67% of landings and approximately 84% of value for the year. 2021 saw a return of pelagic landings from ICES Rectangle 51F0, albeit with a relatively modest catch live weight of 454 Te and a corresponding value of approximately £0.3 million. This accounts for approximately 33% of landings and approximately 16% of value for the year. Rectangle 51F0 contributed approximately 0.25% of landings and 0.3% of value when compared to overall UKCS in 2021. It should be noted that this is significantly lower than ICES rectangles that are regularly targeted by pelagic fisheries. Overall, fishing effort in this ICES area is relatively low, although there is a recent trend showing increased effort; in 2021 there were 218 fishing days compared to 131 days in 2017. Historically, effort was mostly concentrated in the summer months and in November and December. However, as of 2021, fishing occurred in all months except for December. Fishing intensity along the PL3186 pipeline is also low, reaching a maximum of 150 hours (total), attributed to fishing vessels passing over the pipeline during transiting periods.
Other Sea Users
Shipping activity within Blocks 210/24 and 210/25 is considered very low and low, respectively. Neither block is noted as an area of concern for the MoD. There are multiple surface installations within 50 km of the Western Isles FPSO: the closest being the TAQA Tern asset (12 km ENE). There are no cables within 100 km of the infrastructure. There are, at present, no renewable energy sites close to the Western Isles area; however, the FPSO lies approximately 27 km southwest of the NE-a and NE-b Innovation and Targeted Oil and Gas (INTOG) scheme areas. The nearest wreck is located approximately 20 km east of the project area and is classified as non-dangerous.

1.7 Impact Assessment

This EA Report has been prepared in line with the OPRED Decommissioning Guidelines. The environmental impact assessment 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 ENVID workshop discussed the proposed decommissioning activities and any potential impacts these may pose. The impacts assessed were as follows:

1. Atmospheric emissions;
2. Seabed disturbance;
3. Physical presence of infrastructure decommissioned *in situ* in relation to other sea users;
4. Physical presence of vessels in relation to other sea users;
5. Underwater noise associated with general decommissioning activities;

6. Discharges to sea;
7. Resource use;
8. Waste; and
9. Accidental events

Of the nine potential impacts, only impacts associated with 'Atmospheric emissions', 'Seabed disturbance' and 'Physical presence of infrastructure decommissioned *in situ* in relation to other sea users' have been screened in for further assessment based on the potential severity and / or likelihood of their respective environmental impact.

Further reasoning for why the remaining six impacts were scoped out, and mitigation measures that will be applied against each aspect, are presented in Section 5 of this document. The intention is that such measures should remove, reduce or manage the impacts to a point where the resulting residual significance is reduced to 'as low as reasonably practicable' (ALARP). The potential impacts taken forward for further assessment were as follows:

The overall assessment for **Atmospheric emissions** was of 'Low' significance. However further investigation was deemed necessary due to increasing scientific, public and stakeholder concern regarding the impacts of anthropogenic climate change on the environment and the potential contribution of greenhouse gas emissions to global warming, Section 5.2 provides a summary of the emissions, relevant management and mitigation measures and a discussion of cumulative and residual impacts. Emissions during decommissioning activities, (largely comprising fuel combustion gases) will occur following cessation of production (CoP). Emissions generated by equipment and vessels and those associated with production from the fields will be replaced by those from vessel use as well as the recycling of decommissioned materials and the emissions relating to new manufacture of materials for replacement of items decommissioned *in situ*. The estimated CO_2 emissions to be generated by the subsea decommissioning activities are estimated to be 28.81 $ktCO_2e$, which represent 0.19% of the 14.63 $MtCO_2e$ generated offshore on the UKCS in 2018 (OEUK, 2019). Overall, when considering the spatial and temporal scale of the disturbance, and accounting for the following mitigation measures, the impact of the emissions associated with subsea decommissioning activities was considered not significant.

Most emissions during the decommissioning activities will be the result of combustion of hydrocarbons for power generation related to vessels. Vessels will be owned by a 3rd Party and the activities are therefore subject to supply chain processes of contract selection and management. Minimisation of emissions from vessels will form part of the selection criteria for the installation vessels though the tendering and selection process.

- Minimal number of vessels deployed and streamlining of activities through planning to reduce the time required for vessels will be required for these activities and will support the drive to reduce emissions.

- Each vessel will have a Shipboard Energy Efficiency Management Plan (SEEMP) which contains information of minimising fuel consumptions e.g., economical speeds when operationally appropriate and vessel equipment maintained according to manufacturer's recommendations and Dana processes, including the use of low sulphur diesel, green dynamic positioning and the economical speeds when operationally appropriate.
- Dana have also commissioned an Energy and Emissions Report to provide insight into the full lifecycle of emissions associated with the project and to highlight where emissions savings could be made.

Disturbance to seabed was investigated further for potential impacts due to the nature of the proposed decommissioning activities. These will result in an worst-case area of permanent direct disturbance equalling 0.003 km^2 and a temporary direct disturbance equalling 0.032 km^2. When accounting for temporary indirect disturbance (which arises secondarily due to sediment suspension and resettlement), the total area of impact is approximately 0.069 km^2. While the activities may result in the mortality of some individuals, many of the taxa within the area are relatively resilient and the sandy communities which comprise this area are comparatively quick to recover from disturbance. No decommissioning activity will be taking place in protected areas; therefore, it is highly unlikely that any areas of conservation, designated for species of interest, will be directly or indirectly affected. With regards to the sediment and benthic features within area, the proposed activities are unlikely to affect the natural physical processes of the area. Pipelines decommissioned *in situ* are also unlikely to have an impact on these processes and their gradual degradation over time is expected to have a negligible impact on the surrounding sediments. Initial assessment of this aspect within the ENVID yielded; 'Minor' Severity (spatial extent) and 'Very Unlikely' Likelihood producing an overall 'Medium' impact risk. However, taking into consideration the benthic environment, seabed characteristics, commercial fishing, relatively small size of disturbance area and along with industry and Dana mitigation measures, the overall assessment was reduced to 'Low'. Overall, due to the improbability of such a snagging event occurring, the impact is considered not significant.

- All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised. In practical terms this means that dynamically positioned vessels will be used to undertake the decommissioning operations, any excavation will only be undertaken where necessary to facilitate cutting and recovery of items and that recovery basket deployment will be minimised;
- A debris survey will be undertaken at the completion of the decommissioning activities. Any debris identified as resulting from oil and gas activities will be recovered from the seabed where possible; and
- Remedial rock cover will be applied by a fall pipe vessel equipped with an underwater camera on the fall pipe. This will ensure accurate placement and reduce unnecessary spreading of the rock footprint, ensuring that the minimum safe quantity of rock is used.

Impact on other sea users was investigated due to the potential impact on commercial fisheries. Of key importance was understanding the utilisation of the Western Isles area for commercial fisheries purposes and any potential snagging risk that infrastructure decommissioned *in situ* may pose. Also addressed was the potential for seabed depressions (either existing or which may be generated through the decommissioning) and the implications for fishing vessels.

The CA outcome has determined that spools, jumpers, surface laid infrastructure and associated stabilisation material will be fully removed. The trenched and buried rigid pipeline (PL3186) and both surface laid bundles (North and South) will be decommissioned *in situ.* While consideration was given to potential spanning, Dana's understanding is that while there is natural seabed undulation, there are no FishSAFE spans, or exposures associated with either bundle or the pipelines. Should this be found to have changed after the post-decommissioning survey, Dana will engage with OPRED.

Initial assessment of this aspect within the ENVID yielded; a severity of 'Catastrophic' owing to the potential severity of a snagging event, the likelihood of such an event was deemed 'Unlikely' therefore overall, the risk is considered 'Medium'. These impacts will be restricted to commercial fisheries that make active contact with the seabed, such as bottom trawls and dredging gears. Commercial fisheries as a receptor are of low sensitivity as the industry can accommodate change. The vulnerability of the receptor is also considered low as the presence of the pipelines are not likely to influence fishing activity in the area beyond current natural variation. The value of commercial fisheries is also considered low when comparing the financial value and contribution of the catch within the wider regional context. The re-opening of the 500m safety zones around the Western Isles infrastructure will also expand the available fishing grounds. Foreign fleets are also not considered to be highly dependent on the area, based on recent AIS data.

Due to the small area of remaining infrastructure and the commitment to overtrawlability and future monitoring, the likelihood of a snagging event was reduced to 'Very Unlikely' therefore overall, the risk is still considered 'Medium'. Dana will carefully manage Impacts and minimise risk to commercial fisheries through the following measures:

- The Western Isles pipelines are currently shown on Admiralty Charts, the FishSAFE system and the OGA Infrastructure data systems (OGA Open Data). Once decommissioning activities are complete, updated information (i.e., which infrastructure remains *in situ* and which has been removed) will be made available to allow Admiralty charts and the FishSAFE system to be updated;
- Any exposures or cut pipeline ends will be rock covered with a profile designed to ensure they are overtrawlable by fishing vessels;
- Any objects dropped during decommissioning activities will be removed from the seabed where appropriate;
- Dana will monitor the seabed to assess any seabed depressions or clay berms which may present a snag risk. The survey results will be used in discussion with OPRED prior to the commencement of any intervention;

- Clear seabed verification will ensure there is no residual risk to other sea users. The proposed method for clear seabed validation is through non-intrusive methodologies such as Side-scan Sonar (SSS) and Multi-Beam Echosounder (MBES). If non-intrusive methods are deemed inconclusive during verification, alternative methods will be discussed and agreed with OPRED and fishing bodies;
- Ongoing consultation with fisheries representatives; and
- Dana recognises its obligation to monitor any infrastructure decommissioned *in situ* and therefore intends to set up arrangements to undertake post-decommissioning monitoring. The frequency of the monitoring that will be required will be agreed with OPRED and future monitoring will be determined through a risk-based approach established from the findings of each survey in turn. During the period over which monitoring is required, the burial status of the infrastructure decommissioned *in situ* would be reviewed and any necessary remedial action will be undertaken to ensure it does not pose a risk to other sea users.

1.8 Conclusion

This EA has considered Scotland's National Marine Plan, adopted by the Scottish Government to help ensure sustainable development of the marine area. Dana considers 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 and that there is not expected to be a significant impact on any European or nationally designated protected sites in proximity to the activities.

2 INTRODUCTION

2.1 Background

The Western Isles FPSO, operated by Dana Petroleum (E&P) Limited, produces from the Harris and Barra Fields. The Fields are located in the northern North Sea (NNS) UKCS, Block 210/24a, situated 93 km to the northeast of Shetland and 12 km west of the Tern platform, which is the nearest fixed facility. The water depth of the project area varies between 150 mLAT and 165 mLAT. The production and injection wells are clustered around two drill centres: the North Drill Centre (NDC) and the South Drill Centre (SDC). There are currently three production wells one water injection well at the NDC; and two production wells and one water injection well at the SDC.

The Field has been developed using a floating production, storage and offloading (FPSO) facility. is exported by shuttle tanker and excess produced gas was initially exported through a dedicated pipeline to the Tern-North Cormorant gas pipeline. Later in the field life due to a reduction in the quantity of produced gas, it has been continuously imported to balance the fuel gas deficit. The subsea facilities are tied back to the FPSO by two subsea pipeline bundles and flexible risers. Water injection is required to maintain the reservoir pressure and gas lift is also required to assist production. Due to the nature of the reservoir, the production and injection wells are clustered around two drill centres: the North Drill Centre (NDC) and the South Drill Centre (SDC). The NDC and SDC bundle towheads both have eight slot, integral manifolds, allowing for up to 16 wells to be tied back. The NDC has five production and three water injection slots; the SDC has four production and four water injection slots The general arrangement is shown in Figure 2-1.

2.2 Regulatory Context

The decommissioning of offshore oil and gas installations and pipelines on the UKCS is controlled through the Petroleum Act 1998. Decommissioning is also regulated under the Marine and Coastal Act 2009 and Marine (Scotland) Act 2010. The UK's international obligations on decommissioning are primarily governed by the 1992 Convention for the Protection of the Marine Environment of the Northeast Atlantic (‘the Oslo Paris (OSPAR) Convention’). The responsibility for ensuring compliance with the Petroleum Act 1998 rests with the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), part of the Department for Business, Energy and Industrial Strategy (BEIS).

Under the OPRED Guidance Notes, Decommissioning of Offshore Oil and Gas Installations and Pipelines (OPRED, 2018) which align with the Petroleum Act 1998, the DP should be supported by an EA. The Guidance sets out a framework for the required environmental inputs and deliverables throughout the approval process and outlines that an EA should be a document providing necessary content in proportion to the complexity and magnitude of a project. Decom North Sea’s Environmental Appraisal Guidelines for Offshore Oil and Gas Decommissioning provide further definition on the requirements of EA Reports (Decom North Sea, 2018a).

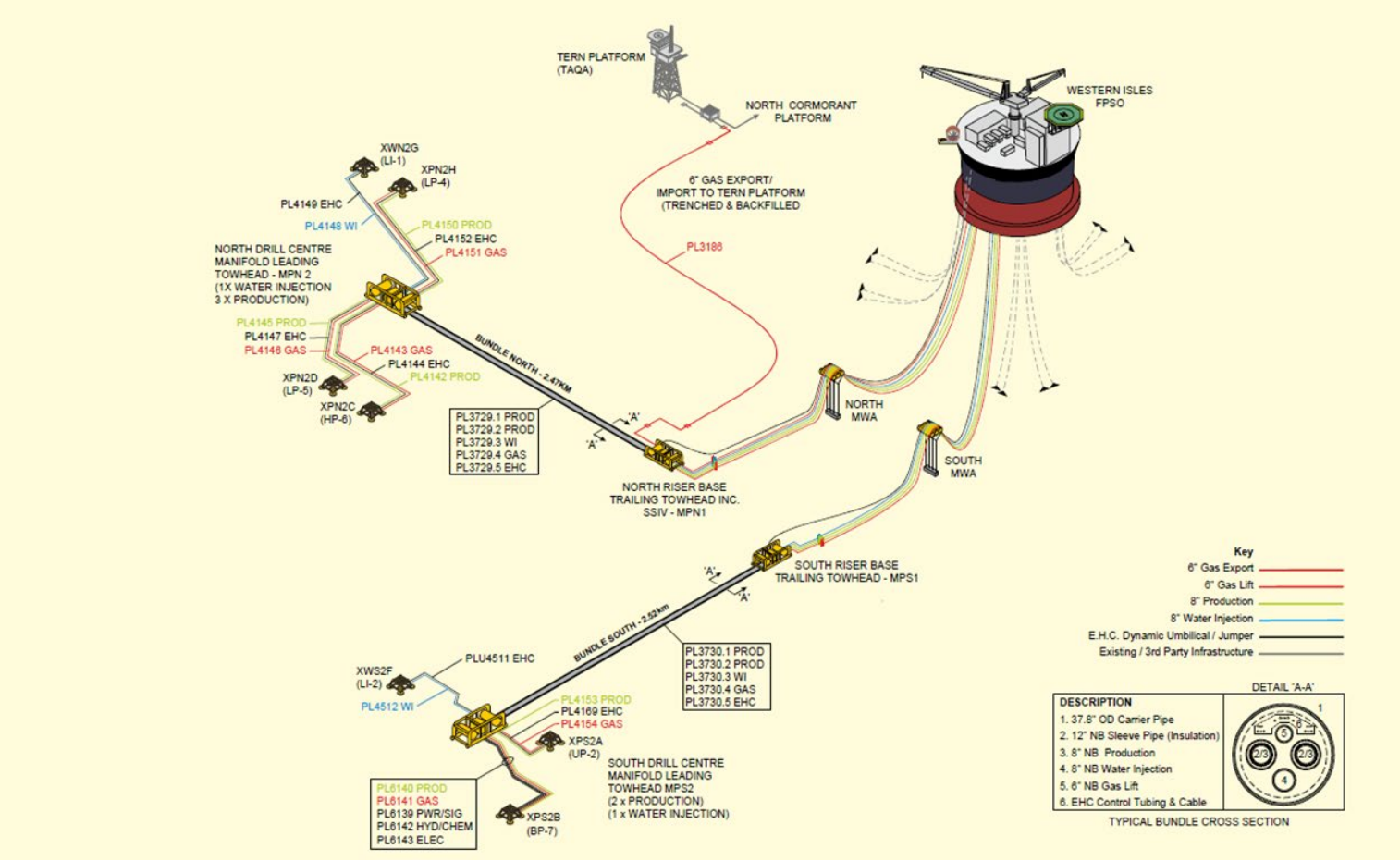


Figure 2-1 Western Isles (Barra and Harris) fields layout

Dana will use a risk assessment process in line with the Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment (EIA)) Regulations 2020, to assess the potential environmental impact of the decommissioning activities.

The Guidance (BEIS, 2018) also states that surface installations (not subject to derogation) and subsea installations (e.g., manifolds, wellhead protection structures) must, where practicable, be completely removed for reuse, recycling or final disposal on land. With regards to pipelines (including flowlines and umbilicals), these should be considered on a case-by-case basis, and there are instances where pipelines could be decommissioned *in situ*. For example, pipelines that are adequately buried, trenched or expected to self-bury could be considered as candidates for *in situ* decommissioning. Where an Operator is considering decommissioning pipelines *in situ*, the decision-making process must be informed by 'Comparative Assessment' (CA) of the feasible decommissioning options to arrive at a preferred decommissioning solution. Finally, the guidance states that mattresses and grout bags installed to protect pipelines should be removed for disposal onshore if their condition allows.

In terms of activities in the Northern North Sea (NNS), the Scotland's National Marine Plan (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 Plan has been developed in line with UK, European Union (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. Dana has given due consideration throughout this EA to the NMP during Project decision making and the interactions between the Project and Plan.

2.3 Scope of the Environmental Appraisal

This EA report covers the environmental impacts of the subsea decommissioning activities following FPSO float-off. Table 2-1 differentiates between the item groups covered by the Subsea DP (and consequently this EA) and the separate FPSO DP and associated permitting application via the Portal Online Tracking System (PETS). The Western Isles infrastructure that falls within scope of this EA includes bundles, rigid pipelines, spools, jumpers, towheads and WHPS, all protection/stabilisation material (concrete mattresses and grout bags) and mooring piles and chains.

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 necessary mitigation/control measures proposed.

Table 2-1 Summary of Decommissioning Programmes				
CA Group	**Title**	**Proposed Decommissioning Solution**	**Associated DP**	**In / Out Scope of EA**
1	FPSO	Full removal	FPSO	Out
2	Mooring Lines (Upper Section)	Full removal	FPSO	Out
3	Mid-water Arches	Full removal	Subsea	In
4	Dynamic Flexible Risers	Full removal	FPSO	Out
5	Dynamic Umbilicals	Full removal	FPSO	Out
6	Bundles	Decommission *in situ*	Subsea	In
7	Rigid Pipelines (Trenched and Backfilled)	Decommission *in situ*	Subsea	In
8	Spools	Full removal	Subsea	In
9	Jumpers	Full removal	Subsea	In
10	Structures	Full removal	Subsea	In
11	Protection Materials	Full removal	Subsea	In
12	Mooring Lines (Lower Chain & Anchor Piles)	Full removal	Subsea	In

2.4 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 DPs, where applicable, and acted upon during the subsequent planning and implementation stages of the project.

Following pre-briefings with stakeholders, a CA workshop was held on the 17th August 2022 with key stakeholders present to inform the proposed decommissioning activities set out in the DP. This provided an opportunity to test both the inputs and outputs and identify any potential gaps in the assessment that may require further review. No gaps were highlighted (although sensitivity tests were explored) and the initial recommendations which emerged from the CA process were broadly agreed.

Regular engagement has also been undertaken with OPRED during the development of the DP, whose representatives were also present to observe the CA workshop. Formal statutory and public stakeholder consultation will be triggered by the submission of the draft DP, supported by this EA (and the CA) to OPRED.

2.5 Environmental Appraisal Process

To evaluate the potential environmental impact of the proposed decommissioning activities, an environmental assessment process has been conducted. This EA documents the results of the process and sets out the detail. An overview of the EIA process is provided in Figure 2-2. A detailed methodology is provided in Appendix A.

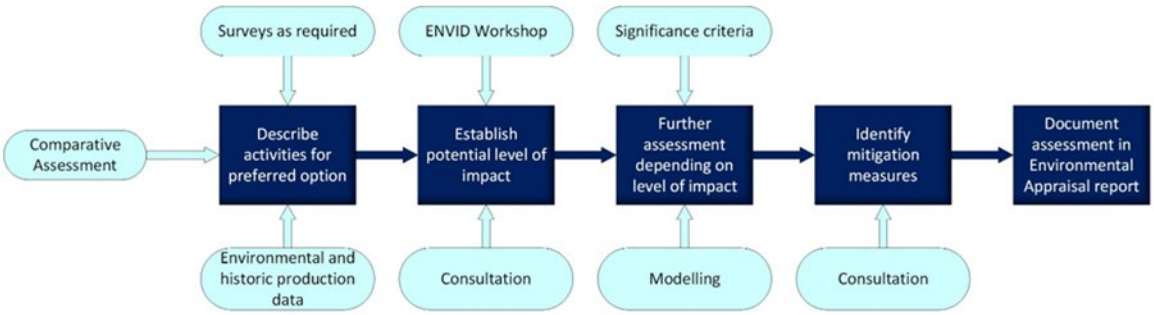


Figure 2-2 The EIA process

3 PROJECT DESCRIPTION

This section outlines the infrastructure being decommissioned as part of the Western Isles subsea decommissioning project and describes the how the infrastructure will either be removed or be decommissioned *in situ.*

3.1 Subsea Infrastructure

There are two towheads associated with each of the bundles (four in total) and seven Wellhead Protection Structures (WHPSs). There are small differences between the towheads for the bundles; however, the typical arrangement is shown in Figure 3-1. There are 12 mooring piles and chains associated with the FPSO, arranged in three groups of four as shown in Figure 3-2.

Table 3-1 Subsea Installations and Stabilisation Features Information

Description	No.	Size/Weight (Te)	Location		Comments/ Status
NDC Leading Towhead (MPN2)	1	29.375 x 6 x 5.956m (L x W x H) 209 Te (In-air)	WGS84 Decimal	61.216895° N 0.703995° E	Gravity Based
			WGS84 Decimal Minute	61° 13' 0.821" N 0° 42' 14.383" E	
SDC Leading Towhead (MPS2)	1	29.375 x 6 x 5.954m (L x W x H) 208 Te (In-air)	WGS84 Decimal	61.195721° N 0.727901° E	Gravity Based
			WGS84 Decimal Minute	61° 11' 44.595" N 0° 43' 40.442" E	
NRB Trailing Towhead (MPN1)	1	19.76 x 6.6 x 5.281m (L x W x H) 119.22 Te (In-air)	WGS84 Decimal	61.216926° N 0.749498° E	Gravity Based
			WGS84 Decimal Minute	61° 13' 0.933" N 0° 44' 58.192" E	
SRB Trailing Towhead (MPS1)	1	19.76 x 6.0 x 5.281m (L x W x H) 109.72 Te (In-air)	WGS84 Decimal	61.216056° N 0.747561° E	Gravity Based
			WGS84 Decimal Minute	61° 12' 57.801" N 0° 44' 51.219" E	
FPSO Mooring Line Anchor Pile #1	1	32 x 2.438m (L x Dia)	WGS84 Decimal	61.212436 °N 0.726678 °E	The lower chain section remains attached to the

Table 3-1 Subsea Installations and Stabilisation Features Information					
Description	**No.**	**Size/Weight (Te)**	**Location**		**Comments/ Status**
		137 Te	WGS84 Decimal Minute	61° 12' 44.771" N 0° 43' 36.042" E	anchor pile. Upper chain section, polyester section, buoyancy tanks and H-shackles shall be removed prior to works covered by this DP. Note: Upper section removals are captured in the Western Isles FPSO DPs.
FPSO Mooring Line Anchor Pile #2	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.212894 °N 0.726510 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 12' 46.420" N 0° 43' 35.436" E	
FPSO Mooring Line Anchor Pile #3	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.215172 °N 0.726347 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 12' 54.619" N 0° 43' 34.848" E	
FPSO Mooring Line Anchor Pile #4	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.215646 °N 0.726457 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 12' 56.326" N 0° 43' 35.244" E	
FPSO Mooring Line Anchor Pile #5	1	36 x 2.438m (L x Dia) 152 Te	WGS84 Decimal	61.227141 °N 0.761179 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 13' 37.708" N 0° 45' 40.244" E	
FPSO Mooring Line Anchor Pile #6	1	32 x 2.438m (L x Dia)	WGS84 Decimal	61.227010 °N 0.762100 °E	

Table 3-1 Subsea Installations and Stabilisation Features Information					
Description	**No.**	**Size/Weight (Te)**	**Location**		**Comments/ Status**
		137 Te	WGS84 Decimal Minute	61° 13' 37.238" N 0° 45' 43.558" E	See comment for FPSO Mooring Line Anchor Pile #1
FPSO Mooring Line Anchor Pile #7	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.226102 °N 0.766492 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 13' 33.966" N 0° 45' 59.370" E	
FPSO Mooring Line Anchor Pile #8	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.225878 °N 0.767333 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 13' 33.160" N 0° 46' 2.399" E	
FPSO Mooring Line Anchor Pile #9	1	35 x 2.438m (L x Dia) 149 Te	WGS84 Decimal	61.203547 °N 0.768877 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 12' 12.771" N 0° 46' 7.956" E	
FPSO Mooring Line Anchor Pile #10	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.203307 °N 0.768098 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 12' 11.905" N 0° 46' 5.154" E	
FPSO Mooring Line Anchor Pile #11	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.202267 °N 0.763853 °E	See comment for FPSO Mooring Line Anchor Pile #1
			WGS84 Decimal Minute	61° 12' 8.161" N 0° 45' 49.870" E	
FPSO Mooring Line Anchor Pile #12	1	32 x 2.438m (L x Dia) 137 Te	WGS84 Decimal	61.202092 °N 0.762959 °E	See comment for FPSO Mooring Line Anchor Pile #1
				61° 12' 7.532" N	

Table 3-1 Subsea Installations and Stabilisation Features Information					
Description	**No.**	**Size/Weight (Te)**	**Location**		**Comments/ Status**
			WGS84 Decimal Minute	0° 45' 46.653" E	
			WGS84 Decimal Minute		
MWA (APN1) Inc Gravity bases (APN1-B1 & APN1-B2) & Tether System (APN1 Tethers)	1	MWA Arch 14.5 x 11.4 x 7m (L x W x H) 157.9 Te (In air) <u>Docking Base</u> 16 x 10 x 3.2m (L x W x H) 212.6 Te (In air) <u>Sinker Weight</u> 14 x 5 x 1.4m (L x W x H) 179.5 Te (In air) <u>Sealantic Tethers (4)</u> 8.4 x 0.7 x 43.2m (L x W x H) 2.74 Te (In air)	WGS84 Decimal	61.215311°N 0.752482°E	Gravity Based
			WGS84 Decimal Minute	61° 12' 55.119" N 0° 45' 8.935" E	
			WGS84 Decimal Minute		
MWA (APS1) Inc Gravity bases (APS1-B1 & APS1-B2) & Tether System (APS1 Tethers)	1	<u>MWA Arch</u> 14.5 x 11.4 x 7m (L x W x H) 157.1 Te (In air)	WGS84 Decimal	61.214992°N 0.751850°E	Gravity Based
			WGS84 Decimal Minute	61° 12' 53.970" N 0° 45' 6.660" E	

Table 3-1 Subsea Installations and Stabilisation Features Information					
Description	**No.**	**Size/Weight (Te)**	**Location**		**Comments/ Status**
		<u>Docking Base</u> 16 x 10 x 3.2m (L x W x H) 210.9 Te (In air) <u>Sinker Weight</u> 14 x 5 x 1.4m (L x W x H) 179.2 Te (In air) <u>Tethers</u> 8.4 x 0.7 x 43.2m (L x W x H) 2.74 Te (In air)			
WHPS - 210/24a-B8Z (UP-2)	1	9.1 x 8.7 x 5.3m (L x W x H) 24.8 Te (In air)	WGS84 Decimal	61.195631 °N 0.728479°E	Attached to wellhead XPS2A
			WGS84 Decimal Minute	61° 11' 44.271" N 0° 43' 42.526" E	
WHPS - 210/24a-B10 (LI-2)	1	9.1 x 8.7 x 5.3m (L x W x H) 24.8 Te (In air)	WGS84 Decimal	61.195918 °N 0.727095 °E	Attached to wellhead XWS2F
			WGS84 Decimal Minute	61° 11' 45.306" N 0° 43' 37.543" E	
WHPS - 210/24a-B11 (BP-7)	1	9.1 x 8.7 x 5.3m (L x W x H) 24.8 Te (In air)	WGS84 Decimal	61.195398 °N 0.728203 °E	Attached to wellhead XPS2B
			WGS84 Decimal Minute	61° 11' 43.432" N 0° 43' 41.533" E	
WHPS - 210/24a-N1Z (HP-6)	1	9.1 x 8.7 x 5.3m (L x W	WGS84 Decimal	61.216504 °N 0.704393 °E	Attached to wellhead XPN2C
				61° 12' 15.815" N	

Table 3-1 Subsea Installations and Stabilisation Features Information					
Description	**No.**	**Size/Weight (Te)**	**Location**		**Comments/ Status**
		x H) 24.8 Te (In air)	WGS84 Decimal Minute	0° 42' 6.660" E	
WHPS - 210/24a-N2 (LP-4)	1	9.1 x 8.7 x 5.3m (L x W x H) 24.8 Te (In air)	WGS84 Decimal	61.217182 °N	Attached to wellhead XPN2H
				0.703810 °E	
			WGS84 Decimal Minute	61° 13' 1.854" N	
				0° 42' 13.716" E	
WHPS - 210/24a-N3Z (LP-5)	1	9.1 x 8.7 x 5.3m (L x W x H) 24.8 Te (In air)	WGS84 Decimal	61.216606 °N	Attached to wellhead XPN2D
				0.704176 °E	
			WGS84 Decimal Minute	61° 12' 59.780" N	
				0° 42' 15.034" E	
WHPS – 210/24a-N4Z (LI-1)	1	9.1 x 8.7 x 5.3m (L x W x H) 24.8 Te (In air)	WGS84 Decimal	61.217261 °N	Attached to wellhead XWN2G
				0.703593 °E	
			WGS84 Decimal Minute	61° 13' 2.140" N	
				0° 42' 12.936" E	

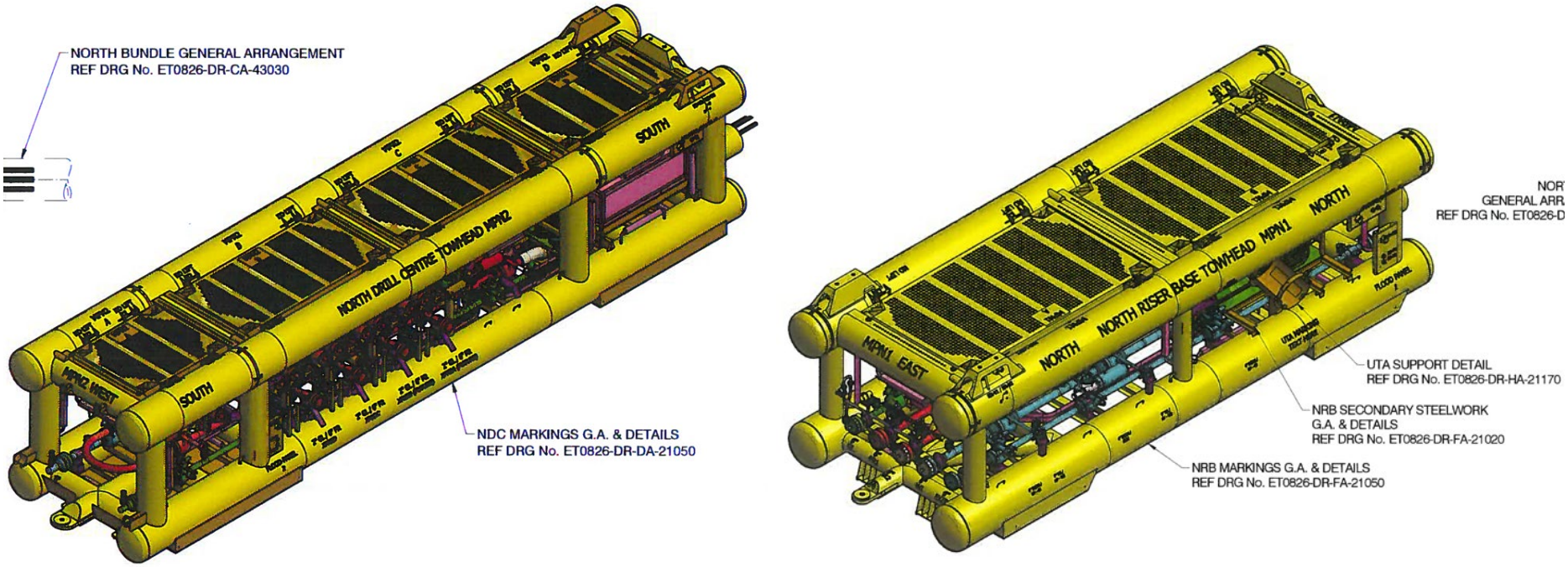


Figure 3-1 Towhead structure arrangement

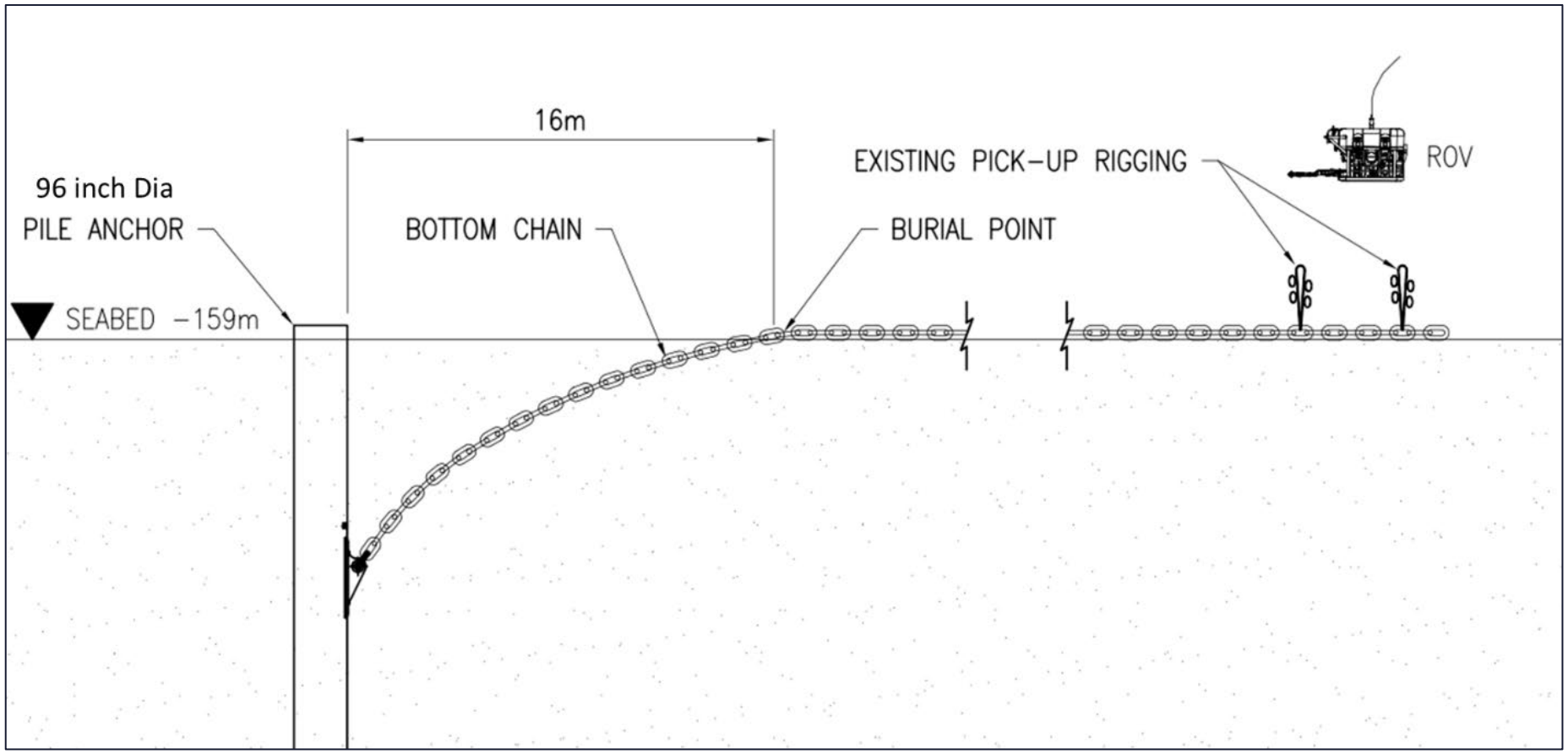


Figure 3-2 Mooring piles and chain arrangement

3.2 Pipelines, umbilicals and cables

There are two bundles, one for the NDC and one for the SDC. There are small differences between the bundles however, the general arrangement is shown in Figure 3-3. There is a single, trenched and buried rigid pipeline associated with the subsea infrastructure and a further 20 spools and six jumpers.

Table 3-2 Pipeline/Flowline/Umbilical Information

Description	Pipeline Number (as per PWA)	Diameter (inches)	Length (km)	Description of Component Parts	Product Conveyed	From – To End Points	Burial Status	Pipeline Status	Current Content
Rigid Gas Import / Export line	PL3186	6	11.274	Steel	Gas	NRB Trailing Towhead to Tern SSIV	Trenched and Buried	Operational	
North Bundle (Pipe-in-Pipes and Pipelines within Bundle)[1] Note: North Bundle total length is 2.4694 km (inc. Leading and Trailing Towhead)	PL3729.1, PL3729.2, PL3729.3, PL3729.4 and PLU3729.5	8 / 12 8 / 12 8 6 -	2.42027 2.42027 2.42027 2.42027 2.42027	Steel	Oil	NDC Leading Towhead to NRB Trailing Towhead	Surface laid (within Bundle)	Operational	Production fluid, Injection water, Lift gas, electrical, hydraulic, and chemical cores

[1] *Full details of the internal arrangements within the North Bundle can be found within the accompanying DP.*

Table 3-2 Pipeline/Flowline/Umbilical Information									
Description	**Pipeline Number (as per PWA)**	**Diameter (inches)**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Points**	**Burial Status**	**Pipeline Status**	**Current Content**
South Bundle (Pipe-in-Pipes and Pipelines within Bundle)[2] Note: South Bundle total length is 2.5235 km (inc. Leading and Trailing Towhead)	PL3730.1, PL3730.2, PL3730.3, PL3730.4 and PLU3730.5	8 / 12 8 / 12 8 6 -	2.47437 2.47437 2.47437 2.47437 2.47437	Steel	Oil	SDC Leading Towhead to SRB Trailing Towhead	Surface laid (within Bundle)	Operational	Production fluids, Injection water, Lift gas and Various electrical, hydraulic and chemical cores
Gas Import / Export Tie-in Spool	PL3186 Ident No.2	6	0.0054	Steel	Gas	6" Gas Import / Export Flexible Riser Flange to NRB Trailing Towhead Toweye	Surface Laid	Operational	Lift gas

[2] *Full details of the internal arrangements within the South Bundle can be found within the accompanying DP.*

Table 3-2 Pipeline/Flowline/Umbilical Information									
Description	**Pipeline Number (as per PWA)**	**Diameter (inches)**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Points**	**Burial Status**	**Pipeline Status**	**Current Content**
	PL3186 Ident No.3	6	0.06494	Steel	Gas	6" Gas Import / Export Flexible Riser Flange to NRB Trailing Towhead Toweye	Surface Laid	Operational	Lift gas
	PL3186 Ident No.5	6	0.0599	Steel	Gas	6" Gas Import / Export Flexible Riser Flange to NRB Trailing Towhead Toweye	Surface Laid	Operational	Lift gas
Production Tie-in Spool	PL3729.1	8	0.00535	Steel	Oil	NRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange	Surface Laid	Operational	Production fluid
	PL3729.2	8	0.00535	Steel	Oil	NRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange	Surface Laid	Operational	Production fluid

Table 3-2 Pipeline/Flowline/Umbilical Information									
Description	**Pipeline Number (as per PWA)**	**Diameter (inches)**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Points**	**Burial Status**	**Pipeline Status**	**Current Content**
Water Injection Tie-in Spool	PL3729.3	8	0.00535	Steel	Water	8" Water Injection Flexible Riser Flange to NRB Trailing Towhead	Surface Laid	Operational	Injection water
Gas Lift Tie-in Spool	PL3729.4	6	0.0054	Steel	Gas	6" Gas Lift Flexible Riser Flange to NRB Trailing Towhead	Surface Laid	Operational	Lift gas
Production Tie-in Spool	PL3730.1	8	0.02472	Steel	Oil	SRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange	Surface Laid	Operational	Production fluid
Production Tie-in Spool	PL3730.2	8	0.02662	Steel	Oil	SRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange	Surface Laid	Operational	Production fluid

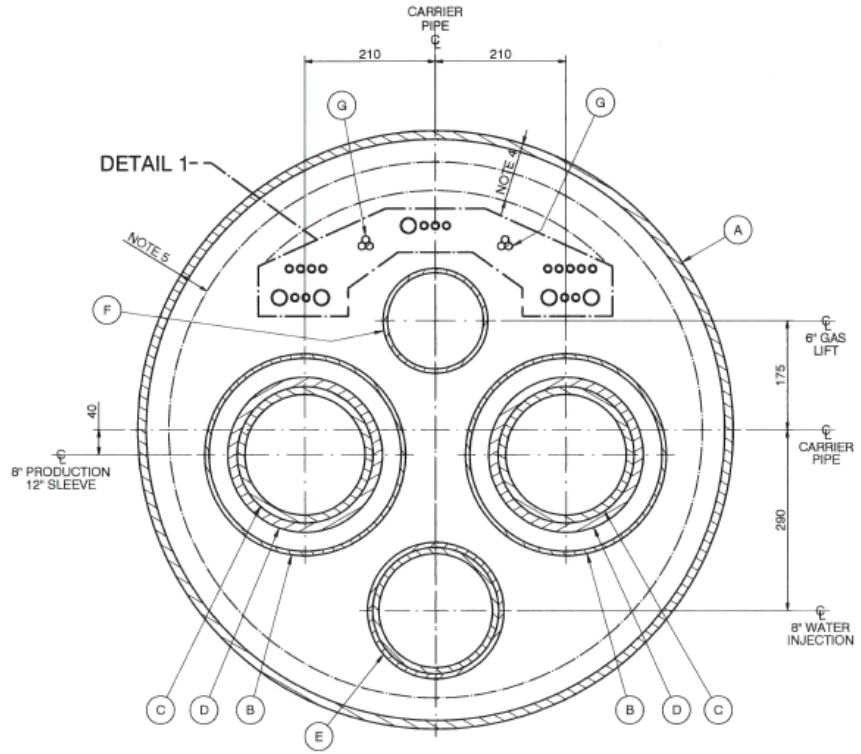
Table 3-2 Pipeline/Flowline/Umbilical Information									
Description	**Pipeline Number (as per PWA)**	**Diameter (inches)**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Points**	**Burial Status**	**Pipeline Status**	**Current Content**
Water Injection Tie-in Spool	PL3730.3	8	0.02832	Steel	Water	9" Water Injection Flexible Riser Flange to NRB Trailing Towhead	Surface Laid	Operational	Injection water
Gas Lift Tie-in Spool	PL3730.4	6	0.02407	Steel	Gas	6" Gas Lift Flexible Riser Flange to SRB Trailing Towhead	Surface Laid	Operational	Lift gas
Production Tie-in Spool	PL4142	6	0.0625	Steel	Oil	Well XPN2C to NDC Leading Towhead	Surface Laid	Operational	Production fluid
Gas Lift Tie-in Spool	PL4143	2	0.06643	Steel	Gas	NDC Leading Towhead to Well XPN2C	Surface Laid	Operational	Lift gas
Production Tie-in Spool	PL4145	6	0.04697	Steel	Oil	Well XPN2D to NDC Leading Towhead	Surface Laid	Operational	Production fluid
Gas Lift Tie-in Spool	PL4146	2	0.04938	Steel	Gas	NDC Leading Towhead to Well XPN2D	Surface Laid	Operational	Lift gas

Table 3-2 Pipeline/Flowline/Umbilical Information									
Description	**Pipeline Number (as per PWA)**	**Diameter (inches)**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Points**	**Burial Status**	**Pipeline Status**	**Current Content**
Water Injection Tie-in Spool	PL4148	6	0.05378	Steel	Water	NDC Leading Towhead to Well XPN2G	Surface Laid	Operational	Injection water
Production Tie-in Spool	PL4150	6	0.04179	Steel	Oil	Well XPN2H to NDC Leading Towhead	Surface Laid	Operational	Production fluid
Gas Lift Tie-in Spool	PL4151	2	0.04484	Steel	Gas	NDC Leading Towhead to Well XPN2H	Surface Laid	Operational	Lift gas
Production Tie-in Spool	PL4153	6	0.03882	Steel	Oil	Well XPS2A to SDC Leading Towhead	Surface Laid	Operational	Production fluid
Gas Lift Tie-in Spool	PL4154	2	0.04251	Steel	Gas	SDC Leading Towhead to Well XPS2A	Surface Laid	Operational	Lift gas
Water Injection Tie-in Spool	PL4512	6	0.046	Steel	Oil	SDC Leading Towhead to Well XWS2F	Surface Laid	Operational	Injection water
Services Umbilical Jumper	PLU4144	-	0.092	Flexible hose	Umbilical Jumper	NDC Leading Towhead to Well XPN2C	Surface Laid	Operational	

Table 3-2 Pipeline/Flowline/Umbilical Information									
Description	**Pipeline Number (as per PWA)**	**Diameter (inches)**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Points**	**Burial Status**	**Pipeline Status**	**Current Content**
Services Umbilical Jumper	PLU4147	-	0.078	Flexible hose	Umbilical Jumper	NDC Leading Towhead to Well XPN2D	Surface Laid	Operational	
Services Umbilical Jumper	PLU4149	-	0.092	Flexible hose	Umbilical Jumper	NDC Leading Towhead to Well XPN2G	Surface Laid	Operational	
Services Umbilical Jumper	PLU4152	-	0.078	Flexible hose	Umbilical Jumper	NDC Leading Towhead to Well XPN2H	Surface Laid	Operational	
Services Umbilical Jumper	PLU4169	-	0.078	Flexible hose	Umbilical Jumper	SDC Leading Towhead to Well XPS2A	Surface Laid	Operational	
Services Umbilical Jumper	PLU4511	-	0.092	Flexible hose	Umbilical Jumper	SDC Leading Towhead to Well XWS2F	Surface Laid	Operational	
Production Tie-in Spool	PL6140	6	0.06214	Steel	Oil	Well XPS2B to SDC Leading Towhead	Surface Laid	Operational	
Gas Lift Tie-in Spool	PL6141	1.2	0.06553	Steel	Gas	SDC Leading Towhead to Well XPS2B	Surface Laid	Operational	

Table 3-2 Pipeline/Flowline/Umbilical Information									
Description	**Pipeline Number (as per PWA)**	**Diameter (inches)**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Points**	**Burial Status**	**Pipeline Status**	**Current Content**
Power/Signal Cable	PL6139	1.2	0.067	Flexible cable	Power / Signal	SDC Leading Towhead to Well XPS2B	Surface Laid	Operational	
Hydraulic and Chemical Jumper	PLU6142	-	0.078	Flexible hose	Umbilical Jumper	SDC Leading Towhead to Well XPS2B	Surface Laid	Operational	
Electrical Jumper	PL6143	1.2	0.068	Flexible cable	Electrical	SDC Leading Towhead to Well XPS2B	Surface Laid	Operational	

Bundle Cross Section



Item	Quantity	Description
A	1	37.8" Carrier Pipe
B	2	12" Sleeve Pipe
C	2	8" Production Pipe
D	2	LDPUF Insulation
E	1	8" Water Injection (HPDE Lined)
F	1	6" Gas Lift Pipe
G	6	Quad Power, Signal Cable and Data Highway Cable (Bundle Monitoring)

Figure 3-3 Bundles internal arrangement

3.3 Pipeline protection and stabilisation features

There are a total of 77 mattresses and 2,160 grout bags across the subsea infrastructure (Table 3-3).

Table 3-3 Subsea pipeline protection and stabilisation features

Protection / Stabilisation Feature	Total Number	Weight (Te)	Location(s)	Exposed/Buried/Condition
Concrete Mattresses	77	395.01 (5.13 each)	NRB: 14 NDC: 28 SRB: 1 SDC: 23 TERN SSIV: 11	Latest survey information indicates; surface laid, exposed, as-placed condition.
Grout Bags	2,160	54 (0.025 each)	NRB: 800 NDC: 480 SRB: 120 SDC: 280 TERN SSIV: 480	Latest survey information indicates; surface laid, exposed, as-placed condition.
Rock	N/A	2,499	Rigid Gas Import/Export line PL3186 trench transitions. NRB: 1,578 Te TERN: 921 Te	Exposed

*The numbers quoted for concrete mattresses and grout bags include those used for tie-in of Well BP7 to the South Drill Centre.

Note: All the mattresses used in the field are placed principally for dropped object and overtrawl protection. This is true for pipeline ends and also for the interconnecting spools between wells and Leading Towheads. The grout bags are placed along the tie-in spools and the exposed pipeline and the interconnecting spools between wells and Leading Towheads. The grout bags are used to create a tapered profile for the mattress to rest. In doing so the grout bags provide lateral support to the spools during operation.

Only burial of the pipeline and rock cover provide required stabilisation and none of the grout bags or mattresses are required to stabilise the pipeline system.

3.4 Consideration of alternatives and selected approach

The latest BEIS Guidance (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 reuse or recycling or final disposal on land (BEIS, 2018). With regards to pipelines (including flowlines and umbilicals), these should be considered on a case-by-case basis. The guidance does provide general advice regarding removal for two categories of pipelines:

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

The guidance also highlights instances where pipelines could be decommissioned *in situ*. Finally, the guidance states that mattresses and grout bags installed to protect pipelines should be removed for disposal onshore, if their condition allows.

Options to re-use the Western Isles infrastructure *in situ* for future hydrocarbon developments are being explored, but to date none have yielded a viable commercial opportunity. The main reason being the absence of remaining hydrocarbon reserves in the vicinity of the infrastructure. It is considered unlikely that any opportunity to re-use the field infrastructure will be feasible and, as such, there is no reason to delay decommissioning of the infrastructure in a way that is safe and environmentally and socioeconomically acceptable.

3.5 Comparative Assessment

Of the pipelines considered in the CA, with all feasible decommissioning options for the infrastructure identified, assessed, ranked, and screened, three were subject to full CA:

- North Bundle
- South Bundle, and
- Rigid Pipeline (PL3186)

For clarity, the surface laid spool sections of bundle, which have the same PL numbers as the bundles themselves, were identified for full removal.

The approach to the CA was semi-quantitative and carried out at a level sufficient to differentiate between the options. The CA process used five assessment criteria (Safety, Environment, Technical, Societal and Economic) to compare the relative merits of each credible decommissioning option for the infrastructure, in line with BEIS guidance notes (BEIS, 2018). Actual environmental data was considered when comparing options including seabed disturbance, habitat loss and underwater noise.

It is proposed to decommission the approaches and towheads irrespective of the decommissioning option chosen therefore these were not included in this assessment.

The following credible decommissioning options were compared for the bundles and the rigid pipeline:

Bundles:

1. Full Removal – Cut and Lift
2. Leave *in situ* (Major Intervention) – Trench & Bury Entire Line
3. Leave *in situ* (Major Intervention) – Rock Cover Entire Line
4. Leave *in situ* (Minimal intervention) – Remove Ends and Remediate Snag Risk

Rigid Pipelines:

5. Full Removal – Reverse Reel with De-burial
6. Leave *in situ* (Minor Intervention) – Remove Ends and Remediate Snag Risk

In line with the guidance summarised above, Dana is committed to fully removing all surface infrastructure, including stabilisation materials with the exception of already existing rock placement. However, the bundles, and rigid pipelines were considered within a CA in order to arrive at an optimal decommissioning method. The CA methodology is described fully within the CA Report (Dana Petroleum E&P, 2022a), which has been submitted in conjunction with this EA in support of the DP. The CA concluded that Leave *in situ* (Minimal intervention) is the preferred option for both the bundles and the rigid pipeline. All bundle towheads and pipeline ends will be removed, and rock will be placed over all cut ends to remediate snag risks. For a more detailed description as to the chosen decommissioning option please refer to Appendix F.

3.6 Proposed Schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability of cost-effective removal services and contractual agreements. As shown in Figure 3-4, the potential activity window for the Western Isles subsea decommissioning activity is between 2024 and 2029.

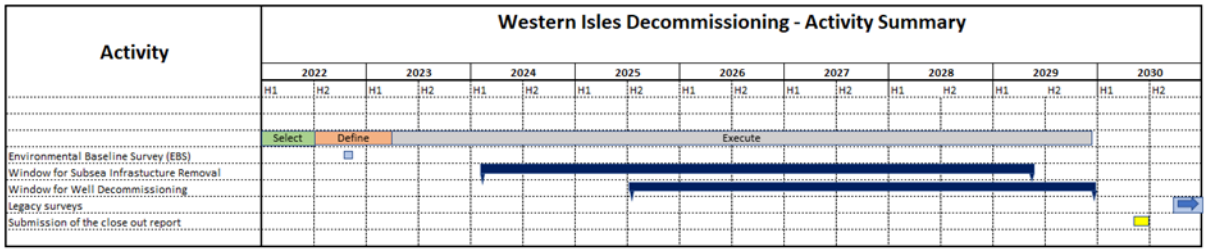


Figure 3-4 Project Schedule

3.7 Decommissioning Activities

3.7.1 Well plug and abandonment

Well plug and abandonment is not within the scope of this EA, and will be assessed separately as part of Well Intervention and Marine Licence applications. However, all wells will be decommissioned to current industry standards, this means that each well will be systematically and permanently abandoned with a reservoir barrier in accordance with well decommissioning best practice; these activities will be carried out using a semi-submersible drilling rig.

WHPS decommissioning is considered as part of this EA. Due to the integration of the wellheads within the WHPS, the seabed footprint and emissions associated with the removal of the WHPS (and associated Xmas tree) will be considered.

3.7.2 Flushing and cleaning operations

Flushing and cleaning operations are not within the scope of this EA as they will be assessed and carried out under the appropriate permitting applications, submitted via the PETS. A description is included here to describe the activities leading up to the point that the decommissioning activities begin. Dana will flush all the infield production pipelines with three to four times the pipeline volume of treated seawater. This is designed to remove mobile hydrocarbons and achieve a suitable standard of cleanliness of oil in pipeline flush fluids back to the topsides**.** Chemical pipelines will be subjected to a turbulent seawater flush to displace all contents.

3.7.3 Subsea infrastructure decommissioning activities

3.7.3.1 Overview

A subsea contractor will mobilise vessels with a range of crane capabilities for lifting objects off the seabed, vessels that can support underwater operations including, disconnection, cutting, and backfilling, excavation and rock placement,. Up to six vessel types are expected in total, including a Remotely Operated Vehicle Support Vessel (ROVSV), Construction Support Vessel (CSV), Diving Support Vessel (DSV), Heavy Lift Vessel (HLV), Rock placement vessel and guard vessel.

ROVs (or divers when necessary) will be deployed to disconnect the subsea installations and tie-in spools and to cut the spools and ends of flowlines. Specific cutting methodology will be developed upon award of contract to the subsea engineering contractor(s) however, the assumption assessed herein is that diamond wire will be utilised to cut the bundles and hydraulic shears to cut the rigid pipelines, spools, flexibles and jumpers. The vessels cranes will lift the subsea structures to the vessel prior to transport to shore for dismantling and recycling or disposal.

3.7.3.2 Subsea installations

Subsea infrastructure, including four bundle towheads, two mid-water arches and bases, mooring line anchor piles and remaining chains and seven WHPS will be disconnected by either ROV or divers, fully removed and recovered to a vessel for transfer onshore for recycling or disposal.

3.7.3.3 Pipelines and umbilicals

Bundles and rigid pipelines will be physically disconnected subsea from all subsea and surface structures and any mattresses and grout bags covering the disconnection points will be recovered back to the vessel. Following this, the lines will be prepared for decommissioning.

The recommendation from the CA is for the North and South bundles to be decommissioned *in situ,* with removal of pipeline ends, venting appurtenances and ballast chains, and remediation (in the form of rock cover) of the cut ends. A suitable vessel will be used to undertake the subsea intervention scopes associated with pipeline disconnection and remediation, removal of infrastructure and stabilisation materials and clearance activities. The rigid pipeline (PL3186) will also be decommissioned *in situ* with both pipeline ends, surface laid ends and trench transition sections disconnected and removed. Remediation in the form of rock cover will be applied over the cut ends.

It is acknowledged that navigational aids and/or a guard vessel will be required to mitigate hazards for other users of the sea in instances where the 500m safety zone is no longer in place and/or potential navigational hazards remain. Detailed plans have not yet been established, however Dana will ensure that Admiralty Charts and Notices to Mariners are updated, and engagement is maintained with the Health and Safety Executive (HSE) and Northern Lighthouse Board (NLB) to ensure appropriate mitigation measures are agreed and put in place.

3.7.3.4 Stabilisation features

As per the BEIS guidance (BEIS, 2018), the base case for mattresses is full removal, with the exception of any protection structures associated with crossing points and any third-party infrastructure. It is currently proposed that all mattresses and grout bags be removed. If any mattresses are found to have insufficient integrity to be removed, Dana will engage with OPRED to discuss alternative options.

There is a total of 77 mattresses of varying types and an estimated 2,160 grout bags supporting pipeline infrastructure. The burial status of the concrete mattresses and pipeline protection covers indicates that they are all surface laid, exposed and in as-placed condition; however, this will be confirmed when decommissioning activities are carried out.

3.7.4 Post-Decommissioning Activities

Following the decommissioning of the Western Isles 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 validated by an independent verification survey of all the installation sites and pipeline corridors. The aim of these clear seabed verification actions is to ensure the seabed is left in a safe condition for future fishing effort, in line with the current Guidance (BEIS, 2018). All pipeline routes

and installation sites will be the subject of oilfield debris clearance, with non-invasive as-left verification surveys when decommissioning activity has concluded. When decommissioning activity has been completed, information will be provided to update Admiralty Charts and the FishSAFE system

A post decommissioning site survey will be carried out along each existing pipeline route to identify any debris. Any seabed debris related to offshore oil and gas activities will be recovered for onshore disposal or recycling in line with existing disposal methods. The proposed method for clear seabed validation is through non-intrusive methodologies such as Side-scan Sonar (SSS) and Multi-Beam Echosounder (MBES). If non-intrusive methods are deemed inconclusive during verification, alternative methods will be discussed and agreed with OPRED. Upon verification of a clear seabed a statement of clearance to all relevant governmental departments and non-governmental organisations will be issued. It is proposed the verification work for the scope of this combined decommissioning programme be completed in conjunction with the FPSO sail away decommissioning programme.

3.7.5 Close out

In accordance with the OPRED guidance a close out report will be submitted to the regulator within one year of the completion of the offshore decommissioning scope including debris clearance, verification of seabed clearance and the first post-decommissioning environmental survey. The report will detail the outcomes of surveys as well as explain any major variances from the programme.

3.7.6 Post-Decommissioning monitoring and evaluation

A post-decommissioning environmental seabed survey will be carried out, centred around sites of the wellheads and installations. The survey will focus on chemical and physical disturbances of the decommissioning, with reference survey / sampling stations from the pre-decommissioning survey identified and revisited to identify and monitor any potential change. Results from this survey will be available once the work is complete, with a copy forwarded to OPRED.

The licence holders recognise their commitment to undertake post-decommissioning monitoring of infrastructure decommissioned *in situ*. After the post-decommissioning survey reports have been submitted to OPRED and reviewed, a post-decommissioning monitoring survey regime, scope and frequency, will be agreed with OPRED.

3.7.7 Waste Management

Decommissioning the Western Isles subsea infrastructure will generate a significant quantity of material for treatment, reuse, recycling and/or disposal. Reuse options are currently being explored, but otherwise recovered infrastructure will be returned to shore and transferred to a suitably authorised waste treatment facility. In this case, it is expected that the recovered infrastructure, i.e., risers, spools, towheads, will be cleaned before being largely recycled. Concrete mattresses and grout bags will be cleaned of marine growth if required, and either reused, recovered as aggregate for infrastructure projects or disposed to landfill if no other option is found to be suitable.

An appropriately authorised disposal company and yard will be identified through a selection process that will ensure that the chosen facility demonstrates a proven track record of waste stream management throughout the deconstruction process, the ability to deliver innovative reuse / recycling options, and ensure the aims of the Waste Hierarchy (see Figure 3.5) are achieved. Geographic locations of potential disposal yard options may require the consideration of Trans Frontier Shipment of Waste (TFSW) regulations, including hazardous materials. Early engagement with SEPA will ensure that any issues with TFSW are addressed. Once an appropriately authorised waste contractor has been selected, SEPA will be informed.

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.

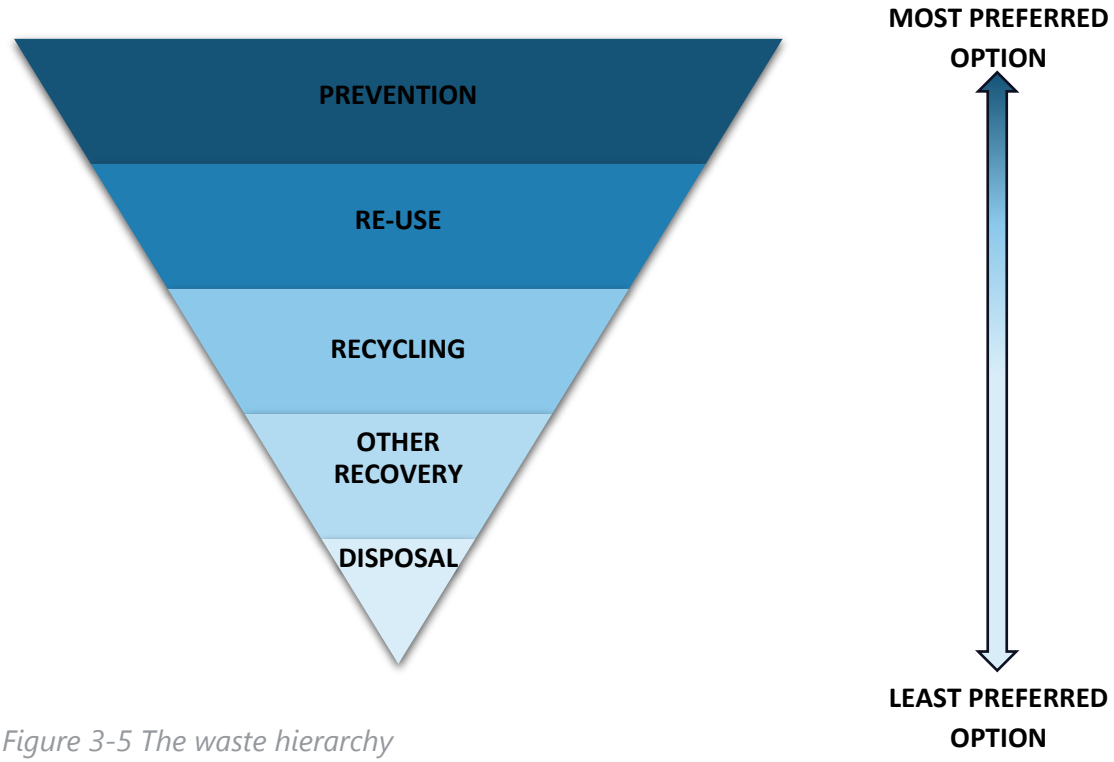


Figure 3-5 The waste hierarchy

Dana is committed to establishing and maintaining environmentally acceptable methods for managing wastes and is developing a project-specific Waste Management Plan in line with the Waste Framework Directive and principles of the Waste Hierarchy. In line with the waste hierarchy, Dana will continue review reuse options for elements of the subsea infrastructure. Table 3-4 summarises the various waste management processes for different waste streams that Dana will follow.

The approximate amounts of key materials that make-up the Western Isles infrastructure have been evaluated. A focused review of the inventories of materials will be conducted during the detailed engineering phase of decommissioning. A summary of the bulk material inventory for Western Isles is presented in Table 3-5, Table 3-6 and Figure 3-6.

Table 3-4 Waste stream management process

Waste Stream	Removal and disposal method
Bulk liquids	All pipelines will be flushed, cleaned prior to decommissioning activities taking place. Further cleaning and decontamination will take place onshore prior to recycling / disposal.
Marine growth	Where marine growth is encountered some may be removed offshore to aid recovery operations. Remaining marine growth will be managed by a selected onshore waste management contractor and disposed of in accordance with the regulations.
Naturally Occurring Radioactive Material (NORM)	NORM contaminated material may be removed and discharged offshore under appropriate permit or returned to shore to be disposed of by the selected onshore waste management contractor.
Asbestos	No asbestos anticipated to be on location due to age.
Other hazardous wastes	Any such materials shall be recovered onshore and will be managed by the selected waste management contractor and disposed of under an appropriate permit.
Onshore Dismantling sites	Appropriate licenced contractor and sites will be selected. The facility selected must demonstrate competence and a proven disposal track record and waste stream management & traceability throughout the deconstruction process and (preferably) demonstrate their ability to deliver innovative recycling options. OPRED will be advised when an appropriate facility has been selected.

Table 3-5 Breakdown of Western Isles infrastructure				
Asset	**Inventory**	**Total Inventory (Te)**	**Planned mass to shore (Te)**	**Planned mass decommissioned *In situ* (Te)**
Western Isles	Installations	4,970.3	3,249.7	1,720.6[3]
	Pipelines	4,482.6	496.5	3,986.1
Total		**≈ 9,453**	**≈ 3,746**	**≈ 5,707**

Table 3-6 Material inventory for Western Isles field subsea infrastructure (Excl. Rock)	
Material	**Weight (Te)**
Ferrous Metal	8,881.0
Non-Ferrous	19.5
Plastic	91.1
Hazardous (includes NORM)	7.3
Concrete	449.0
Marine Growth	5.0
Other	0.2
Total	**≈ 9,453**

[3] *The planned mass of installations decommissioned in situ is comprised entirely of the lower sections of the anchor piles and an 18m length of chain attached to each pile which is buried below the seabed surface.*

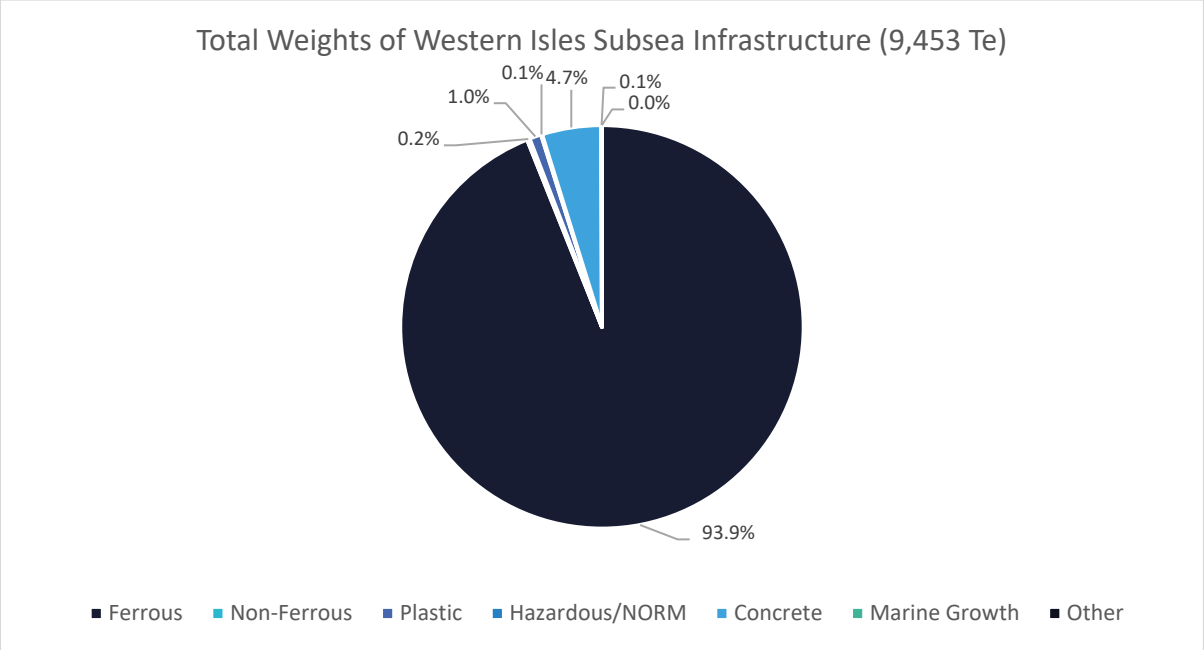


Figure 3-6 Pie Chart of estimated material inventory for the Western Isles infrastructure

3.8 Environmental Management Approach

Dana has an established independently verified Environmental Management Systems (EMS) which operates in accordance with the requirements of ISO14001:2015. The scopes of Dana's Environmental Management System (EMS) are defined to include all activities, onshore and offshore, in relation to the exploration for and production of hydrocarbons in defined license areas of the UK sector of the North Sea. This scope encompasses the proposed Western Isles Filed decommissioning. The EMS meets the requirements of OSPAR Recommendation 2003/5 which promotes the use and implementation of the EMS by the offshore industry.

The EMS is an integral part of both Dana's structured Health, Safety and Environmental Management System (HSE MS) which describes the means of compliance with HSE legislation and industry standards and manages HSE risks in their respective businesses. Relevant to the EA, and to all of Dana's activities, is the commitment to managing all environmental impacts associated with its activities. Continuous improvement in environmental performance is sought through effective project planning and implementation, emissions reduction, waste minimisation and waste management; this mindset has fed into the development of the mitigation measures developed for the Project; these include both industry-standard and project specific measures. Signed copies of Dana's Health and Safety Policy and Environmental Management Policy are presented in Appendix B.

4 ENVIRONMENTAL AND SOCIETAL BASELINE

4.1 Summary of Environmental Surveys

This section draws on several data sources, including published scientific research in the area, studies commissioned by the oil and gas industry, and site-specific investigations commissioned as part of the exploration and development process.

A pre-decommissioning environmental survey was conducted in the Western Isles area in 2022 to inform environmental baseline survey (EBS) and habitat assessment (Fugro, 2023) reports. The sample analysis and subsequent report of the EBS are still ongoing at the time of preparation of the pre-consultation draft of this EA and will be incorporated into the post-consultation draft as has been agreed with OPRED. Preceding this, three EBS reports have been produced; one in 2012 required due to project changes and two in 2010 (Gardline, 2010a, 2010b) in advance of the field being developed (one report covered the field and the second covered the area along the associated pipeline route). An outline of these surveys is provided in the following sections. The sampling locations of the environmental surveys undertaken in the area are presented in Figure 4-1. The results of the following (additional) surveys were used to inform the environmental description:

- Gardline undertook a survey in June 2010 that was centred on the proposed NDC and SDCs and the FPSO locations (Gardline, 2010a). The survey established the baseline physico-chemical characteristics and the benthic community composition of the area. 24 sample stations were investigated with ten sample stations arranged in a cruciform pattern around each of the proposed drill centres. The remaining four sample stations were located around the proposed location of the FPSO. The survey scope also included a geophysical site survey and habitat assessment. The geophysical survey utilised single and multi-beam echosounders (MBES), SSS, pinger and mini airgun together with geotechnical sampling equipment. Video footage and photos were used in the habitat assessment.
- An environmental baseline survey of the proposed pipeline route between Tern platform and Western Isles FPSO was conducted by Gardline from in June 2010 (Gardline, 2010b). The geophysical and habitat assessment survey methods along the pipeline are the same as those in utilised in the Western Isles area survey. Eight stations were sampled along the pipeline.
- As part of the 2012 survey effort, Gardline also conducted a survey of the Western Isles in-field pipeline routes (Gardline, 2012). This geophysical survey did not involve any sampling effort. Instead, multi-beam swathe data was collected to inform the bathymetry. Additionally, sub-bottom profiling, SSS and magnetometer data was also collected. A habitat assessment was conducted using observational methods along the proposed pipeline route.
- An environmental baseline survey of the Western Isles area was conducted by Gardline in September/October 2012 (Gardline, 2013a). This built on previous survey effort and was required due to project changes. 12 infill environmental stations were selected in support of the earlier 2010 scope which focussed on the new location of the FPSO and new proposed NDC. A habitat

assessment (Gardline, 2013b) was also undertaken within the site, consisting of seabed imagery using a digital stills camera and video system and in conjunction with previous assessments conducted in 2010 (outlined below).

- As part of the 2022 pre-decommissioning environmental surveying effort, a Habitat Report (Fugro, 2023) was prepared to describe all habitats within the survey area and to identify the presence and extent of any Annex I habitats, as well as any other habitats or species of conservation interest. The fauna observed were compared with the OSPAR threatened and/or declining habitats and species List, Scottish Priority Marine Feature (PMF) list and UK Biodiversity Action Plan (UKBAP).

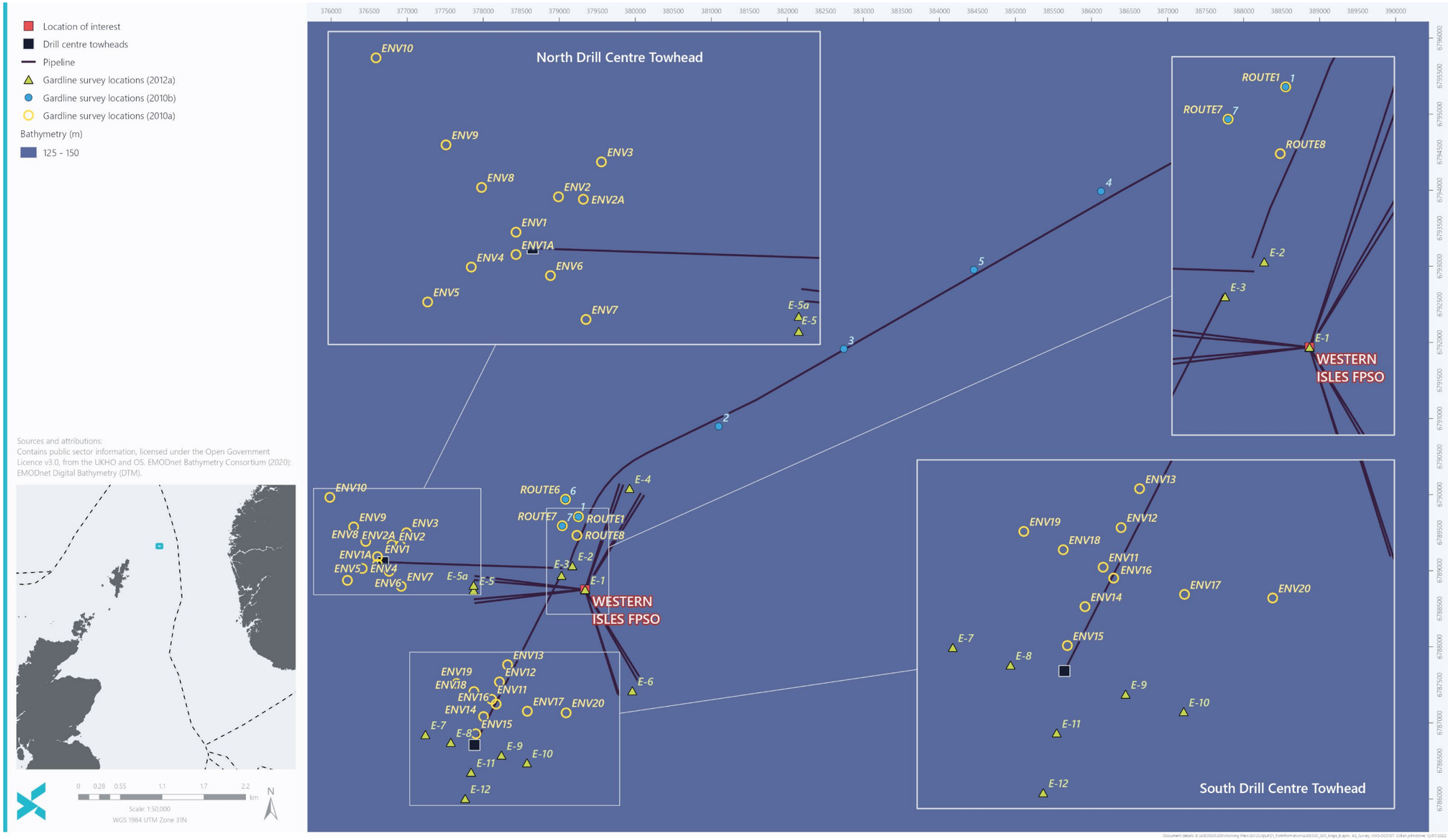


Figure 4-1 Survey effort within the Western Isles area

4.2 Physical Environment

Characteristics of bathymetry, currents and wave action, seabed sediments and features in the Western Isles area are described in the following subsections.

4.2.1 Bathymetry

Water depth across the in-field survey area ranged from 150 m below mLAT and 165 mLAT. There are a series of broad undulations across the survey area, with shallower points across the centre and west and deepening towards the east and south of the survey site. The maximum gradients within the area were approximately 3° on the edge of a broad depression in the southwest of the surveyed area (Gardline, 2010a, 2013a).

Along the pipeline route from the FPSO to Tern, the survey found that the water depth ranged from 160 mLAT to 165 mLAT. The seabed undulated along the pipeline and the overall depth increased from southwest to northeast at a gradient of <1° (Gardline, 2010b).

4.2.2 Current and wave properties

The anti-clockwise movement of water through the North Sea and around the NNS region originates from the influx of Atlantic water, via the Fair Isle Channel and around the north of Shetland, and the main outflow northwards along the Norwegian coast (DECC, 2016). Against this background of tidal flow, the direction of residual water movement in the NNS is generally to the south or east (DTI, 2001; DECC, 2016). The peak flow for mean spring tide ranges between low velocities of 0.01 m/s in open water to 2.5 m/s in the narrow sounds around Orkney (for example in the Pentland Firth) (DECC, 2016). The mean peak spring and neap flows surrounding the project area are approximately 0.14 m/s and 0.07 m/s respectively (Wolf *et al.*, 2016).

The annual mean significant wave height in the NNS region follows a gradient increasing from the southern point in the Fladen/Witch Ground to the northern area of the East Shetland Basin. In the project area the annual mean significant wave height is approximately 3.0 m to 3.28 m (Dana Petroleum E&P, 2011). McBreen *et al.* (2011) shows wave energy at the seabed to range between 'low' (less than 0.21 N/m^2) and 'moderate' (0.21–1.2 N/m^2) for most of the NNS region, increasing to 'high' (more than 12 N/m^2) close to shore. The annual mean wave power is approximately 36.1-42.0 kW/m (NMPi, 2021).

4.2.3 Meteorology

The prevailing winds in the NNS are from the southwest and north northeast. Wind strengths in winter are typically in the range of Beaufort scale force 4-6 (6-11 m/s) with higher winds of force 8-12 (17-32 m/s) being much less frequent. Winds of force 5 (8 m/s) and greater are recorded 60-65% of the time in winter and 22 to 27% of the time during the summer months. In April and July, winds in the open, central to NNS, are highly variable and there is a greater incidence of north westerly winds (DECC, 2016).

4.2.4 Seabed sediments

The sediment in the surveyed area around the FPSO and drill centres was silty shelly gravelly sand; the sediments were poorly sorted within the surveyed area, and under the Wentworth classification, they were classified as medium sand (Gardline, 2010a; 2013a).

Across the centre and west of the surveyed area there were outcrops of gravelly sandy clay with cobbles. Additionally, boulders were occasionally observed. The seabed was also heavily scarred due to anchoring activity from previous drilling operations (Gardline, 2010a; 2013a) undertaken between 1974 and 2009.

The contribution of fines to the sediment ranges from 5.6% to 9.2% across all stations, while sand particles (≥0.063-2 mm) account for 83.3% to 94.2%. Gravel sized particles, including shells and shell fragments make up <1% of the material at all stations, aside from three (ENV8, ENV15 and ENV16). The gravel component of these latter sites was mainly made up of shell debris. The general trend across the surveyed area showed that stations in deeper water, below the FPSO location and to the south and east, had a lower percentage of coarse material (Gardline, 2010a).

Along the route there was some variation, with higher percentages of fines at stations located in deeper water. Fines content ranged from 7.7% to 16.9%, and the percentage contribution of sand ranged from 82.4% to 92.2%. Gravel sized particles made up <1% at all stations (Gardline, 2010b).

Total Organic Matter (TOM) content ranged between 0.9% and 1.6% and Total Organic Carbon (TOC) concentrations ranged between 0.6% and 1.0% (Gardline, 2010a). Along the pipeline, concentrations were comparable; TOM ranged from 1.0% to 1.7% and TOC ranged from 0.6% to 1.1% (Gardline, 2010b). Both TOM and TOC concentrations were within the range for organic matter within the wider NNS, (UKOOA, 2001 and Gardline, 2010a). Comparatively, TOM results were slightly above the average along the pipeline, although within the 95th percentile bracket of UKOOA data and therefore were not considered anomalous (Gardline, 2010b). Overall, there is not thought to be any anthropogenic nutrient enrichment within the surveyed area (Gardline, 2010a, 2010b).

Total Hydrocarbon Concentration (THC) varied from 5.4 µg/g to 10.3 µg/g. In the context of the NNS, THC concentrations more than 5 km from installations are in the region of 10.8 µg/g (Gardline, 2010a). In-field THC concentrations were lower than those established along the pipeline route, where the highest concentration was 15.4 µg/g at station Route 5 (Gardline, 2010b). THC level in 2012 at Station E-6 was 40.1 µg/g, which was higher than all other survey station and four times greater than that of the earlier 2010 survey and should therefore be considered as above background concentrations for the region. The THC at Station E-4 was also elevated, although not as considerably (25.0 µg/g; Gardline, 2013a).

Total Polycyclic Aromatic Hydrocarbons (PAH) concentrations were below the Effects Range Low (ERL) both within the FPSO area and along the pipeline, meaning it is unlikely that concentrations present

in the area are having a significant effect on the local benthos. PAH concentrations were comparable to those identified during previous surveys suggesting they are concentrations typical of the area (Gardline, 2010a, 2010b).

Barite is an essential constituent of drilling muds, hence the presence of Barium (Ba; as a component of barite) occurs in sediments affected by drilling activity. While broadly comparable, the Ba concentrations along the pipeline (mean of 300 µg/g) were slightly higher than those found within the in-field survey (Gardline, 2010b). The mean Ba concentration for the NNS is reported as 332 µg/g. This was only exceeded at one station along the pipeline route (Route 5) which had a Ba concentration of 400 µg/g. This level is still below the 95th percentile figure recorded by UKOOA (2001), therefore the Ba at this sample location is still considered to be in line with background concentrations and is not attributable to a specific local source (Gardline, 2010b). All Ba concentrations within the in-field surveyed area were found to be below the NNS mean level (Gardline, 2010a).

Results for Vanadium (V) and Zinc (Zn) were slightly above their recognised background values at several stations within the in-field survey area. However, the concentrations of these metals were within the accepted Analytical Evaluation Threshold (AET) threshold values, therefore they are unlikely to be associated with any potential impact on the surrounding benthic communities (Gardline, 2010a).

Trace metals along the pipeline were similar between stations and were generally comparable with UKOOA NNS mean background concentrations (Gardline, 2010b). However, Lead (Pb), V and Zn at several stations exceeded the 95th percentile values, meaning that they are higher than the measured concentrations at 95% of sites in the NNS located >5 km from a platform. Despite being slightly elevated, these concentrations are consistent with past surveys of the wider area, therefore they are still considered to be typical of the region (Gardline, 2010b).

4.3 Biological Environment

4.3.1 Benthic habitat

The habitats assigned within the 2022 survey area based on the photographic data are the EUNIS level 3 habitat types ‘Atlantic offshore circalittoral coarse sediment’ (MD32), ‘Atlantic offshore circalittoral mixed sediment’ (MD42), ‘Atlantic offshore circalittoral sand’ (MD52) ‘Atlantic offshore circalittoral mud’ (MD62). These habitats observed within the survey area are consistent with EMODnet habitat map of the area and immediate surroundings. All EUNIS level 3 habitat types observed in the survey area are well represented in areas around the NNS (Fugro, 2023).

The habitat Feature of Conservation Interest (FOCI) and priority habitat ‘Subtidal sands and gravels’ may be present across the survey area where habitat types ‘Atlantic offshore circalittoral sand’ (MD52) and ‘Atlantic offshore circalittoral coarse sediment’ (MD32) is present. This habitat is widely distributed within the North Sea and already included within UK MPA network. Taxa characteristic of

this priority habitat that were observed included flatfish (Pleuronectiformes), hermit crabs (Paguridae) and urchins (Spatangoidea) (Fugro, 2023).

Burrows and mounds were observed at an abundance of 'frequent' on transects in the south and in the far north of the survey area. Therefore, areas of 'Atlantic offshore circalittoral mud' (MD62) within the survey area may have the potential to represent the OSPAR listed threatened and/or declining habitat 'sea pens and burrowing megafauna communities' (Fugro, 2023). This is, however, based on photographic data only, without infaunal grab sample data or particle size distribution (PSD). The EBS report (Fugro, in prep) will consider infaunal communities and sediment characteristics further.

In addition to these more natural habitat types, there appeared to be a bacterial mat at the location of a historic oil-based mud discharge of 60 tonnes in 2016. The influx of mud from this spill may have given rise to a low oxygen and less diverse habitat allowing a bacterial (e.g. *Beggiatoa* sp.) mat to build up (Fugro, 2023).

There was no indication from the 2010, 2012 or 2022 surveys of the presence of any Annex I habitats along either of the survey corridors within the in-field area, along the two in-field routes, or along the pipeline from the FPSO to Tern (Gardline, 2010b, 2012, 2013a, 2013b; Fugro, 2023). A single adult *Arctica islandica* was found at Station E-4 and four juveniles were recorded at Station ROUTE6 (Gardline, 2013a). *A. islandica* is a threatened and/or declining species listed in OSPAR (2008) and is also a Scottish Priority Marine Feature (PMF). Block 210/24 is not considered a particularly important area for this species based on records in NMPi (2022), the adult individual identified in Gardline (2013a) occurred in a non-typical sediment type within the wider survey area. *A. islandica* has not been identified in any subsequent survey of the area, including in the 2022 pre-decommissioning EBS (Fugro, in prep).

4.3.2 Benthic fauna

According to the Gardline (2012) survey, fauna observed across the surveyed area included: Annelida (*Ditrupa arietina*, *Hylinoecia tubicola*), Arthropoda (Euphausiacea, *Pagarus bernhardus*), Chordata (*Callionymus maculates*), Cnidaria (Actinaria, *Bolocera tuediae*, *Caryophyllia smithii*, *Flabellum alabastrum*, *Hydractiniid echinata*, Hydrozoa), Echinodermata (*Henricia sp.*, *Asterias rubens*, *Ophiura albida*, *Ophiura sp.*), Mollusca (Scaphopoda, *Turritella communis*), Porifera (*Haliclona urceolus*, *Hymedesmia paupertas*, *Polymastia sp.*) and evidence of bioturbation in the form of faunal tracks and burrows (Gardline, 2013a, 2013b).

In the 2012 survey identified a total of 14,142 individuals across 407 taxa. Overall, polychaetes were the dominant species group across all surveys (Gardline, 2010a, 2013a). Fauna observed in the grab samples taken in 2012 were largely consistent with the fauna observed in the 2010 survey (Gardline, 2013a). However, there was some variation between years as the number of individuals was higher during the 2010 survey, although this is not abnormal. There was potential evidence of historic contamination at stations E-4 and E-6 which exhibited fewer individuals in comparison to all other

stations (Gardline, 2013a). This corresponds to the stations which showed elevated THC concentrations.

There was some differentiation between the sample stations within the area surveyed around the FPSO and drill centres. Interpretation of the variable community was attributed to natural variation and suggested that the surveyed area was indicative of a taxonomically rich and diverse community not affected by drilling related contamination (Gardline, 2010a). Results were similar to those along the pipeline route.

Polychaetes made up 69% of all individuals and 53% of all recorded taxa. The single most abundant taxon identified to genus level was the polychaete *P. vanelli*, which was found in every sample (Gardline, 2010b). Overall, the high number of taxa present at low abundances suggests that the survey area has not been subject to significant recent contamination (Gardline, 2010b).

The PMF species *Parazoanthus anguicomus* has the potential to occur within the 2022 pre-decommissioning environmental survey area as several instances of *Parazoanthus sp*. were recorded from analysis of the video data (Fugro, 2023).

4.3.3 Fish and shellfish

The project area is located in International Council for the Exploration of the Seas (ICES) Statistical Rectangle 51F0. Several fish species use the area as a spawning or nursery ground throughout the year, as shown in Table 4-1. The field is in an area of high nursery intensity for blue whiting (*Micromesistius poutassou).* Anglerfish (monkfish) (*Lophius piscatorius)*, European hake (*Merluccius merluccius)*, haddock (*Melanogrammus aeglefinus)*, herring (*Clupea harengus)*, ling *Molva (molva)*, mackerel (*Scomber scombrus)*, Norway pout (*Trisopterus esmarkii)*, spurdog (*Squalus acanthias)* and whiting (*Merlangius merlangus)* all use the area as nursery grounds (Coull *et al.*, 1998; Ellis *et al.*, 2012).

Haddock, Norway pout, saithe (*Pollachius virens)* and whiting use the area as grounds for spawning, with spawning efforts for these species being concentrated in the first half of the year (between January and June).

Table 4-1 Fish nursery and spawning in ICES rectangle 51F0 throughout the year (Coull *et al.*, 1998; Ellis *et al.*, 2012)												
Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Anglerfish	N	N	N	N	N	N	N	N	N	N	N	N
Blue whiting	N	N	N	N	N	N	N	N	N	N	N	N
European hake	N	N	N	N	N	N	N	N	N	N	N	N
Haddock	N	S*N	S*N	S*N	SN	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	N	N	N	N	N
Ling	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	N	N	N	N	N	N	N	N
Norway pout	SN	S*N	S*N	SN	N	N	N	N	N	N	N	N
Saithe	S*	S*	S	S								
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 nursery intensity as per Ellis *et al.* (2012)												

Aires *et al.* (2014) provides modelled spatial representations of the predicted distribution of 0 age group fish. The modelling indicates the presence of juvenile fish (less than one year old) for multiple species: anglerfish, blue whiting, cod, haddock, European hake, herring, horse mackerel, mackerel, Norway pout, plaice, sole, sprat, whiting. The probability of juvenile aggregations occurring is very low across all these species, except for blue whiting and European hake (probability >0.2).

Two individuals from the Rajidae family were observed during video analysis obtained during the pre-decommissioning environmental survey though identification to species level was not possible. The OSPAR threatened and/or declining species Common skate, White skate, Thornback ray and Spotted ray may be present within the survey area (Fugro, 2023).

Of the species which are known to occur in the area in some capacity, a number are species of conservation concern. Anglerfish, blue whiting, herring, ling, mackerel, Norway pout, saithe and whiting are all Scottish Priority Marine Features (PMFs). Additionally, spurdog are an OSPAR listed Threatened and/or Declining Species.

4.3.4 Marine mammals

4.3.4.1 Cetaceans

Harbour porpoise (*Phocoena phocoena)* are frequently found throughout UK waters. They typically occur in groups of one to three individuals in shallow waters, although they have been sighted in larger groups and in deep waters. They are present in UK waters throughout the year. They are most likely to be observed in the project area during the summer months (Reid *et al.*, 2003). The density of harbour porpoise in the project area is estimated to be 0.402 animals/km^2 (Hammond *et al.*, 2021).

Minke whales (*Balaenoptera acutorostrata)* occur in water depths of 200 m or less throughout the NNS and Central North Sea (CNS). They are usually sighted in pairs or alone; however, groups of up to 15 individuals can be sighted feeding. It appears that animals return to the same seasonal feeding grounds (Reid *et al.*, 2003). Minke whales are most likely to be observed in the project area in the summer months and in low numbers. Their density is predicted to be 0.0316 animals/km^2 which is the highest across all areas surveyed (Hammond *et al.*, 2021).

Atlantic white-sided dolphins (*Lagenorhynchus acutus*) have a limited distribution but are found in both temperate and cold waters of the North Atlantic Ocean, usually over deep-slope continental shelves and canyon waters. They tend to prefer deeper water and are not seen close to shore that often. They feed in groups, usually found in pods of anything between 2 and 50 individuals. It is not uncommon to see much larger pods (hundreds or even thousands of dolphins) where they have found dense concentrations of food. They are only likely to be observed in the project area during July though in high numbers (Reid *et al.*, 2003). The density of Atlantic white-sided dolphins in the project area is estimated to be 0.003 animals/km^2 (Hammond *et al.*, 2021).

Harbour porpoise, minke whale and Atlantic white-sided dolphin are all PMFs, European Protected Species (EPS), are covered by OSPAR and the United Kingdom Biodiversity Action Plan (UKBAP) and are listed on the International Union for Conservation of Nature (IUCN) Global Red List as species of lower risk. Harbour porpoise are additionally an Annex II listed species.

No other cetacean species are likely to be present in the project area.

4.3.4.2 Pinnipeds

Two species of seal are resident in UK waters: the grey seal (*Halichoerus grypus)* and the harbour or common seal (*Phoca vitulina)*, both occurring regularly over large parts of the North Sea and both Annex II listed species. Figure 4-2 shows the at-sea presence of grey and harbour seals around the Western Isles FPSO and within the wider NNS region.

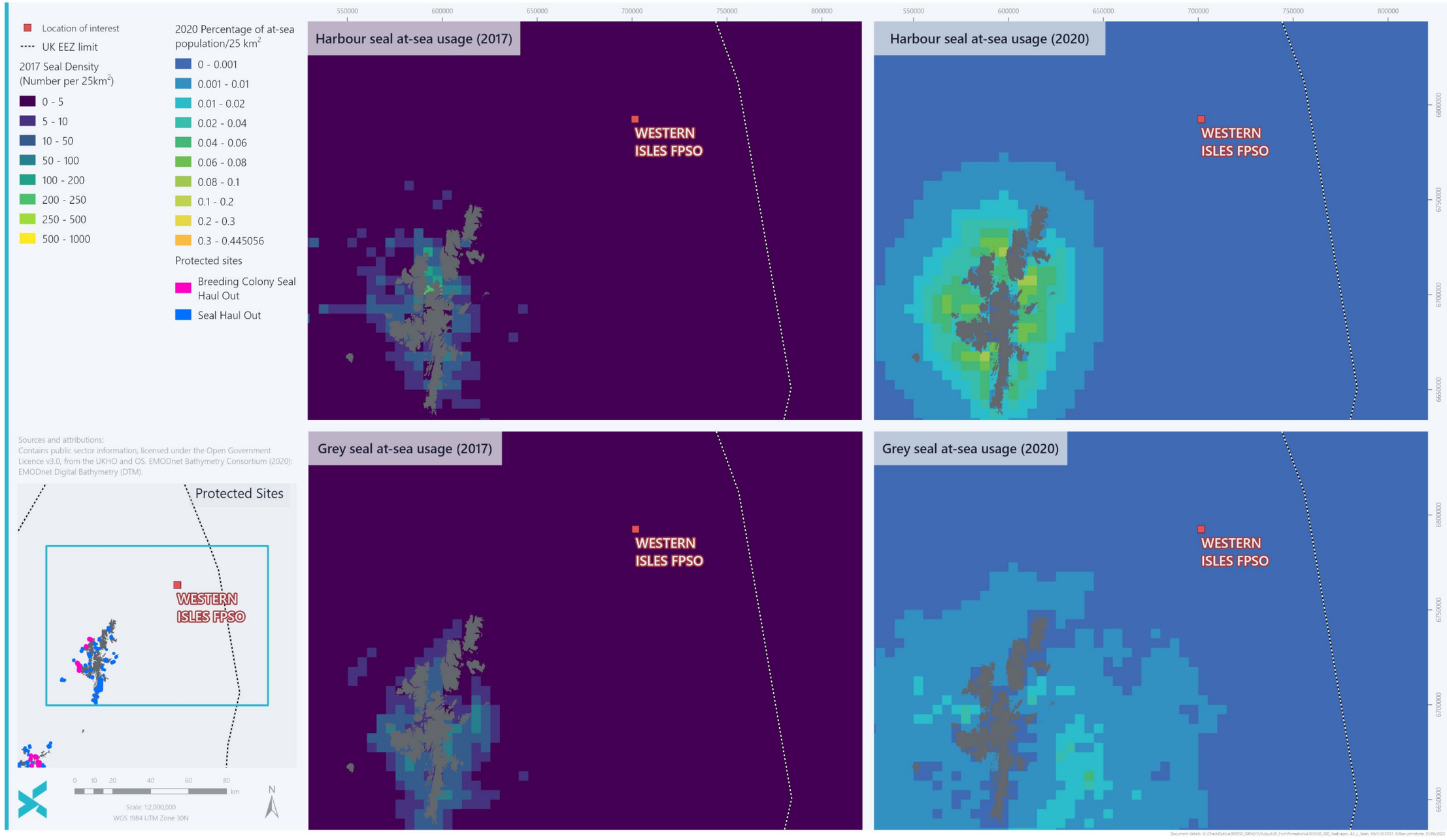


Figure 4-2 Seal at-sea presence (Russell et al., 2017; Carter and Russell, 2020)

Approximately 38% of the world's grey seal population breeds in the UK, the majority of which breed in Scotland. Most grey seals forage within 100 km of haul out sites, although they can travel many hundreds of kilometres. As is shown in Figure 4-2, the estimated seal-at-sea density of grey seals within the Western Isles area is thought to be 0.009 individuals per 25 km^2 (Russell *et al.*, 2017). The percentage of the grey seal population in the Western Isles area at any given time is ≤0.001% (Carter and Russell, 2020). The UK population of harbour seals is estimated to be approximately 44,000 individuals (SCOS, 2020). Generally, harbour seals forage around their haul out sites throughout the year and are not normally recorded more than 60 km from shore, although tagging studies have shown that they may occasionally forage at much greater distances. Due to this, the estimated seal-at-sea density of harbour seals in the project area 0.005 individuals per km^2 (Russell *et al.*, 2017; Figure 4-2). The percentage of the harbour seal population in the Western Isles area at any given time is ≤0.001% (Carter and Russell, 2020).

4.3.5 Seabirds

The project area is utilised by the following species at points in the year: European storm petrel (*Hydrobates pelagicus)*; long tailed skua (*Stercorarius longicaudus);* northern gannet (*Morus bassanus)*; great skua (*Stercorarius skua)*; black-legged kittiwake (*Rissa tridactyla)*; glaucous gull (*Larus hyperboreus)*; great black-backed gull (*Larus marinus)*; herring gull (*Larus argentatus)*; common guillemot (*Uria aalge)*; little auk (*Alle alle)*; razorbill (*Alca torda)* and Atlantic puffin (*Fratercula arctica)* (Kober *et al.*, 2010). The Seabird Oil Sensitivity Index (SOSI) identifies areas at sea where seabirds are likely to be most sensitive to surface pollution (Webb *et al.*, 2016). SOSI is shown by UKCS Block; the Western Isles FPSO and associated subsea infrastructure are located within Blocks 210/24 and 210/25. SOSI for the Block and surrounding area is shown in Table 4-2. Seabird sensitivity to oil in the area is typically low throughout much of the year except for January which experience extremely high sensitivity (Webb *et al.*, 2016).

Table 4-2 SOSI for Blocks 210/24 and 201/25 (Webb *et al.*, 2016)												
Block	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
210/18	1	5	5	5*	5	5*	5	5	5	5*	N	1*
210/19	1	5	5	5*	5*	5*	5	5	5	5*	N	1*
210/20	3	5	5	5*	N	5*	5	5	5	5*	4*	4
210/23	1	5	5	5*	5*	5*	5	5	5	5*	5*	5
210/24	1	5	5	5*	5*	5*	5	5	5	5*	5*	5
210/25	5	5	5	5*	N	5*	5	5	5	5*	5*	5
210/28	1	5	5	5*	5*	5*	5	5	5	5*	5*	5
210/29	2	5	5	5*	3*	3	5	5	5	5*	5*	5
210/30	5	5	5	5*	5*	5	5	5	5	5*	5*	5
211/16	4*	5	5	5*	N	5*	5	5	5	5*	4*	4
211/21	5	5	5	5*	N	5*	5	5	5	5*	5*	5
211/26	5	5	5	5*	5*	5	5	5	5	5*	5*	5
Key:	1 = Extremely high		2 = Very high		3 = High		4 = Medium		5 = Low		N = No data	

4.4 Conservation

The Western Isles FPSO is located approximately 61 km from the nearest conservation site – the Pobie Bank Reef Special Area of Conservation (SAC). The SAC is designated for the presence of Annex I habitat Reefs. Pobie Bank Reef's stony and bedrock reef provides a habitat to an extensive community of encrusting and robust sponges and bryozoans, which are found throughout the site. In the shallowest areas the bedrock and boulders also support encrusting coralline algae.

All other conservation sites are located over 90 km from the project area. The closest coastal designated site is the Hermaness, Saxa Vord and Valla Field SPA (approximately 93 km from the Western Isles FPSO). Sites of conservation importance within the vicinity of the proposed decommissioning activities are shown in Figure 4-3.

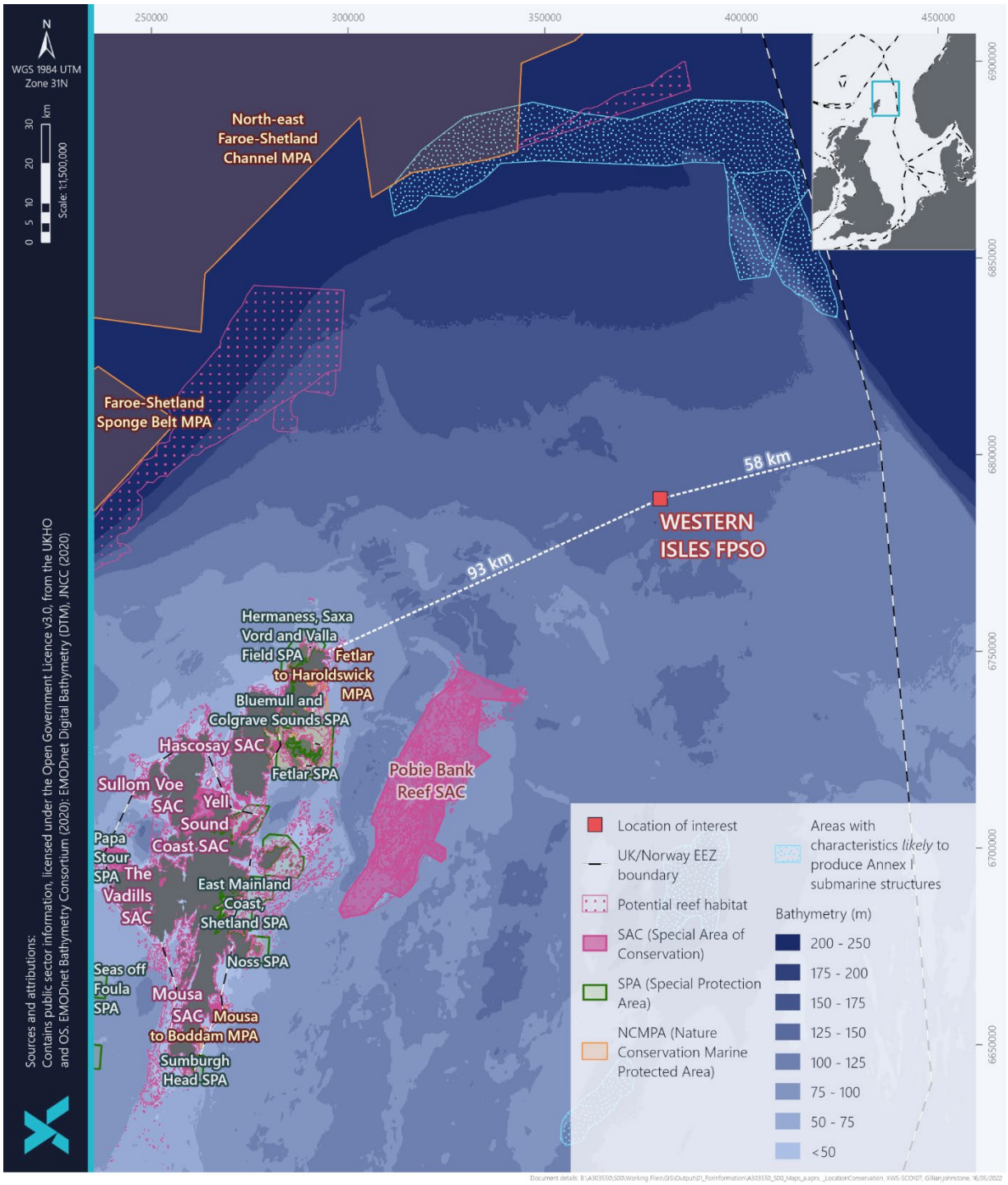


Figure 4-3 Location of conservation sites in relation to the Western Isles FPSO

4.5 Socio-economic Environment

4.5.1 Commercial fisheries

The North Sea has important fishing grounds and is fished throughout by both UK and international fishing fleets, targeting demersal, pelagic and shellfish stocks.

According to Scottish Government (2022) landings data for 2021, Rectangle 51F0 (where the fields under consideration are located) is targeted primarily for demersal species. In 2021, the demersal catch live weight was 911 Te with a corresponding value of approximately £1.7 million. This accounts for approximately 67% of landings and approximately 84% of value for the year. Landings data for 2017 until 2021 are shown in Table 4-3 and Figure 4.4.

To put landings into context, a total of 538,469 tonnes with a value of £686 million was landed in the UK in 2021 (Scottish Government, 2022). Fisheries in Rectangle 51F0 contribute approximately 0.25% of landings and 0.30% of value when compared to overall UKCS (Scottish Government, 2022).

In the four years preceding 2021, demersal species were similarly the main species group being targeted in the area, regularly equating to approximately 99% of the annual catch live weight and value respectively. Pelagic species catch has largely been negligible/low, with an anomalous peak in 2017, when pelagic species contributed 21% of the live weight for Rectangle 51F0, although this still equated to <1% of the value for the rectangle for that year. 2021 saw a return of pelagic landings from ICES Rectangle 51F0, albeit with a relatively modest catch live weight of 454 Te and a corresponding value of approximately £0.3 million. This accounts for approximately 33% of landings and approximately 16% of value for the year. It should be noted that this level of pelagic landings is significantly lower than would be observed from a targeted fishery for the species. The contribution of shellfish has been similarly low across the years (Scottish Government, 2022).

Fishing effort data is also recorded by the Scottish Government for ICES Rectangles. The effort, in fishing days, is shown for Rectangle 51F0 in Table 4-4 and Figure 4.5 (Scottish Government (2022)). Overall, effort is relatively low, although there is a recent trend showing increased effort; in 2021 there were 218 fishing days compared to 131 days in 2017. This is due to the recent spread in fishing effort throughout the year (in 2019 and 2020). Historically, effort was mostly concentrated in the summer months and in November and December. However, as of 2021, fishing occurred in all months. Nevertheless, overall fishing effort remains relatively low as there are <100 days of fishing in each month Scottish Government (2022). Figure 4-6 shows the distribution of fishing effort around the project area. Overall, fishing effort is concentrated to the south, west and east of the project area. This is similarly shown in Figure 4-6, indicated by the higher density of Automatic Identification System (AIS) tracks and the increased fishing hours in these areas. Fishing intensity along the PL3186 pipeline is also low, reaching a maximum of 150 hours (total) attributed to fishing vessels passing over the pipeline. As indicated by the density of AIS lines in the vicinity of the pipeline, it is most likely that this time can be attributed to fishing vessels passing in transit.

Table 4-3 Landings weight and value in ICES rectangle 51F0 between 2016 and 2021 (Scottish Government, 2022)												
Species type	**2021**		**2020**		**2019**		**2018**		**2017**		**2016**	
	Value (£)	**Live weight (Te)**	**Value (£)**	**Live weight (Te)**	**Value (£)**	**Live weight (Te)**	**Value (£)**	**Live weight (Te)**	**Value (£)**	**Live weight (Te)**	**Value (£)**	**Live weight (Te)**
Demersal	1,706,031	911	1,960,217	1,195	3,542,562	1,840	1,625,141	1,003	1,142,774	556	1,447,307	709
Pelagic	327,991	454	19	0	178	0	-	-	7	147	-	-
Shellfish	7,245	3	10,681	4	12,244	3	2,966	1	1,846	1	1,559	0
Total	2,041,267	1,367	1,970,917	1,198	3,554,984	1,843	1,628,107	1,004	1,144,627	703	1,448,867	709

Table 4-4 Fishing effort (in days fished) for ICES rectangle 51F0 between 2016 and 2021 (Scottish Government, 2022)													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2021	4	18	10	15	23	25	23	24	33	22	17	D	218
2020	9	23	14	29	47	76	13	25	26	21	18	D	303
2019	5	10	17	D	25	D	10	60	23	28	57	6	261
2018	D	D	D	19	29	33	23	12	D	10	10	21	185
2017	D	D	D	-	13	26	D	57	D	D	3	7	131
2016	D	D	6	D	5	7	25	D	9	D	16	13	121
Key: - = No Data, D = Disclosive Data (indicating very low effort), green = 0-100 days fished, yellow = 101-200 days fished, orange = 201-300 days fished, red = ≥301													

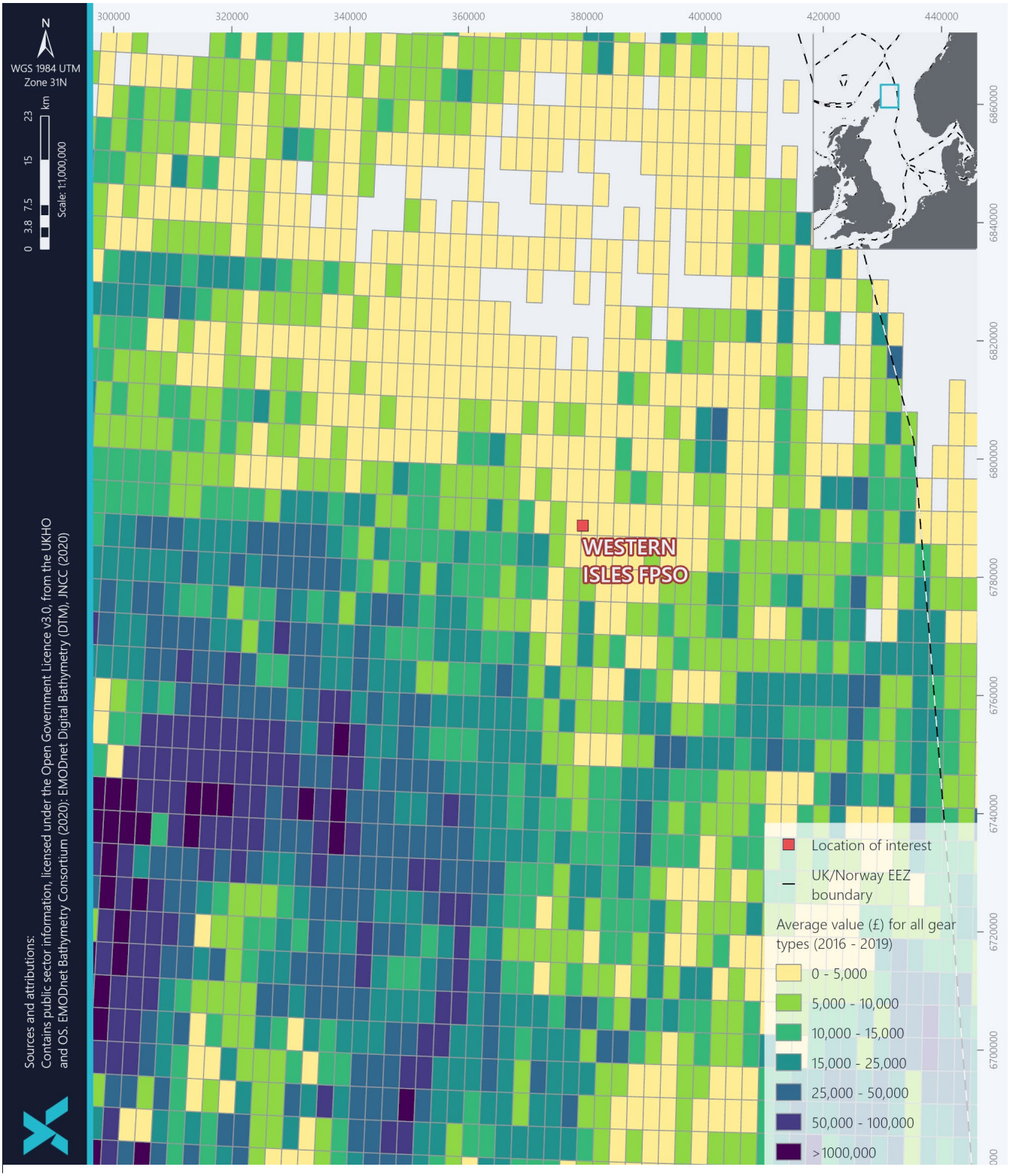


Figure 4-4 Average catch value in the Western Isles area

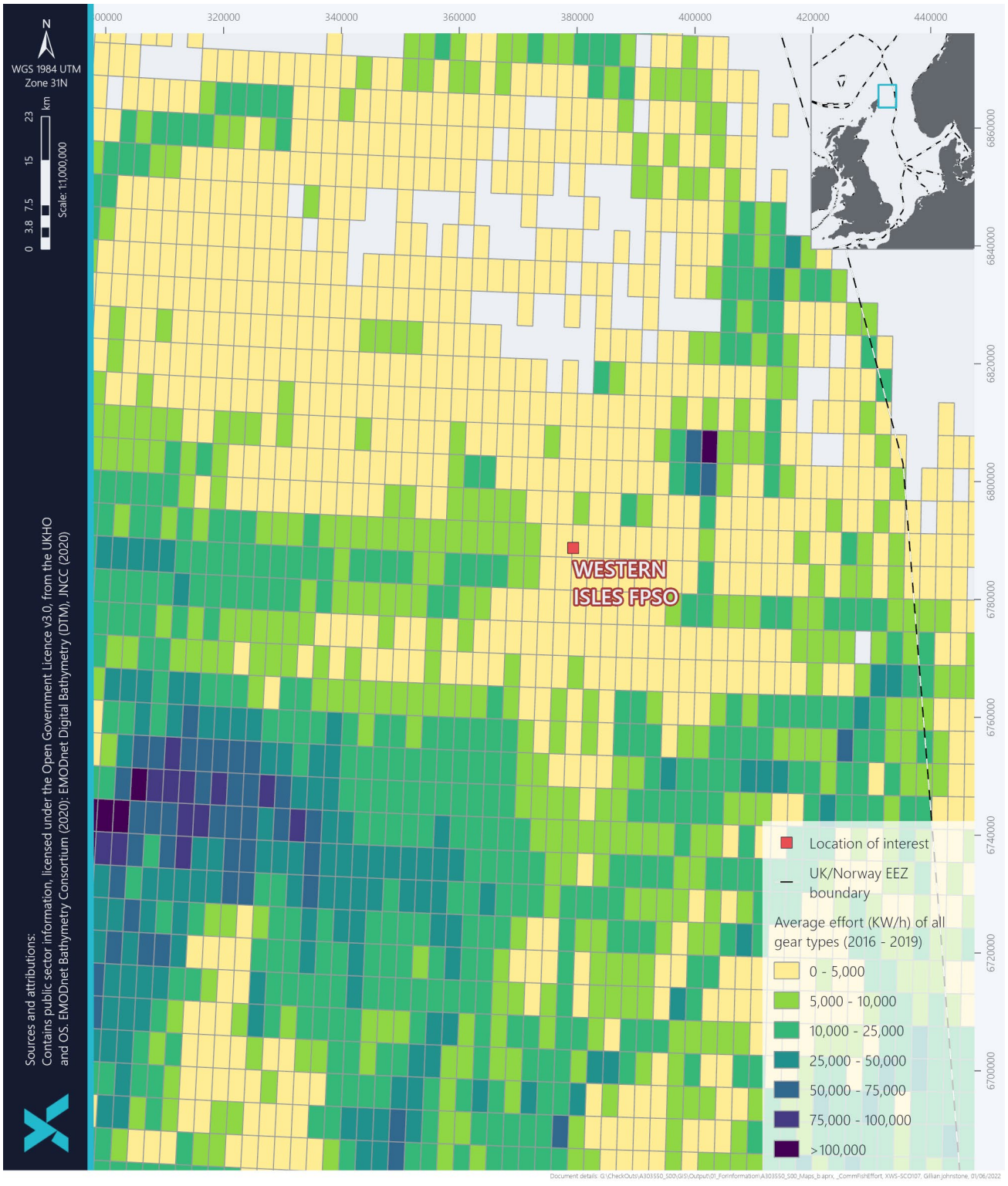


Figure 4-5 Average fishing effort in the Western Isles area

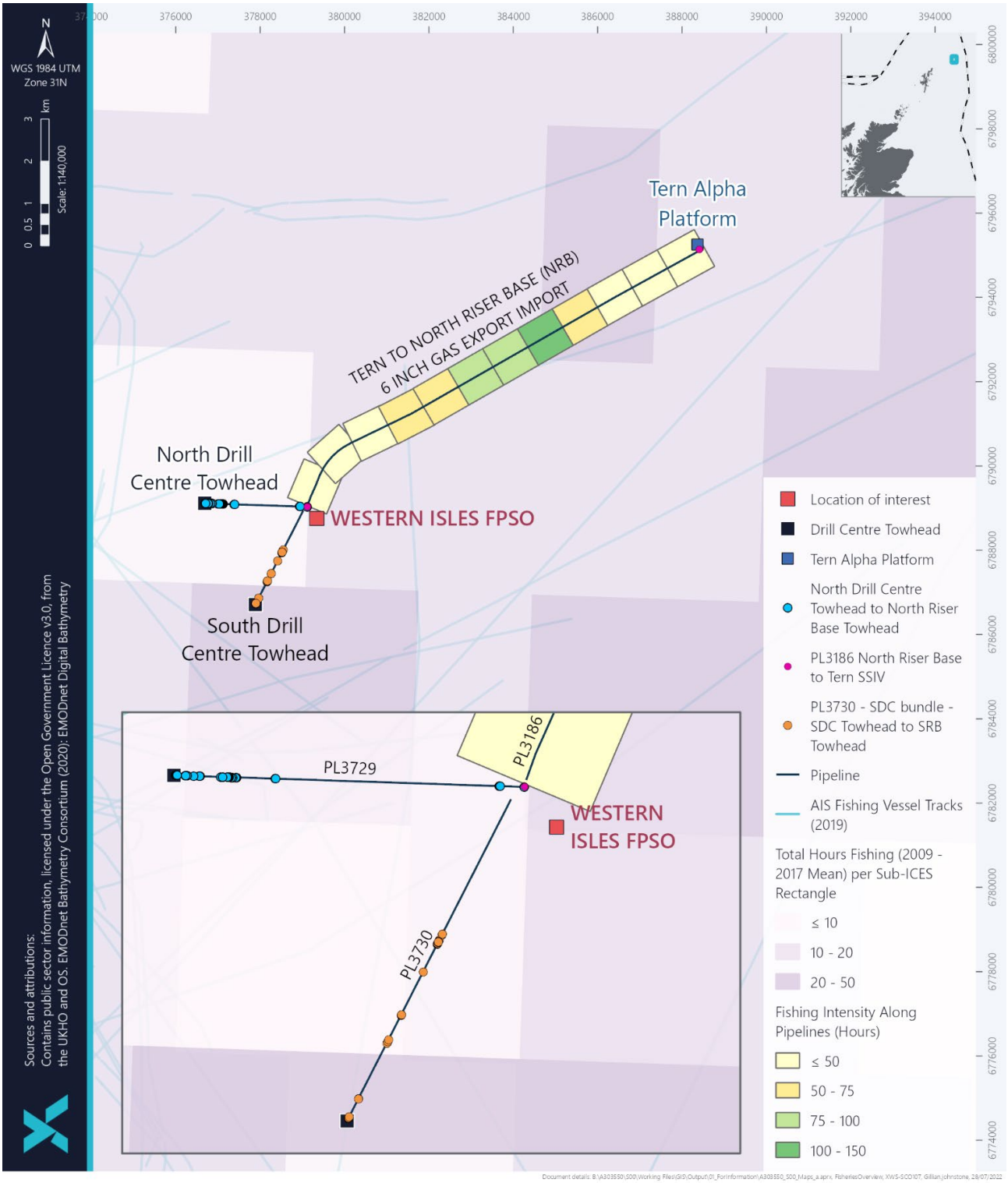


Figure 4-6 Fishing effort, fishing intensity across the PL3186 and AIS tracks associated with fishing vessels

Trawl gears targeting demersal species are the most utilised gear type in the project area. Figure 4-7 shows the fishing intensity according to gear type, with the lack of fishing for shellfish evident.

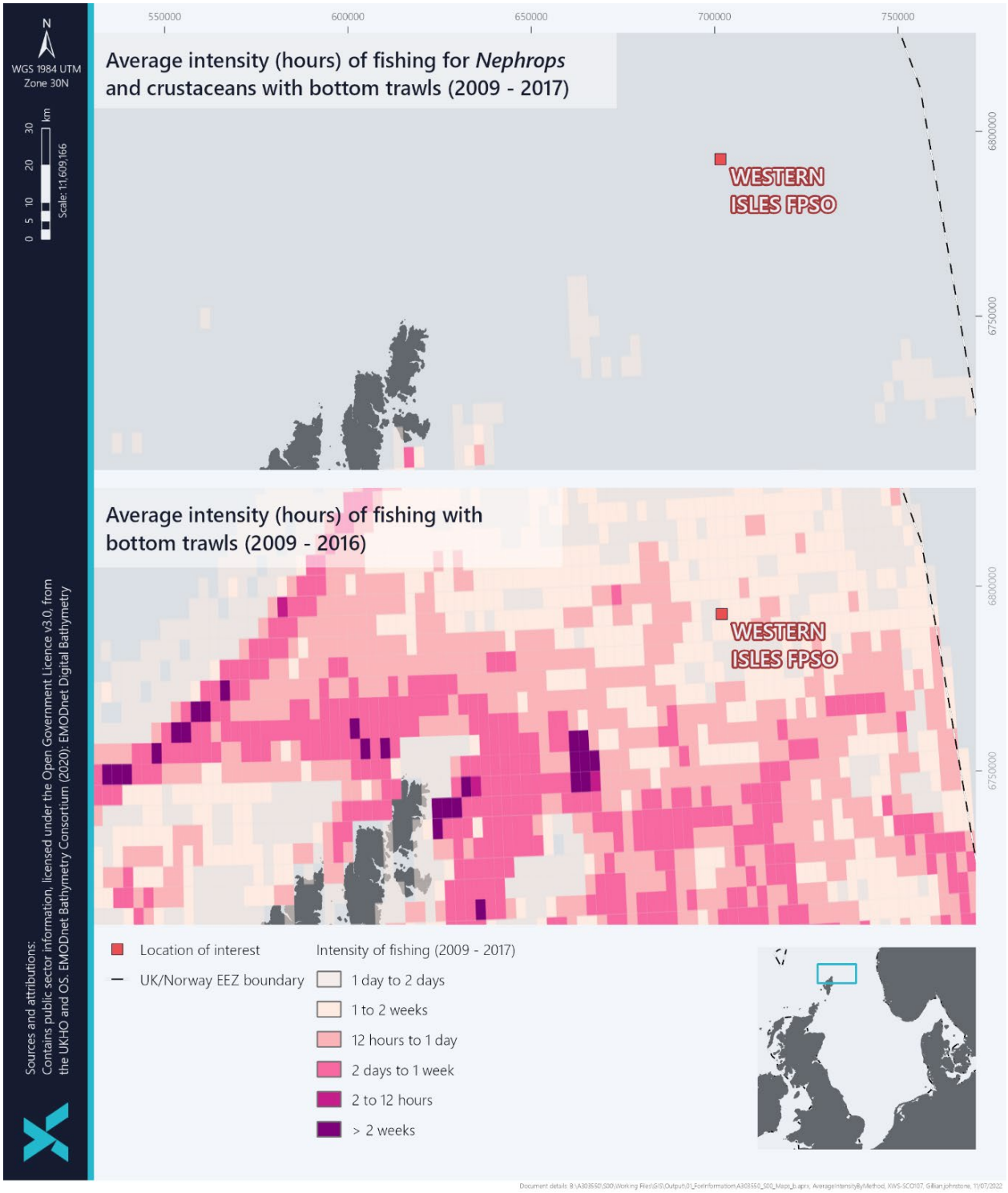


Figure 4-7 Fishing intensity according to gear type

4.5.2 Commercial Shipping

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

Shipping activity within Blocks 210/24 and 210/25 is very low and low respectively (Oil and Gas Authority, 2016).

4.5.3 Oil and gas activity

There are several oil and gas developments in the vicinity of the Western Isles FPSO, which are shown in Figure 4-8. Oil and gas surface infrastructure within 50 km of the Western Isles FPSO is listed in Table 4-5.

Table 4-5 Surface assets within 50 km of the Western Isles FPSO

Surface asset	Status	Operator	Distance and direction from Western Isles FPSO
Tern	Topsides DP approved	TAQA	12 km ENE
Cormorant Alpha	Topsides DP approved	TAQA	21.2 km ESE
Cormorant North	Topsides DP approved	TAQA	21.4 km ENE
Eider	Topsides DP approved	TAQA	26.9 km ENE
Heather Alpha	Not producing	EnQuest	30.8 km SSE
Dunlin Alpha	Topsides removed	Fairfield	45.7 km ENE
Thistle Alpha	Not producing	EnQuest	47.2 km ENE
Ninian Northern	Topsides and Jacket removed	CNRI	49.8 km ESE

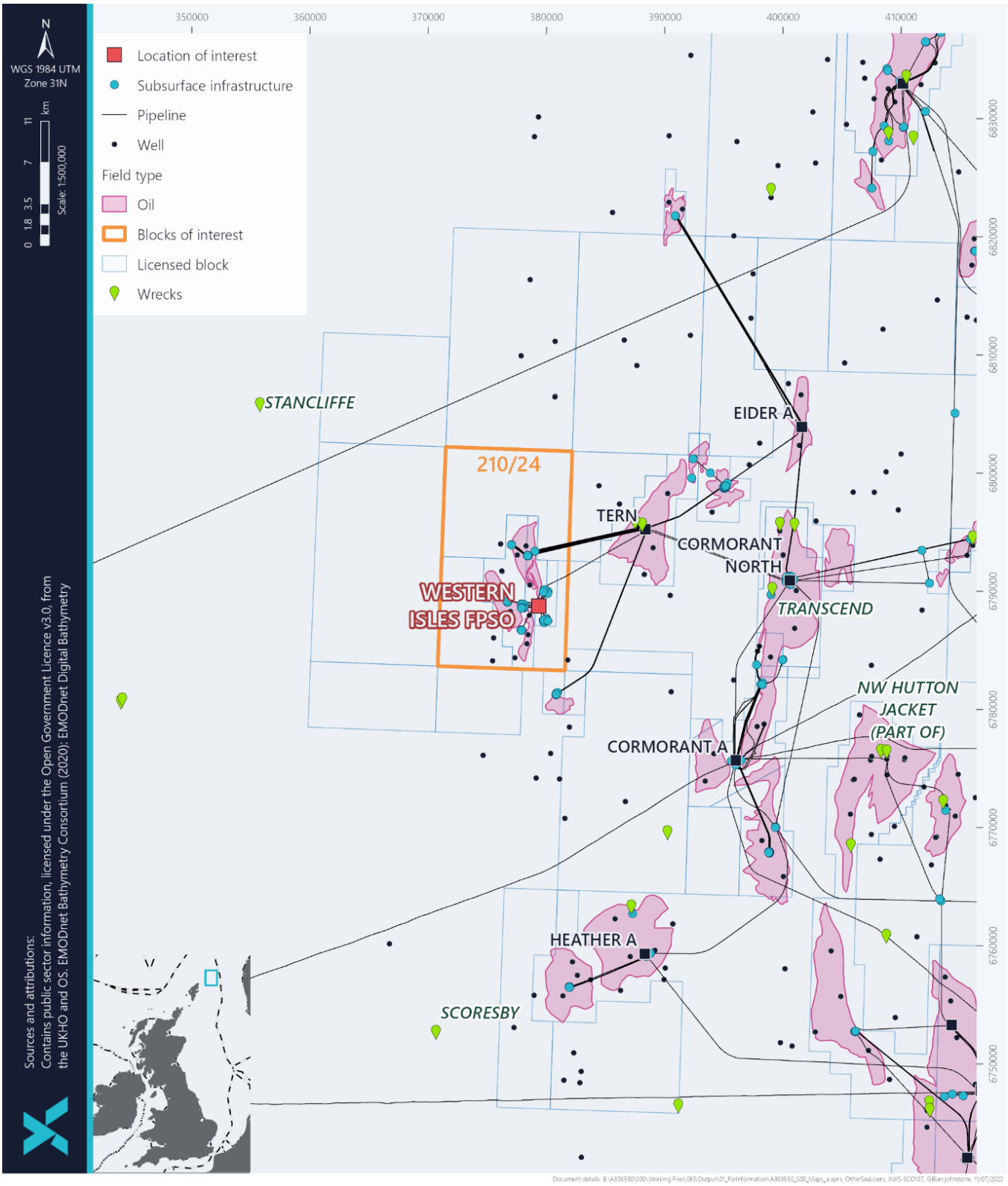


Figure 4-8 Location of the Western Isles development in relation to other sea users

4.5.4 Renewable energy activities

There are no operational offshore wind farms (OWFs) in the vicinity of the project area. However, the project area is close to areas identified under the Innovation and Targeted Oil and Gas (INTOG) scheme. The INTOG areas represent areas within which projects targeting oil and gas decarbonisation or which will generate >100 MW of energy will be considered for approval (Marine Scotland, 2021). The Western Isles FPSO lies approximately 27 km southwest of the NE-a and NE-b INTOG areas.

The Western Isles FPSO lies approximately 86 km north-northeast of the NE1 ScotWind area which was made available in April 2022 for ScotWind applicants who met the required standards but who did not secure their chosen location earlier in the leasing process. A total of 14 applicants were received and three projects were ultimately selected and offered option arrangements, between them covering an area of seabed of 560 km^2 and generating an expected 2.8 GW of electricity (Crown Estate Scotland, 2023). Given that these projects are only in their embryonic form at present, it is unlikely that they will be installed within the window of proposed Western Isles decommissioning activities. However, even if offshore operations were to be concurrent, the Western Isles and NE1 project areas are sufficiently distanced from one another to alleviate any concern of interaction.

There are no other renewables developments, proposed or active, near the project area.

4.5.5 Submarine cables

There are no active or disused cables within 100 km of the project area. The CANTAT-3 active telecom cable is located approximately 105 km northeast of the Western Isles FPSO location (KIS-ORCA, 2022).

4.5.6 Military activities

Aircraft, surface craft and submarines from many countries use the North Sea as a training ground and for routine operations but the distribution and frequency of these activities is unknown.

Blocks 210/24 and 210/25 are not considered blocks of interest to the Ministry of Defence (MoD) (Oil and Gas Authority, 2019).

4.5.7 Marine archaeology and wrecks

There are few wrecks recorded in the vicinity of the project area. The closest is 20 km due east of the Western Isles FPSO; the non-dangerous wreck of the vessel *Transcend*. Closer to the project area lies an area of foul ground and an unknown obstacle, both 10 km from the FPSO and located <1 km from the associated pipeline (NMPi, 2022).

Wrecks are shown in the context of the project area in Figure 4-8.

4.6 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 National Marine Plan (NMP),

2015. The NMP covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles). Its aim 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. Dana will ensure it complies with all the new policies that have been introduced; with particular attention being paid to the following 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.

Decommissioning of the Western Isles project area will result in the removal of infrastructure, the recovery of debris and the cessation of produced water discharges, all of which will enhance the local marine environment in the longer term.

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.

Potential impacts to other users of the sea during execution will be managed through existing safety zones and subsequent guard vessel deployment, UKHO standard communication channels (including Kingfisher, Notice to Mariners and radio navigation warnings) and the use of Automatic Identification Systems as well as other navigational controls. Upon completion of the operations, the area of sea from which other users of the sea have been excluded throughout the operational phase of the project area will be made available for them once again.

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.

Dana will ensure that the minimal number of vessels will be deployed and the streamlining of activities through planning to reduce the time required for vessels to undertake these activities and, in doing so, will support the drive to reduce emissions. Each vessel will have a Shipboard Energy Efficiency Management Plan (SEEMP) which contains information on minimising fuel consumptions. Dana have also commissioned an Energy and Emissions Report to provide insight into the full lifecycle of emissions associated with the project and to highlight where emissions savings could be made.

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.*

Legal requirements will be adhered to throughout the duration of the project, including those relating to the protected species which may be present within the project area. There are no protected areas within 60 km of the project area. There a number of PMFs expected within the project area however the proposed operations will not result in significant impact on their national status. As previously mentioned, decommissioning of the Western Isles project area will result in the removal of infrastructure, the recovery of debris and the cessation of produced water discharges, all of which will enhance the local marine environment in the longer term.

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.

All pipelines and subsea infrastructure will be cleaned and flushed prior to decommissioning. Therefore, any residual discharges during decommissioning activities will be negligible and managed / risk assessed under the existing permitting regime. Discharges from vessels are typically well-controlled activities that are regulated through vessel and machinery design, management and operation procedures. Controls will be in place, as required, through compliance with the Offshore Chemical Regulations and the Oil Pollution Prevention and Control Regulations.

GEN 14 – Air Quality

Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits. Some development and use may result in increased emissions to air, including particulate matter and gasses. Impacts on relevant statutory air quality limits must be taken into account and mitigation measures adopted, if necessary, to allow an activity to proceed within these limits.

Dana will ensure that the minimal number of vessels will be deployed and the streamlining of activities through planning to reduce the time required for vessels to undertake these activities and, in doing so, will support the drive to reduce emissions. Each vessel will have a Shipboard Energy Efficiency Management Plan (SEEMP) which contains information on minimising fuel consumptions. Dana have also commissioned an Energy and Emissions Report to provide insight into the full lifecycle of emissions associated with the project and to highlight where emissions savings could be made.

GEN 21 – Cumulative Impacts

Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation.

In terms of air and water quality, Dana's approach and project-specific mitigation measures will minimise the potential negative aspects contributing towards cumulative impacts as detailed in the responses to GEN 12 and GEN 14. In terms of seabed disturbance, it is reasonable to presume that the proposed operations are not of significant magnitude to have any discernible contribution to cumulative impacts in the broader context though this presumption is qualified in Section 5.3.7.

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.

Dana is committed to establishing and maintaining environmentally acceptable methods for managing wastes and is developing a project-specific Waste Management Plan in line with the Waste Framework Directive and principles of the Waste Hierarchy. In line with the waste hierarchy, Dana will continue review reuse options for elements of the subsea infrastructure.

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

Supporting marine and coastal infrastructure for oil and gas developments, including for storage, should utilise the minimum space needed for activity and should take into account environmental and socio-economic constraints.

Dana will identify an appropriately authorised disposal company and fit for purpose yard through a selection process that will ensure that the chosen facility demonstrates a proven track record of waste stream management throughout the deconstruction process, the ability to deliver innovative reuse / recycling options, and thus minimises the space required to process recovered items.

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.

Dana has the relevant risk reduction measures in place for the proposed decommissioning activities and will demonstrate this appropriately through this DP / EA process, through stakeholder engagement and ultimately through the submission of notifications and applications for the authorisations, permits, licences and consents required to execute the work.

5 IMPACT ASSESSMENT

Table 5-1 summarises the findings of the impact identification workshop, providing justification for the inclusion and exclusion of impact mechanisms. More information regarding industry standard and project-specific mitigation and controls can be found in the ENVID tables in Appendix C**.**

5.1 Impact Identification Outcome

Table 5-1 Impact identification

Impact	Further assessment?	Justification	Mitigation
Atmospheric emissions	Yes	Due to increasing scientific, public and stakeholder concern regarding anthropogenic climate change and the potential contribution of these emissions to global warming, Section 5.2 provides a summary of the emissions, relevant management and mitigation measures and a discussion of cumulative and residual impacts.	Mitigation addressed in Section 5.2.8
Seabed disturbance	Yes	There is potential for decommissioning activities to generate disturbance to the seabed including the removal of the subsea structures and stabilisation materials and the disconnection and removal of pipeline and bundle ends. This aspect has therefore been assessed further in Section 5.2.	Mitigation addressed in Section 5.3.6.
Physical presence of infrastructure decommissioned *in situ*	Yes	Dana will leave the seabed in an overtrawlable state following decommissioning activities, however, stakeholder concern in this case warrants it to be considered further. As such, these two impact pathways have been fully assessed in Section 5.4.	Mitigation addressed in Section 5.4.5.
Physical presence of vessels in relation to other sea users	No	The presence of vessels for decommissioning activities will be relatively short-term in the context of the life of the assets involved. Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities across the North Sea. The small number of vessels required will also generally be in use within the existing	• Safety zones (where / when applicable and being mindful that arrangements will

Table 5-1 Impact identification			
Impact	**Further assessment?**	**Justification**	**Mitigation**
		500 m safety zones at the individual field sites and will not occupy any new areas. Vessel presence will be spatially and temporally restricted so exclusion will only be short-term. Other sea users will be excluded from the 500 m safety zone during active operations. The 500 m safety zones will remain until such time as the FPSO is fully removed. Thereafter guard vessels will remain until such time as debris clearance and seabed remediation activities have been completed. The decommissioning of the Western Isles area will benefit commercial fisheries by reopening fishing grounds previously unavailable due to the 500 m safety exclusion zones currently imposed around the FPSO during operation. The proposed decommissioning of the Western Isles subsea infrastructure is estimated to require 6 different vessel types with no more than four vessels to be on site at any one time. The project area experiences low and very low shipping and with standard mitigation measures in place and the nature of these operations, the risk of collision is not expected to be significant (Dana Petroleum E&P, 2020). Such measures include Notice to Mariners, the maintained presence of 500 m safety exclusion zone around the FPSO while on station and use of navigation aids and guard vessels. Other sea users will be notified in advance of planned activities through the appropriate mechanisms, meaning those stakeholders will have time to make any necessary alternative arrangements during the finite period of operations. Considering the above, the physical presence of vessels does not warrant further assessment.	change at certain stages of the project) • UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings • Use of Automatic Identification Systems (AIS) and other navigational controls • Dana Stakeholder Engagement Management Plan / Process

Table 5-1 Impact identification			
Impact	**Further assessment?**	**Justification**	**Mitigation**
Underwater noise	No	As presented in the ENVID workshop, the activities associated with the decommissioning of the Western Isles infrastructure are unlikely to generate significant noise levels. Underwater noise generating activities will be restricted to vessel noise and cutting activities undertaken using a combination of diamond wire and hydraulic shears. Noise levels emitted during these operations are not easily discernible above the background noise levels, mostly attributed to vessel activity (Pangerc *et al.*, 2016). 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. MBES survey equipment is likely to be used for imaging and identification of pipeline exposures. Industry-standard mitigation measures and the JNCC (2020) Guidelines will be employed for mitigation of noise impacts to marine mammals. On this basis, underwater noise assessment does not need assessed further in this EA.	• Vessel noise unlikely to be far above ambient noise levels • No use of explosives • JNCC (2017) Guidelines will be employed for mitigation of noise impacts to marine mammals for future survey work involving seismic survey equipment
Discharges to sea	No	All pipelines and subsea infrastructure will be cleaned and flushed prior to decommissioning. Therefore, any residual discharges during decommissioning activities will be negligible and managed / risk assessed under the existing permitting regime. Discharges from vessels are typically well-controlled activities that are regulated through vessel and machinery design, management and operation procedures. Controls will be in place, as required, through compliance with the Offshore Chemical Regulations and the Oil Pollution Prevention and Control Regulations. All residual solids will be shipped to shore for disposal.	• Treatment and maceration to IMO standards • Bilge management procedures • Good operating practices • Vessel equipment maintained according to manufacturer's recommendations

Table 5-1 Impact identification			
Impact	**Further assessment?**	**Justification**	**Mitigation**
		Considering the above, discharges to sea during decommissioning activities are not assessed further herein.	• Appropriate Risk Assessment through the MATs / SATs (OCR) system • Compliance with RSA authorisation
Resource use	No	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 Dana where possible. The estimated total energy usage for the project is 179,628 GJ. This number accounts for all operations, material recycling, and the resource loss associated with decommissioning items *in situ*. This is considered minor when compared to the resources generated during the production phase of the project. Consequently, resource use does not warrant further assessment.	• Minimal number of vessels deployed • Use of low sulphur diesel • Vessel equipment maintained according to manufacturer's recommendations
Waste	No	A stakeholder concern often cited, is the management of waste generated during the decommissioning project, rather than the generation of waste itself. The waste to be brought to shore, albeit large in volume, is industry standard and routine in nature. The waste will be recorded and tracked in the project's Active Waste Management Plan (AWMP) and managed in line with Dana's WMP and the Waste Hierarchy, using appropriately authorised waste management contractors and in liaison with the relevant regulators. On that basis, no further assessment of waste is necessary.	• Use of appropriately authorised waste management contractor(s) and facilities. • Compliance with Waste Hierarchy • Detailed inventories (including IHM) • Active Waste Management Plan

Table 5-1 Impact identification			
Impact	**Further assessment?**	**Justification**	**Mitigation**
			• Compliance with Western Isles Decommissioning Waste Management Plan • - Project Waste Management Targets • SCAP
Accidental events (Vessel inventory loss and dropped objects)	No	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 from the pipelines and umbilicals is therefore also out of scope of this assessment. 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. Any spills from vessels in transit or participating in decommissioning activities are covered by a Communication and Interface Plan of the Southern North Sea Offshore Oil Pollution Emergency Plan, and by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). Dana will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP. Dropped object procedures are industry-standard and will be employed throughout the project. All infrastructure prior to removal will also have been flushed and cleaned, minimising risk of contamination if dropped. All unplanned losses in the marine environment will be attempted to be	• OPEP / SOPEP • MARPOL Compliance • Nav Aids • Safety Zones • UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings. • Compliance with Dana Vessel Assurance process / procedure • Client Representatives on board vessel

Table 5-1 Impact identification			
Impact	**Further assessment?**	**Justification**	**Mitigation**
		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. In line with the mitigation measures in place, accidental events are not assessed further herein.	

5.2 Atmospheric Emissions

5.2.1 Introduction

On a global scale, concern regarding atmospheric emissions of direct and indirect greenhouse gasses (GHGs) (including water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxides (NOx), ozone (O_3), chlorofluorocarbons (CFCs) and volatile organic compounds (VOCs)) is focused on the impact they have on global climate change. The Intergovernmental Panel on Climate Change (IPCC) in its sixth assessment report (AR6) states that it is unequivocal that the increase of CO_2, CH_4 and NOx in the atmosphere over the industrial era is the result of human activities. Human influence is the principal driver of many changes observed across the atmosphere, ocean, cryosphere and biosphere. (IPCC, 2021). Climate change estimates in the AR6 report state that each of the last four decades have been successively warmer than any decade that preceded it since 1850. IPCC (2021) reports a 47% increase in CO2 concentrations since 1750, which far exceeds the natural multi-millennial changes between glacial and interglacial periods over at least the past 800,000 years, and states that fossil fuel combustion is the primary contributor to the observed climate change. This has prompted increasing public and stakeholder concern regarding the impacts of anthropogenic climate change on the environment and the potential contribution of GHG emissions to global warming.

The information on the quantification and impact assessment of the emissions is presented in this section of the EA represents atmospheric emissions associated with the proposed Western Isles subsea decommissioning activities:

- Offshore vessel use for decommissioning activities.
- Lifecycle emissions (onshore transport, recycling, new manufacture of recyclable material decommissioned *in situ*).

On a local-scale emissions such as nitrogen and sulphur oxides (NOx and SOx) and carbon monoxide (CO) may affect air quality. These emissions may be assessed against onshore local air quality guidelines to understand the potential magnitude of impact on human health and the environment. These guidelines are intended to mitigate the regional, national, and transboundary issues caused by these pollutants such as acid rain and eutrophication.

5.2.2 Regulatory Controls

In the UK, there are several atmospheric regulatory controls which apply to offshore developments and require the provision of atmospheric emissions inventories and management. Following the UK's departure from the EU, the atmospherics legislation that is derived from EU regulations was transcribed into UK law.

Relevant legislation for offshore combustion equipment includes:

- Climate Change Act 2008 (as amended).
- The National Emission Ceilings Regulations 2002.

- The Greenhouse Gas Emissions Trading Scheme Order 2020.
- Pollution Prevention and Control Act 1999.
- The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 as amended by The Offshore Combustion Installations (Pollution Prevention and Control) (Amendment) Regulations 2018.
- The Pollution Prevention and Control (Designation of Medium Combustion Plant Directive) (Scotland) Order 2017.
- The Pollution Prevention and Control (Scotland) Amendment Regulations 2017.
- The Pollution Prevention and Control (Designation of the Medium Combustion Plant Directive) (Offshore) Order 2018.

The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008 implement MARPOL Annex VI in the UK and establish controls on marine engines and marine fuel in order to limit emissions, in particular NOx and SOx. All vessels used during the proposed project will have the appropriate UK Air Pollution Prevention Certificate (UKAPP) or International Air Pollution Prevention Certificate (IAPP) in place, as required.

- Regulation 14 designated the North Sea for the purposes of SOx and particulate matter control Sulphur Oxides Emission Control Areas (SECA).
- Regulation 13 requires Nitrogen Oxides Emissions Control Areas (NECA) to be included within Emission Control Areas (ECA) as evidenced by the issue of Engine International Air Pollution Prevention Certifications (EIAPP).
- Directive 2005/33/EC amending Directive 1999/32/EC as regards the sulphur content of marine fuels:
    - The Sulphur Content of Liquid Fuels (England and Wales) Regulations 2000.
    - The Sulphur Content of Liquid Fuels (Scotland) Regulations 2014.

5.2.3 Approach

5.2.3.1 Offshore vessel use

The emissions of relevant GHGs, for which the global warming potentials (GWPs) are listed in Table 5-2 have been calculated from the estimated total amount of fuel that will be required by vessels (Institute of Petroleum (IoP; 2000) and the National Atmospheric Emissions Inventory (NAEI; 2019)). Vessels emissions for combustion gases other than CO_2 were converted into an overall CO_2e using their GWP as defined by the IPCC. The emissions of individual GHGs were then summed to a single value of carbon dioxide equivalent (CO_2e), to describe different GHGs in a common unit (Table 5-2). For any quantity and type of GHG, CO_2e signifies the amount of CO_2 with the equivalent global warming impact. CO_2e was then used to compare the emissions from the Western Isles decommissioning vessel activities with total UKCS emissions and the UK carbon budget.

Table 5-2 GWP (100-year horizon) of relevant GHGs (Te CO2e; IPCC, 2021)				
CO_2	**CH_4**	**N_2O**	**CO**	**VOC**
1	29.7	273	1.6	5.6

Table 5-3 Western Isles subsea decommissioning vessel activity						
Activity	**Vessel**	**Duration (days)**				**Fuel use (Te)**
		Mob/ demob	**Transit**	**Working**	**Waiting on Weather**	
Pre-decommissioning survey	ROVSV	2	2.2	3.2	0.5	158.1
Xmas tree disconnections	DSV	3.3	2.7	17.4	3	412.5
Mattress and spools removal and towhead preparation	DSV	2.8	1.1	18.1	2.9	387
Riser removal and recovery	CSV	6	3.1	15	3.6	563.8
MWA Removal	CSV	6.5	3.4	8	2.3	365.7
Towhead recovery	HLV	5	3.4	16.5	3	980
Pile cutting and recovery	ROVSV	2.5	1.4	15.1	10.5	684.2
Remediation	Rock placement vessel	3	2	8	1.2	164.0
Post-decommissioning survey	ROVSV	2	2.2	6.24	0	221.6
Guard vessel*		3	2	730	0	591.6

*Guard vessel demob only required on one occasion, following which it will be on site for the duration of the decommissioning activities.

Table 5-4 Western Isles subsea decommissioning vessel emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Pre-decommissioning survey	501.18	2.48	9.33	0.03	1.90	0.03	0.38	517.29
Xmas tree disconnections	1,307.63	6.48	24.34	0.09	4.95	0.07	0.99	1,349.66
Mattress and spools removal and towhead preparation	1,228.06	6.08	22.86	0.09	4.65	0.07	0.93	1,267.53
Riser removal and recovery	1,787.25	8.85	33.26	0.12	6.77	0.10	1.35	1,844.70
MWA Removal	1,159.27	5.74	21.58	0.08	4.39	0.07	0.88	1,196.53
Towhead recovery	3,106.60	15.39	57.82	0.22	11.76	0.18	2.35	3,206.46
Pile cutting and recovery	2,168.91	10.74	40.37	0.15	8.21	0.12	1.64	2,238.63
Remediation	519.88	2.57	9.68	0.04	1.97	0.03	0.39	536.59
Post-decommissioning survey	2,168.91	10.74	40.37	0.15	8.21	0.12	1.64	2,238.63
Guard vessel*	1,875.37	9.29	34.90	0.13	7.10	0.11	1.42	1,935.66
TOTAL	**13,855.44**	**68.62**	**257.88**	**0.97**	**52.46**	**0.79**	**10.48**	**14,300.81**

Note: Emissions factors for marine diesel are included in Appendix D.

In 2019, commercial fishing in UK waters emitted 782 kt CO_2e, coastal shipping 4,521 kt CO_2e, and leisure craft 186 kt CO_2e (NAEI, 2019). The maximum emissions from the Wester Isles decommissioning vessels would amount to approximately 14.3 kt CO_2e. This represents approximately 0.26% of the sum of the emissions from the sources described above for shipping in 2019.

Impacts on local air quality and global warming due to vessel use in the project area are not expected to be detectable above current background levels due to the limited number of vessels and time spent of decommissioning activities. As with all other sectors of UK industry, shipping is identifying opportunities to decarbonize and therefore the atmospheric emissions from the decommissioning vessels may be less than those predicted for installation and commissioning.

5.2.4 Lifecycle emissions

5.2.4.1 Onshore transport

Onshore transport emissions are those associated with the transport of waste from the arrival port to treatment, landfill and/ or recycling facilities. As waste contractors have not been identified yet, the distance travelled is based on a worst-case scenario of transport to a recycling and/ or treatment facility within a 150 km radius (300 km round trip) of the port location. The total (worst-case) emissions associated with onshore transport were estimated to be 123 tCO_2e (Table 5-5).

Table 5-5 Western Isles onshore transport emissions (Te)

Activity	CO_2	N_2O	CH_4	CO	VOC	NOx	SO_2	CO_2e
Onshore transport (Lorry) Emissions	41.1	0.3	0.0	0.0	0.0	0.5	0.0	123

Note: Emissions factors for diesel are included in Appendix D.

5.2.4.2 Recycling

Inevitably, recycling creates carbon emissions as energy is required to re-process recyclable waste. GHG emissions are estimated using EFs that relate the quantity of a pollutant emitted to a unit of activity (e.g., kg fossil CO_2 per tonne of material reprocessed). In the case of waste material recycling, EFs are often expressed per tonne of waste material collected and sent for recycling (kg CO_2e/t). The total emissions associated with recycling of the waste materials listed in Table 3-6, were estimated to be 3,823 tCO_2e, as shown in Table 5-6.

Table 5-6 Western Isles decommissioning lifecycle emissions (Te)

Activity	CO_2	N_2O	CH_4	CO	VOC	NOx	SO_2	CO_2e
Recycling	3,823	ND	ND	ND	ND	5.3	13	3,823
New manufacture	10,562	ND	ND	ND	ND	19.6	31.9	10,562
Total	**14,385**	**0**	**0**	**0**	**0**	**24.9**	**44.9**	**14,385**

Note: Emissions factors for specific materials and activities are included in Appendix D.

5.2.4.3 New manufacture

The manufacture of materials results in the emission of CO_2e, also termed embodied carbon. The embodied carbon in the context of the Western Isles decommissioning project is in relation to the loss to society of otherwise recyclable material decommissioned in situ, i.e., that contained within the bundles and pipelines. The material quantities were calculated based on the available data with expert engineering knowledge. EFs were applied to obtain the values for the embodied carbon in the materials. The total embodied carbon for the Western Isles infrastructure (material quantities presented in Table 3-6 was estimated to be 10,562 tCO_2e (Table 5-6).

5.2.5 Summary of the atmospheric emissions impact quantification

The maximum emissions from the Western Isles decommissioning vessels would amount to approximately 14.3 kt CO_2e. This represents about 0.26% of all the emission sources for shipping on the UKCS in 2019 (NAEI, 2019; Table 5-4).

The embodied carbon associated with the decommissioning of the pipelines and cables in situ makes the largest contribution to the lifecycle carbon inventory for the project with an associated 10.56 kt CO_2e GHG emissions. This is due to the quantity of material to be decommissioned *in situ* Table 5-6 and also the quantity of emissions generated when manufacturing new material. Recycling emissions associated with materials returned to shore amount to approximately 3.8 kt CO_2e (Table 5-6) and the total (worst-case) emissions associated with the transportation of this material for recycling were estimated to be 0.123 kt tCO_2e (Table 5-5). Despite the emissions during recycling activities, international studies have also shown that the recycling of waste materials can result in net savings of GHG emissions in contrast to new manufacture (Björklund and Finnveden, 2005; Franchetti and Kilaru, 2012; Manfredi et al., 2011; Turner et al., 2015; WRAP, 2006). This is because recycling materials into new ("secondary") products can displace production of "primary" products that can require even more significant inputs of energy and raw materials.

The total GHG emissions, when considering all aspects of the planned decommissioning activities are estimated to be in the region of 28.81 kt CO_2e

5.2.6 Impacts on sensitive receptors

To determine the significance level of impacts resulting from atmospheric emissions, there is a requirement to understand the sensitive receptors. Gaseous emissions from the proposed decommissioning activities include CO_2, CO, NOx, N_2O, SOx, CH_4 and VOCs. These have the potential to impact sensitive receptors in the area.

The direct effect of the emission of CO_2, CH_4, N_2O and VOCs is the implication for climate change and the contribution to localised air quality deterioration due to low-level ozone (IPCC, 2021). The indirect effects of low-level ozone include deleterious health effects, as well as damage to ecosystems. The direct effect of NOx, SOx and VOC emissions is the formation of photochemical pollution in the presence of sunlight. Low level ozone is the main chemical pollutant formed, with by-products that include nitric and sulphuric acid and nitrate particulates, contributing to acid rain formation.

The exposed offshore conditions will promote the rapid dispersion and dilution of these emissions. Outside the immediate vicinity of the decommissioning activities, all emitted gases would only be present in low concentrations. Potential impacts from onshore emissions are likely to be relatively minor and within local and regional air quality criteria.

In summary, the atmospheric emissions from the Western Isles subsea decommissioning activities are unlikely to have any effect on sensitive receptors. Potential impacts from onshore transport and recycling emissions are likely to be relatively minor and within local and regional air quality criteria.

5.2.7 Cumulative and Transboundary Impacts

5.2.7.1 Local air quality

Throughout the decommissioning activities there will be atmospheric emissions, which have the potential to have local, regional (including transboundary) effects. As noted in Section 4.5.3, the closest active oil and gas activities to the Western Isles infrastructure are those associated with the TAQA-owned Tern (12 km ENE), Cormorant Alpha (21.2 km ESE) and North Cormorant (21.4 km ENE) platforms and given these distances, local air quality decline is not likely to be cumulative in nature. There are no offshore windfarms in the direct vicinity (and therefore no associated vessel emissions). There is unlikely to be a noticeable cumulative effect in terms of local air quality above the current levels, given the transitory nature of the decommissioning activities. The main activities and associated emissions arising from the decommissioning activities will be approximately 93 km from the UK coastline and 58 km from the UK/Norway European Economic Zone (EEZ) boundary line.

Any emissions will be limited to the duration of the decommissioning activities and will be minimised as far as possible following the mitigation approaches outlined in Section 5.2.8.

5.2.7.2 Global Climate Change

Atmospheric emissions from fuel supply (of which production of oil and gas is part) was 39 million tCO_2e in 2018, which represents 7% of the UK total emissions for that year, according to the Committee on Climate Change (CCC) latest Progress report to Parliament (CCC 2019). Of this sector-specific emissions, oil and gas production comprise approximately 40% (16 $MtCO_2e$), including onshore petroleum production. In context, the total offshore emissions from the UKCS (14.63 $MtCO_2e$) represents only 3% of the UK's total emissions for the same year (OEUK 2019). The estimated CO_2 emissions to be generated by the subsea decommissioning activities are estimated to be 28.83 $ktCO_2e$, which represent 0.19% of the 14.63 $MtCO_2e$ generated offshore on the UKCS in 2018 (OEUK, 2019). The emissions from the removal of the FPSO are estimated to be in the region of 13.65 $ktCO_2e$. This means that the emissions associated with the cumulative Western Isles decommissioning activities will amount to 42.48 $ktCO_2e$, approximately 0.29% of the 14.63 $MtCO_2e$ generated offshore on the UKCS in 2018.

Any emissions will be limited to the duration of the decommissioning activities in contrast to the continuous emissions associated with live production operations and will be minimised as far as possible following the mitigation approaches outlined in Section 5.2.8.

5.2.8 Management and Mitigation

Most emissions during the decommissioning activities will be the result of combustion of hydrocarbons for power generation related to vessels. Vessels will be owned by a 3rd Party and the activities are therefore subject to supply chain processes of contract selection and management. Minimisation of emissions from vessels will form part of the selection criteria for the installation vessels though the tendering and selection process.

- Minimal number of vessels deployed and streamlining of activities through planning to reduce the time required for vessels will be required for these activities and will support the drive to reduce emissions.
- Each vessel will have a Shipboard Energy Efficiency Management Plan (SEEMP) which contains information of minimising fuel consumptions e.g., economical speeds when operationally appropriate.
- Vessel equipment maintained according to manufacturer's recommendations
- Use of low sulphur diesel
- Green dynamic positioning or economical speeds when operationally appropriate
- Dana Vessel Assurance process / procedure
- Third Party Contractor Assurance process / procedure
- Dana have also commissioned an Energy and Emissions Report to provide insight into the full lifecycle of emissions associated with the project and to highlight where emissions savings could be made.

5.2.9 Residual Impacts

The overall assessment for **Atmospheric emissions** was of 'Low' significance. However further investigation was deemed necessary due to increasing scientific, public and stakeholder concern regarding the impacts of anthropogenic climate change on the environment and the potential contribution of greenhouse gas emissions to global warming.

The atmospheric emissions from the Western Isles subsea decommissioning activities will be temporary and limited in nature. It is not expected that atmospheric emissions will negatively impact local air quality or result in significant local cumulative impacts. In terms of global climate change (i.e., cumulative and transboundary impacts), the decommissioning activities will add a very small (0.29%) contribution to the overall offshore emissions in the UK (based on 2018 reported values) and the emission of GHG into the environment. The contribution to global warming will be negligible in relation to those from the wider offshore industry and outputs at a national or international level. However, Dana is aware of the impact of operational emissions, including those which may be an indirect result of decommissioning operations.

The CCC concluded in their 2019 report, that it is achievable for the UK to implement a new target of net-zero GHG emissions by 2050 in England and Wales, and by 2045 in Scotland. To achieve the net-zero goal, the CCC report calls for concerted effort and action by all to reduce emissions and for any remaining emissions in 2050 to be offset. As part of this, the offshore oil and gas industry is focussed on the continued management and reduction of its operational emissions and the recently announced North Sea Transition Deal (BEIS, 2021) further commits the sector to early targets for the reduction of greenhouse gas emissions from production, against a 2018 baseline.

In line with the NSTA Stewardship Expectation 11 (NSTA, 2021) Dana is committed to reduce, as far as is reasonably practicable, GHG emissions from all aspects of our operated assets and to collaborate with and facilitate partners to do the same for our non-operated portfolio. This includes: the development of new hydrocarbon projects; existing producing assets; the abandonment and

decommissioning of fields; and the progression of potential energy integration/net zero solutions to assist the governments in our areas of active operations in meeting Net Zero targets.

5.3 Disturbance to Seabed

5.3.1 Introduction

This section discusses the potential environmental impacts associated with disturbance to the seabed resulting from the proposed Western Isles decommissioning activities and the presence of the associated subsea pipelines decommissioned *in situ*. The measures planned by Dana to minimise these impacts are detailed in Section 5.3.6.

5.3.2 Approach

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

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

The seabed impacts resulting from the activities associated with the Western Isles decommissioning can also be classified as temporary or permanent. Temporary impacts are defined here as those which have transient impacts lasting a few days to a few years (Appendix A.3). Permanent impacts are those which will continue to have an impact for decades to centuries following decommissioning. In the following sections, potential impacts will also be defined either as temporary or permanent.

5.3.3 Description and quantification of impact

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

- Subsea infrastructure decommissioning:
  - Removal of towheads, mooring line anchor piles and Wellhead Protection Structure (WHPS) (Section 5.3.3.1)
- Decommissioning of bundles and pipeline:

- Remediation of pipeline ends, surface laid sections of rigid pipeline and exposed bundle midline sections (Section 5.3.3.2)
- Removal of stabilisation and protection structures (Section 5.3.3.3)
- Pipelines decommissioned *in situ* (Section 5.3.3.4)

5.3.3.1 Subsea structures

All subsea structures within the Western Isles Area are to be fully removed (as described in Section 3.5). Decommissioning of the wellheads is accounted for within the footprint associated with the removal of the integrated WHPSs considered as part of this EA.

Dana intends to recover the MWAs directly from the water column to surface as part of FPSO sail away operations but wish to retain the contingency option to lay down and short-term wet store them safely ahead of recovery, rather than leaving them in mid-water suspension, in the event that direct recovery to surface is not practicable at the time of execution. To account for that eventuality, the temporary disturbance associated with the laydown, wet store and subsequent recovery of the MWAs has been assessed.

Mooring line anchor piles will be internally dredged out to remove the soil plugs then cut using an internal abrasive water jet cutting tool.

To calculate the area of direct disturbance the dimensions of the structures have been used. A 3 m buffer, which considers allowance for any minor excavations associated with prepping the items to be recovered and deployment of any tooling etc., has been added to the length and width of the structures. This methodology has been used in the interest of adopting a conservative approach to calculating a worst-case possible impact for the removal of the Western Isles subsea structures.

An estimate has been made of the possible indirect disturbance due to re-suspension and settlement of sediment. Most re-suspended sediment will settle within the initial disturbance area, but it has been assumed that some will land beyond that area. Again, adopting a conservative approach, the area of indirect disturbance has been assumed to be double the area of direct disturbance. This disturbance will be temporary and resettlement will only occur as long as activities are underway and shortly afterwards.

The direct and indirect disturbance areas associated with these proposed operations are summarised in Table 5-7.

Table 5-7 Seabed disturbance associated with the decommissioning of structures				
Activity	**Description and dimensions**	**Expected duration of disturbance**	**Temporary direct disturbance area (km^2)**	**Temporary indirect disturbance area (km^2)**
Removal	NDC Leading Towhead (MPN2) 29.375m (L) x 6m (W) x 5.956m (H)	Temporary	0.000291	0.000583
Removal	SDC Leading Towhead (MPS2) 29.375m (L) x 6m (W) x 5.954m (H)	Temporary	0.000291	0.000583
Removal	NRB Trailing Towhead (MPN1) 19.76m (L) x 6.6m (W) x 5.281m (H)	Temporary	0.000218	0.000437
Removal	SRB Trailing Towhead (MPS1) 19.76m (L) x 6.0m (W) x 5.281m (H)	Temporary	0.000205	0.000410
Removal	FPSO Mooring Line Anchor Pile #1 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #2 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #3 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #4 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #5 36m (L) x 2.438m (Dia)	Temporary	0.000212	0.000424
Removal	FPSO Mooring Line Anchor Pile #6 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #7 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #8 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #9 35m (L) x 2.438m (Dia)	Temporary	0.000207	0.000413
Removal	FPSO Mooring Line Anchor Pile #10 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #11 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	FPSO Mooring Line Anchor Pile #12 32m (L) x 2.438m (Dia)	Temporary	0.000190	0.000381
Removal	MWA (APN1) 14.5m (L) x 11.4m (W) x 7m (H)	Temporary	0.000252	0.000504
Removal	MWA – Gravity bases (APN1-B1 & APN1-B2): Docking Base 16m (L) x 10m (W) x 3.2m (H)	Temporary	0.000247	0.000494
Removal	MWA – Gravity bases (APN1-B1 & APN1-B2): Sinker Weight 14m (L) x 5m (W) x 1.4m (H)	Temporary	0.000136	0.000272
Removal	MWA – Gravity bases (APN1-B1 & APN1-B2): Tethers	Temporary	0.000042	0.000084

	8.4m (L) x 0.7m (W) x 43.2m (H)			
Removal	MWA (APS1) 14.5m (L) x 11.4m (W) x 7m (H)	Temporary	0.000252	0.000504
Removal	MWA - Gravity bases (APS1-B1 & APS1-B2): Docking Base 16m (L) x 10m (W) x 3.2m (H)	Temporary	0.000247	0.000494
Removal	MWA - Gravity bases (APS1-B1 & APS1-B2): Sinker Weight 14m (L) x 5m (W) x 1.4m (H)	Temporary	0.000136	0.000272
Removal	MWA - Gravity bases (APS1-B1 & APS1-B2): Tethers 8.4m (L) x 0.7m (W) x 43.2m (H)	Temporary	0.000042	0.000084
Removal	WHPS - 210/24a-B8Z (UP-2) 9.1m (L) x 8.7m (W) x 5.3m (H)	Temporary	0.000142	0.000283
Removal	WHPS - 210/24a-B10 (LI-2) 9.1m (L) x 8.7m (W) x 5.3m (H)	Temporary	0.000142	0.000283
Removal	WHPS - 210/24a-B11 (BP-7) 9.1m (L) x 8.7m (W) x 5.3m (H)	Temporary	0.000142	0.000283
Removal	WHPS - 210/24a-N1Z (HP-6) 9.1m (L) x 8.7m (W) x 5.3m (H)	Temporary	0.000142	0.000283
Removal	WHPS - 210/24a-N2 (LP-4) 9.1m (L) x 8.7m (W) x 5.3m (H)	Temporary	0.000142	0.000283
Removal	WHPS - 210/24a-N3Z (LP-5) 9.1m (L) x 8.7m (W) x 5.3m (H)	Temporary	0.000142	0.000283
Removal	WHPS – 210/24a-N4Z (LI-1) 9.1m (L) x 8.7m (W) x 5.3m (H)	Temporary	0.000142	0.000283
		Total (km^2)	**0.005673**	**0.011347**

*Note: any apparent discrepancy in the totals is due to rounding within the table.

5.3.3.2 Pipeline, jumpers, spools and pipeline ends

Where outlined in Section 3.5, pipelines will be decommissioned *in situ*, while pipeline ends, surface laid ends and trench transition sections of the rigid pipeline (up to the point of burial) will be cut and removed, with remedial rock applied at the cut points. Specific cutting methodologies will be developed upon award of contract to the subsea engineering contractor(s) however, the assumption is that diamond wire will be utilised to cut the bundles and hydraulic shears to cut the rigid pipelines, spools, jumpers and flexibles. All spools and jumpers will be disconnected and removed.

The area of seabed disturbed by the disconnection and recovery of each individual pipeline end, spool and jumper to the surface has been estimated by multiplying the length of each individual line section which will be removed, by a 1 m buffer corridor. The bundle ends, given their width, have been estimated using a 3 m buffer corridor. The areas disturbed by recovery of each individual line have then been summed to give an overall area of disturbance. Indirect disturbance has been assumed to be twice that of the direct area. This accounts for the resuspension of sediment generated due to the direct disturbance, most of which will settle within the direct footprint.

The direct and indirect disturbance areas associated with these proposed operations are summarised in Table 5-8. A full inventory of infrastructure dimensions is available in Section 3. All disturbance will be temporary.

Table 5-8 Seabed disturbance associated with the decommissioning of pipelines, jumpers, spools and pipeline ends

Activity	Description and dimensions	Expected duration of disturbance	Temporary direct disturbance area (km^2)	Temporary indirect disturbance area (km^2)
Removal	PL3186 Rigid Gas Import / Export line ends 2 off 15m (L) x 6" (Dia)	Temporary	0.000035	0.000069
Removal	PL3186 (Ident No.2) Gas Import/Export Flexible Riser Flange to NRB Trailing Towhead Toweye 5.4m (L) x 6" (Dia)	Temporary	0.000006	0.000012
Removal	PL3186 (Ident No.3) NRB Trailing Towhead Toweye to 6" Gas Import / Export Pipeline Tie-in Flange 64.94m (L) x 6" (Dia)	Temporary	0.000075	0.000150
Removal	PL3186 (Ident No. 5) 6" Gas Import / Export Pipeline Tie-in Flange to Tern SSIV Structure 59.9m (L) x 6" (Dia)	Temporary	0.000069	0.000138
Removal	North bundle ends 2 off 50m (L) x 37.8" (Dia)	Temporary	0.000396	0.000792
Removal	North bundle NRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange 5.35m (L) x 8" (Dia)	Temporary	0.000006	0.000013
Removal	North bundle NRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange 5.35m (L) x 8" (Dia)	Temporary	0.000006	0.000013
Removal	North bundle 8" Water Injection Flexible Riser Flange to NRB Trailing Towhead 5.35m (L) x 8" (Dia)	Temporary	0.000006	0.000013
Removal	North bundle* 6" Gas Lift Flexible Riser Flange to NRB Trailing Towhead 5.4m (L) x 6" (Dia)	Temporary	0.000006	0.000012

Removal	South bundle ends 2 off 50m (L) x 37.8” (Dia)	Temporary	0.000396	0.000792
Removal	South bundle SRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange 24.72m (L) x 8” (Dia)	Temporary	0.000030	0.000059
Removal	South bundle SRB Trailing Towhead Toweye to 8" Production Flexible Riser Flange 26.62m (L) x 8” (Dia)	Temporary	0.000032	0.000064
Removal	South bundle 9" Water Injection Flexible Riser Flange to NRB Trailing Towhead 28.32m (L) x 9” (Dia)	Temporary	0.000035	0.000070
Removal	South bundle* 6" Gas Lift Flexible Riser Flange to SRB Trailing Towhead 24.07m (L) x 6” (Dia)	Temporary	0.000028	0.000055
Removal	PL4142 Production Spool Well XPN2C (HP-6) to NDC Leading Towhead 64.25m (L) x 6” (Dia)	Temporary	0.000074	0.000148
Removal	PL4143 Gas Lift Spool NDC Leading Towhead to Well XPN2C (HP-6) 66.43m (L) 2” (Dia)	Temporary	0.000070	0.000140
Removal	PL4145 Production Spool Well XPN2D (LP-5) to NDC Leading Towhead 46.97m (L) x 6” (Dia)	Temporary	0.000054	0.000108
Removal	PL4146 Gas Lift Spool NDC Leading Towhead to Well XPN2D (LP-5) 49.38m (L) x 2” (Dia)	Temporary	0.000052	0.000104
Removal	PL4148 Water Injection Spool NDC Leading Towhead to Well XWN2G (LI-1) 53.78m (L) x 6” (Dia)	Temporary	0.000062	0.000124
Removal	PL4150 Production Spool Well XPN2H (LP-4) to NDC Leading Towhead 41.79m (L) x 6” (Dia)	Temporary	0.000048	0.000096
Removal	PL4151 Gas Lift Spool NDC Leading Towhead to Well XPN2H (LP-4) 44.84m (L) x 2” (Dia)	Temporary	0.000047	0.000094
Removal	PL4153 Production Spool Well XPS2A (UP-2) to SDC Leading Towhead 38.82m (L) x 6” (Dia)	Temporary	0.000045	0.000089

Removal	PL4154 Gas Lift Spool SDC Leading Towhead to Well XPS2A (UP-2) 42.51m (L) x 2” (Dia)	Temporary	0.000045	0.000089
Removal	PL4512 Water Injection Spool SDC Leading Towhead to Well XWS2F (LI-2) 56.72m (L) x 6” (Dia)	Temporary	0.000065	0.000131
Removal	PLU4144 Jumper NDC Leading Towhead to Well XPN2C (HP-6) 92m (L) x 3” (Dia)	Temporary	0.000099	0.000198
Removal	PLU4147 Jumper NDC Leading Towhead to Well XPN2D (LP-5) 78m (L) x 3” (Dia)	Temporary	0.000084	0.000168
Removal	PLU4149 Jumper NDC Leading Towhead to Well XWN2G (LI-1) 92m (L) x 3” (Dia)	Temporary	0.000099	0.000198
Removal	PLU4152 Jumper NDC Leading Towhead to Well XPN2H (LP-4) 78m (L) x 3” (Dia)	Temporary	0.000084	0.000168
Removal	PLU4169 SDC Leading Towhead to Well XPS2A (UP-2) 78m (L) x 3” (Dia)	Temporary	0.000084	0.000168
Removal	PLU4511 Jumper SDC Leading Towhead to Well XWS2F (LI-2) 92m (L) x 3” (Dia)	Temporary	0.000099	0.000198
Removal	PL6140 Production Spool Well XPS2B (BP-7) to SDC Leading Towhead 62.14m (L) x 6” (Dia)	Temporary	0.000072	0.000143
Removal	PL6141 Gas Lift Spool SDC Leading Towhead to Well XPS2B (BP-7) 65.53m (L) x 1.2” (Dia)	Temporary	0.000068	0.000135
Removal	PL6139 PWR/SIG SDC Leading Towhead to Well XPS2B (BP-7) 67m (L) x 1.2” (Dia)	Temporary	0.000069	0.000138
Removal	PLU6142 HYD/CHEM SDC Leading Towhead to Well XPS2B (BP-7) 78m (L) x 1.2” (Dia)	Temporary	0.000080	0.000161
Removal	PL6143 ELEC SDC Leading Towhead to Well XPS2B (BP-7) 68m (L) x 1.2” (Dia)	Temporary	0.000070	0.000140
		Total (km^2)	**0.002596**	**0.005192**

Note: North bundle 6" Gas Lift Flexible Riser Flange to NRB Trailing Towhead and South Bundle 6" Gas Lift Flexible Riser Flange to SRB Trailing Towhead are control umbilicals and not associated spools, so the seabed disturbance impact does not need to be included in this table as they tied directly into the risers.

5.3.3.3 Stabilisation and Protection (Mattresses and Grout Bags)

Concrete mattresses and grout bags have previously been deployed across the Western Isles area to stabilise and protect the seabed infrastructure. The intention is that all concrete mattresses and grout bags will be recovered; this will cause temporary direct and indirect disturbance. There have been 77 concrete mattresses identified across the Western Isles area which will be removed where possible. The dimensions of the concrete mattresses (6 m by 3 m). A 1 m buffer, which considers allowance for any minor excavations associated with prepping the items to be recovered and deployment of any tooling etc., has been added to the length and width of the mattresses. This methodology has been used in the interest of adopting a conservative approach to calculating a worst-case possible impact for the removal of the Western Isles subsea structures. It is likely that mattresses are overlapping or have been used in conjunction with other forms of remediation, therefore the seabed footprint of these mattresses likely represents an overestimate.

There has also been 2,160 grout bags identified within the Western Isles area. Full inventory details are presented in Section 3.3. Grout bags are used in conjunction with different subsurface installations to provide protection or stability. As such, they are usually stacked or piled on top of one another or on top of other installations / mattresses. The exact location and layout of the bags is unknown. A maximum area of $1m^2$ of impact has been assumed for each individual grout bag.

The direct and indirect seabed disturbance areas associated with the stabilisation materials are summarised in Table 5-9. As previously, the indirect impact has been assumed to be double the direct impact area.

Table 5-9 Seabed disturbance associated with the decommissioning of stabilisation materials				
Activity	**Quantity and dimensions**	**Expected duration of disturbance**	**Direct disturbance area (km^2)**	**Indirect disturbance area (km^2)**
Removal of existing concrete mattresses	Estimated 77 concrete mattresses (6m (L) x 3m (W) x 0.15m (H))	Temporary	0.002156	0.004312
Removal of grout bags	Estimated 2,160 grout bags of 1 m^2	Temporary	0.002160	0.004320
		Total (km^2)	**0.004316**	**0.008632**

5.3.3.4 Pipelines Decommissioned *in situ*

Following the removal of the pipeline ends, the remaining sections of pipeline and bundles will be decommissioned *in situ*. The permanent direct area calculated in Table 5-10 represents the approximate footprint of seabed affected in perpetuity by decommissioning the pipelines and bundles to be decommissioned *in situ*.

The temporary direct disturbance has been calculated by applying a 3 m buffer corridor to the lengths of the bundles remaining *in situ* to allow for seabed disturbance during recovery of the bundle ballast chains which, in some instances, may first require minor excavations to facilitate recovery.

Indirect disturbance has been assumed to be twice that of the direct area. This accounts for the resuspension of sediment generated due to the direct disturbance, most of which will settle within the direct footprint.

Table 5-10 Area of seabed impact associated with the decommissioning *in situ* of pipelines and bundles				
Pipelines/Umbilical Left *in situ*	**Quantity and dimensions**	**Permanent footprint (km^2)**	**Temporary direct disturbance area (km^2)**	**Temporary indirect disturbance area (km^2)**
PL3186 Rigid Pipeline	11.244 km (L) x 15.24 cm (W)	0.001714	-	-
North Bundle	2.369 km (L) x 96 cm (W)	0.002275	0.009383	0.018766
South Bundle	2.424 km (L) x 96 cm (W)	0.002327	0.009597	0.019195
	Total (km^2)	**0.006315**	**0.018980**	**0.037961**

5.3.3.5 Remedial Rock Placement

An estimated 11,410 Te of rock, permanently covering an area of 0.0029 km^2, is thought to be required to cover the pipeline ends with an overtrawlable (1:3) profile to minimise any residual risk to

commercial fishers. Indirect disturbance, temporary in nature, has been assumed to be twice that of the direct area. This accounts for the resuspension of sediment generated due to the direct disturbance, most of which will settle within the direct footprint.

Table 5-11 Area of seabed footprint related to the requirement for remedial rock placement					
Pipeline	**Rock Location**	**Rock Dimensions**	**Quantity of rock (Te)**	**Permanent direct disturbance area (km^2)**	**Temporary indirect disturbance area (km^2)**
PL3186	Pipeline ends	10m (L) x 5m (W) x 2	210	0.000100	0.000200
North bundle	Pipeline ends	50m (L) x 14m (W) x 2	5,600	0.001400	0.002800
South bundle	Pipeline ends	50m (L) x 14m (W) x 2	5,600	0.001400	0.002800
		Total	**11,410**	**0.002900**	**0.005800**

5.3.4 Summary of Disturbance to the Seabed

The seabed disturbance from the decommissioning activities calculated throughout this section is summarised in Table 5-12. This illustrates a worst-case scenario for seabed disturbance, in which most of the temporary seabed impact is associated with the removal of existing stabilisation materials and most of the permanent seabed impact is associated with rock remediation over free pipeline ends on pipelines decommissioned *in situ*.

Table 5-12 Total potential seabed disturbance from the decommissioning activities			
Activity	**Permanent direct disturbance area (km^2)**	**Temporary direct disturbance area (km^2)**	**Temporary indirect disturbance area (km^2)**
Removal of structures	-	0.005673	0.011347
Removal of pipelines, jumpers, spools and pipeline ends	-	0.002596	0.005192
Removal of stabilisation material (mattresses, grout bags)	-	0.004316	0.008632
Remediation of pipeline ends	0.002900	-	0.005800
In situ decommissioning of pipelines and bundles	-	0.018980	0.037961
Total (km^2)	**0.002900**	**0.031566**	**0.068932**

5.3.5 Impacts on sensitive receptors

5.3.5.1 Direct Disturbance

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

The second type of direct disturbance will be permanent disturbance caused by the deposition of additional rock cover 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.

5.3.5.1.1 Permanent Direct Disturbance

Permanent direct disturbance will occur due to the application of remedial rock cover to cover the cut ends (see Table 5-11) as a consequence of the *in* situ decommissioning of the rigid pipeline PL3185, the North and South bundles (see Table 5-10). Approximately 0.0029 km^2 of seabed will be subject to permanent direct disturbance due to the introduction of rock protection material, as detailed in Section 5.3.3.5.

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 mobile sediments and 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 in the NNS. Rock remediation will be targeted and localised.

Impact of Pipelines Decommissioned *in situ*

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

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

- Pipeline scale
- Steel
- Sacrificial anodes
- Plastic coating

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

Metals

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

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

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

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

The pipelines to be decommissioned *in situ* cover an area of 0.0063 km^2. Degradation is unlikely to occur at a constant rate and across the entire length of the pipeline. Therefore, due to the highly localised nature of any degradation products and the low concentrations of contaminants being released over an elongated period it is highly unlikely that these products will be detectable above current background conditions.

Plastics

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

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

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

5.3.5.1.2 Temporary Direct Disturbance

As noted in Table 5-12, approximately 0.032 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. An otter trawler with a 12 m wide beam trawl trawling at its slowest rate of approximately 2.8 km/h would cover an area of roughly 0.03 km^2 per hour so would therefore take little over an hour to cover the anticipated temporary direct disturbance area (FAO, 2019).

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. Direct mortality of the limited mobility seabed organisms and direct loss of habitat would be expected.

The seabed type in the surveyed area around the FPSO and drill centres was silty shelly gravelly sand; the sediments were poorly sorted within the surveyed area, and under the Wentworth classification, they were classified as medium sand (Gardline, 2010a; 2013a). Spawn is usually deposited demersally, on marine vegetation or on a substrate with a high percentage of gravel and a low fine sediment component (Maravelias *et al.*, 2000). This habitat would therefore support the high intensity saithe, Norway pout and haddock spawning grounds and high intensity blue whiting nursery grounds which (Ellis *et al.*, 2012) 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, 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 (Corten, 1999) Therefore, the proposed activities are unlikely to have an impact on fish and shellfish species populations or their long-term survival.

5.3.5.2 Indirect Disturbance

Indirect disturbance (being twice the areas of both permanent and temporary direct disturbance) is projected to have an area of temporary impact of 0.069 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 silty shelly gravelly sand, 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 (Gubbay, 2003) with the degree of impact related to their ability to clear particles from their feeding and respiratory surfaces (Rogers, 1990). 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). Recovery of communities will be monitored and assessed by post-decommissioning surveys.

5.3.6 Management and mitigation

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

- All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised. In practical terms this means that dynamically positioned vessels will be used to undertake the decommissioning operations, any excavation will only be undertaken where necessary to facilitate cutting / recovery of items and that recovery basket deployment will be minimised;
- A debris survey will be undertaken at the completion of the decommissioning activities. Any debris identified as resulting from oil and gas activities will be recovered from the seabed where possible; and
- Rock cover will be applied by a fall pipe vessel equipped with an underwater camera to ensure accurate placement and reduce unnecessary spreading of the footprint while ensuring the minimum safe quantity is used.

5.3.7 Cumulative Assessment

The decommissioning activities taking place within the Western Isles area are likely to be occurring concurrently with the decommissioning of the Tern area which is located 12 km northeast. Most of the remaining seven surrounding oil and gas assets within 50 km of the Western Isles Area will be subject to decommissioning in the coming years. The anticipated seabed footprint of these activities cannot be known at present. However, given that the total area of seabed disturbance, permanent and temporary, of these proposed operations amounts to less than 0.0013% of the 7,854 km^2 of seabed available within that radius, it is reasonable to presume that it is not of significant magnitude to have any discernible contribution to cumulative impacts in the broader context. Therefore, cumulative impacts to the seabed caused by these decommissioning activities are considered to be negligible.

The Western Isles pipelines are located approximately 58 km from the UK/Norway median line (closest point). Given this distance, and the area of indirect temporary disturbance being 0.069 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 highly unlikely.

5.3.8 Residual Impact

Decommissioning of the Western Isles infrastructure will cause physical disturbance to the local seabed environment. Activities will result in an expected area of permanent direct disturbance equalling 0.003 km^2 and a temporary direct disturbance equalling 0.032 km^2. When accounting for temporary indirect disturbance, which arises secondarily due to sediment suspension and resettlement, the total area of impact is approximately 0.103 km^2.

An evaluation of threats and impacts to silty sand and slightly mixed sediment suggested that the threat from infrastructure installation offshore is low. 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 activities and 'recolonise' it in the future. Although substratum loss may cause a decline in species diversity and quantity within the 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 pipelines to be decommissioned *in situ* cover an area of 0.0063 km^2. Degradation is unlikely to occur at a constant rate and across the entire length of the pipeline. Therefore, due to the highly localised nature of any degradation products and the low concentrations of contaminants being released over an elongated period it is highly unlikely that these products will be detectable above current background conditions.

The addition of rock is also unlikely to disturb the natural physical processes of the area. While the addition of 0.0029 km^2 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.

The seabed disturbance resulting from the proposed Western Isles subsea decommissioning activities has the potential to cause a direct loss of habitat, mortality to of sessile organisms and a change in the natural physical processes of the area. Initial assessment of this aspect within the ENVID (Appendix C) yielded; 'Minor' Severity (spatial extent) and 'Very Unlikely' Likelihood producing an overall 'Medium' impact risk. However, taking into consideration the benthic environment, seabed characteristics, commercial fishing, relatively small size of disturbance area and along with industry and Dana mitigation measures, the severity can be reduced to 'Minimal' the overall assessment can therefore be reduced to 'Low'. Overall, due to the improbability of such a snagging event occurring, the impact is considered not significant.

5.4 Impacts on Other Sea Users

5.4.1 Introduction

The proposed Western Isles decommissioning activities have the potential to impact upon other users of the sea, namely commercial fisheries. This may happen during the decommissioning activities themselves of after, should any infrastructure decommissioned *in situ* interact with fishing gear. Sea users, other than commercial fisheries, are unlikely to be affected by the proposed decommissioning.

In this instance, PL3186, North bundle and South bundle are proposed to be decommissioned *in situ* and the remaining infrastructure will be removed, with a clear seabed to be confirmed following removal activities. This is anticipated to be the only potential impact to fisheries as a result of the decommissioning activities and is assessed throughout the rest of this Section.

5.4.2 Description and quantification of impacts

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

Demersal fishing gears which interact with the seabed are most vulnerable to snagging. Snagging may lead to loss or damage of catch or fishing gear and may result in vessel destabilisation in extreme circumstances. Generally, the patterns in interactions between oil and gas infrastructure and fishing gear are most prevalent in the NNS where demersal fishing effort is relatively high (Rouse, Hayes and Wilding, 2018).

5.4.3 Impacts on sensitive receptors

As previously detailed within Section 4.5.1, annual fishing effort in the Western Isles Area (ICES rectangles 51F0) is generally targeted primarily for demersal species. ICES 51F0 is deemed to be of low contribution to the total UK landings values and weights. Trawls are the most utilised gear in ICES rectangles 51F0, although seine nets, hooks and lines were also operated across all years. Fishing intensity along the PL3186 pipeline is also low. As indicated by the density of AIS lines in the vicinity of the pipeline, it is most likely that this time can be attributed to fishing vessels passing in transit.

Currently, no FishSAFE reportable free spans or exposures have been observed along either PL3186, North bundle or South bundle. Clear seabed verification will ensure there is no residual risk to other sea users. The proposed method for clear seabed validation is through non-intrusive methodologies such as Sidescan Sonar (SSS) and Multi-Beam Echosounder (MBES). If non-intrusive methods are deemed inconclusive during verification, alternative methods will be discussed and agreed with OPRED and fishing bodies.

The seabed within the surrounding area is relatively stable, which further reduces the risk of exposure over time. Any potential changes in burial status of the pipelines resulting in legacy impacts to commercial fisheries due to degradation over time will be managed through continued monitoring and communication with relevant users of the sea, as detailed in Section 5.4.5.

The average weekly density of vessels (all combined) using AIS data between 2012 and 2017 is variable across the Western Isles Area, ranging from 0 – 150 transits per 2 km^2. There are two regions of increased vessel density, the Western Isles FPSO and the Tern platform. This increase in vessel activity can be attributed to the presence of operational and maintenance vessels around these surface installations, with lower vessel movement around the Western Isles pipelines (Figure 4-6 and Figure 4-7).

Overall, the region experiences both low fishing activity and effort. Some snagging risks will arise in at the pipeline ends where rock remediation is required and at any clay berms which result from infrastructure being removed. All pipelines' ends will be remediated by rock cover. Further, all rock cover will be designed with an overtrawlable (1:3) profile to minimise any residual risk to commercial fishers. Considering this, and the low fishing effort observed within the Western Isles Area and the remediation strategies to be put in place, the snagging risks associated with the decommissioning of the pipelines *in situ* is considered minimal.

5.4.4 Cumulative and transboundary impacts

The Western Isles infrastructure is located approximately 58 km from the UK/Norway border. The most recent AIS vessel track data shows the density of vessels in 2017 was generally low across the pipelines. In the wake of the decommissioning activities, all potential snagging risks will be remediated, and the seabed will be left in a safe overtrawlable condition, so no impacts to any UK or foreign fishing fleets are expected to result from the proposed activities.

There is the potential for cumulative impacts to occur with other activities occurring nearby which could also interfere with commercial fishing activity. The decommissioning activities taking place are likely to be occurring concurrently with the decommissioning of the Tern platform and may be occurring concurrently with the decommissioning of the Tern subsea infrastructure. Most of the surrounding NNS oil and gas assets will be subject to decommissioning in the coming years, however the anticipated schedule for activities is currently unknown.

It is expected that adequate mitigations will be in place at these Fields to minimise snagging risk as far as possible. In addition, snagging risk or interference with commercial fisheries may arise due the decommissioning of wells within the Western Isles and the removal of other infrastructure, however, these will be remediated prior to the removal of any 500 m safety exclusion zones. Overall, considering the low potential for snagging risk within the project area and the fact that any rock placement will be overtrawlable, no cumulative impacts are expected to arise.

5.4.5 Management and mitigation

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

- The Western Isles pipelines are currently shown on Admiralty Charts, the FishSAFE system and the OGA Infrastructure data systems (OGA Open Data). Once decommissioning activities are complete, updated information (i.e., which infrastructure remains *in situ* and which has been removed) will be made available to allow Admiralty charts and the FishSAFE system to be updated;
- Any exposures or cut pipeline ends will be rock covered to ensure they are overtrawlable by fishing vessels;
- Any objects dropped during decommissioning activities will be removed from the seabed where appropriate;
- Dana will monitor the seabed to assess any seabed depressions or clay berms which may present a snag risk. The survey results will be used in discussion with OPRED prior to the commencement of any intervention;
- Clear seabed verification will ensure there is no residual risk to other sea users. The proposed method for clear seabed validation is through non-intrusive methodologies such as Sidescan Sonar (SSS) and Multi-Beam Echosounder (MBES). If non-intrusive methods are deemed inconclusive during verification, alternative methods will be discussed and agreed with OPRED.
- Ongoing consultation with fisheries representatives; and
- Dana recognises its obligation to monitor any infrastructure decommissioned *in situ* and therefore intends to set up arrangements to undertake post-decommissioning monitoring. The frequency of the monitoring that will be required will be agreed with OPRED and future monitoring will be determined through a risk-based approach established from the findings of each survey in turn. During the period over which monitoring is required, the burial status of the infrastructure decommissioned *in situ* would be reviewed and any necessary remedial action undertaken to ensure it does not pose a risk to other sea users.

5.4.6 Residual impacts

While the impact magnitude may be considered major owing to the potential severity of a snagging events, the likelihood of such an event is relatively unlikely.

Of the pipelines being decommissioned *in situ*, PL3186 is trenched and buried to a suitable depth with no FishSAFE reportable spans or exposures, as can be seen in Appendix E. The North and South bundles are surface laid with no FishSAFE reportable spans or exposures. Should this be found to have changed after the post-decommissioning survey, Dana will engage with OPRED.

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*. Initial assessment of this aspect within the ENVID (Appendix C) yielded; a severity of 'Catastrophic' owing to the potential severity of a snagging event, the likelihood of such an event was deemed

‘Unlikely’ therefore overall, the risk is considered ‘Medium’. These impacts will be restricted to commercial fisheries that make active contact with the seabed, such as bottom trawls and dredging gears. Commercial fisheries as a receptor are considered to be of low sensitivity as the industry is able to accommodate change. The vulnerability of the receptor is also considered low as the presence of the pipelines are not likely to influence fishing activity in the area beyond current natural variation. The value of commercial fisheries is also considered low when comparing the financial value and contribution of the catch within the wider regional context. The re-opening of the 500m safety zones around the Western Isles infrastructure will also expand the available fishing grounds. Foreign fleets are also not considered to be highly dependent on the area, based on recent AIS data. Due to the small area of remaining infrastructure and the commitment to overtrawlability and future monitoring, the likelihood of a snagging event was reduced to ‘Very Unlikely’ therefore overall, the risk is still considered ‘Medium’.

Dana will carefully manage Impacts and minimise risk to commercial fisheries through clear communication (ongoing consultation with fisheries bodies, Admiralty Charts, FishSAFE and via OGA Open Data), removal of any snagging risk (overtrawlable rock berms, clear seabed verification) and ongoing monitoring and remedial action if required).

6 CONCLUSIONS

The Western Isles infrastructure within the scope of this EA includes subsea structures and protection materials (towheads, WHPS, protection and mooring piles and chains) and pipelines (bundles and rigid pipeline). The subsea installations, where practicable, will be completely removed for reuse or recycling or final disposal on land in line with the Guidance (BEIS, 2018). Pipelines have been considered on a case-by-case basis through the CA process, which looked at a number of full removal, partial removal and decommission *in situ* options.

All decommissioning activities and potential impact were considered and assessed alongside an environmental baseline for the project area, using established EIA assessment methods (Appendix A).

The project area is located well offshore in the NNS remote from coastal sensitivities and from any designated sites. Therefore, no significant impact to any protected sites is expected. The marine environment 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 stakeholder concerns, it was determined that three out of the nine potential impacts required further assessment. The aspects scoped in for further assessment were:

- Atmospheric Emissions;
- Disturbance to the seabed; and
- Impacts on other sea users.

The overall assessment for **Atmospheric emissions** was of 'Low' significance. However further investigation was deemed necessary due to increasing scientific, public and stakeholder concern regarding the impacts of anthropogenic climate change on the environment and the potential contribution of greenhouse gas emissions to global warming. Emissions during decommissioning activities, (largely comprising fuel combustion gases) will occur following cessation of production (CoP). Emissions generated by equipment and vessels and those associated with production from the fields will be replaced by those from vessel use as well as the recycling of decommissioned materials and the emissions relating to new manufacture of materials for replacement of items decommissioned *in situ*. The estimated CO_2 emissions to be generated by the subsea decommissioning activities are estimated to be 28.81 $ktCO_2e$, which represent 0.19% of the 14.63 $MtCO_2e$ generated offshore on the UKCS in 2018 (OEUK, 2019). Mitigation to reduce and manage emissions will include careful planning of the offshore vessel programme, vessel speeds and fuel type (i.e., low sulphur), all of which will be subject of a SEEMP. Overall, when considering the spatial and temporal scale of the disturbance, and accounting for the following mitigation measures, the impact of the emissions associated with subsea decommissioning activities was considered not significant.

The **seabed disturbance** resulting from the proposed Western Isles subsea decommissioning activities has the potential to cause a direct loss of habitat, mortality to of sessile organisms and a change in the natural physical processes of the area. Initial assessment of this aspect within the ENVID (Appendix C) yielded; 'Minor' Severity (spatial extent) and 'Very Likely' Likelihood producing an overall 'Medium' impact risk. However, taking into consideration the benthic environment, seabed characteristics, commercial fishing, relatively small size of disturbance area and along with industry and Dana mitigation measures, the severity can be reduced to 'Minimal' and the overall assessment can be reduced to 'Low'. Overall, due to the improbability of such a snagging event occurring, the impact is considered not significant.

The potential **impacts on other sea users** were limited to possible legacy impacts such as the snagging of fishing gears due to the physical presence of infrastructure decommissioned *in situ*. Initial assessment of this aspect within the ENVID (Appendix C) yielded; a severity of 'Catastrophic' owing to the potential severity of a snagging event, the likelihood of such an event was deemed 'Unlikely' therefore overall, the risk is considered 'Medium'. These impacts will be restricted to commercial fisheries that make active contact with the seabed, such as bottom trawls and dredging gears. Commercial fisheries as a receptor are of low sensitivity as the industry is able to accommodate change. The vulnerability of the receptor is also considered low as the presence of the pipelines are not likely to influence fishing activity in the area beyond current natural variation. The value of commercial fisheries is also considered low when comparing the financial value and contribution of the catch within the wider regional context. The re-opening of the 500m safety zones around the Western Isles infrastructure will also expand the available fishing grounds. Foreign fleets are also not considered to be highly dependent on the area, based on recent AIS data.

Due to the small area of remaining infrastructure and the commitment to overtrawlability and future monitoring, the likelihood of a snagging event was reduced to 'Very Unlikely' therefore overall, the risk is still considered 'Medium'. Dana will carefully manage Impacts and minimise risk to commercial fisheries through clear communication (ongoing consultation with fisheries bodies, Admiralty Charts, FishSAFE and via OGA Open Data), removal of any snagging risk (overtrawlable rock berms, clear seabed verification) and ongoing monitoring and remedial action if required).

This EA has considered the Scottish NMP, adopted by the Scottish Government to help ensure sustainable development of the marine area. Dana 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 Dana's HSE Policy and principles, it is considered that the proposed Western Isles subsea infrastructure decommissioning activities do not pose any significant threat to environmental or societal receptors within the UK.

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APPENDIX A METHOD

A.1 Impact Identification

An EA in support of a Decommissioning Programme should be focused on the key issues related to the specific activities proposed; the impact assessment write-up should be proportionate to the scale of the project and to the environmental sensitivities of the project area. This does not mean, however, that the impact assessment process should be any less robust than for a statutory EIA or consider any fewer impact mechanisms. An environmental impact identification (ENVID) exercise (Appendix D: ENVID) was undertaken early in the EA process. This exercise identified the key environmental sensitivities, discussed the sources of potential impact and identified those aspects which required further assessment and those which could be scoped out. The decision on which issues required further assessment was based on:

- Specific proposed activities and sensitive environmental receptors;
- A review of industry experience of decommissioning impact assessment; and
- An assessment of wider stakeholder interest

A.2 Environmental Significance

For the potential sources of impact that were assessed in this EA, it is important that a conclusion is reached regarding whether the impact is likely to result in a substantive change to environmental and societal conditions. During EA, there are many ways this can be done; a common approach is to define 'significance', and this approach is taken here. However, it is equally appropriate to employ some other method; the key is that the methods used for identifying and assessing significance are transparent and verifiable.

In this risk analysis we use words to describe the severity of the potential consequences and likelihood of an undesirable event occurring. The risk level is then also expressed with words such as High, Medium, Low and Low Low. This is known as Qualitive analysis and is generally used in high level preliminary risk assessment processes, Operational risk assessments and workplace risk assessments such as Job Safety Analysis and hazard spotting.

For each consequence identified the team should review and choose the severity which best represents the seriousness of the consequence(s) should an incident/failure occur (Minimal, Minor, Significant, Major or Catastrophic). The description of the consequence chosen must represent the severest category agreed on by the team. For example, if the Environment severity is slight is Major, then Major is the overall severity rating that should be used.

Once the team has agreed on a severity and consequence, it should then determine how likely it is for consequence to occur. The likelihood of the risk hazard being realised is categorised by reviewing and

choosing a descriptor from the table. The choice is based on the information available to the team and based on the team's knowledge and experience of the environment in which the task will take place.

A.3 Severity Determination Method

		Consequence			
		People	Environment	Asset/Loss	Reputation
Severity	1: Minimal	First aid treatment. Minor health issue. Slight pain.	Tier 1: situation where the spill volume will not exceed 1m^3.	Slight damage. No significant consequence on production. Loss of less than $100k.	No consequence to local community. No interest external to the company.
	2: Minor	Medical treatment injury. Health issue requiring physiotherapy or counselling. Moderate pain. Restricted Work Case (RWC).	Tier 2 or Tier 3 situation where the spill volume is typically between 1 and 100m^3.	Minor damage to equipment. Minor consequence on production. Loss of between $100k and $1m.	Minor consequence to area immediate to the facility.
	3: Significant	Lost time injury. Health issue requiring time off work. Significant pain.	Tier 2 or Tier 3 situation where the spilled volume will exceed 100m^3.	Localised damage to equipment. Consequence on part of operations. Loss of between $1m and $10m.	Considerable consequences to local community. Local coverage.
	4: Major	Permanent disability. Significant long term health effects.	Tier 2 or Tier 3 situation where the spilled volume will exceed 100m^3 for a period not longer than 1 week.	Major damage to equipment. Short term production delay. Loss of between $10m and $100m.	Consequence would receive industry and national/regional coverage.
	5: Catastrophic	Fatality. Terminal ill health.	Tier 2 or Tier 3 situation where the spilled volume will 100m^3 for a period longer then 1 week.	Extensive damage. Long term consequences on operations. Loss in excess of $100m.	Consequence would receive global attention.

1: Minimal	- Effects unlikely to be discernible or measurable. - No contribution to transboundary or cumulative impacts.
2: Minor	- Minor environmental damage, but no lasting effects. - Change in habitats or species which can be seen and measured but is at same scale as natural variability. - Unlikely to contribute to transboundary or cumulative effects. - Short-term or localised decrease in the availability or quality of a resource, likely to be noticed by users.
3: Significant	- Environmental damage that will persist or require cleaning up. - Widespread change in habitats or species beyond natural variability. - Observed off-site effects or damage e.g. fish kill or damaged vegetation. - Decrease in short-term (1-2 years) availability or quality of a resource effecting usage. - Local or regional stakeholders' concerns leading to complaints. - Minor transboundary and cumulative effects.
4: Major	- Severe environmental damage that will require extensive measures to restore beneficial uses of environment. - Widespread degradation to the quality of habitats and / or wildlife requiring significant long-term restoration effort. - Major oi spill over wide area leading to campaigns and major stakeholders' concerns. - Transboundary effects or major contribution to cumulative effects. - Mid-term (2-5 years) decrease in the availability or quality of a resource affecting usage. - National stakeholders' concern leading to campaigns affecting Company's reputation.
5: Catastrophic	- Persistent severe environmental damage leading to loss of use or loss of natural resources over wide area. - Widespread long-term degradation to the quality or availability of habitats that cannot easily be rectified. - Major impact on the conservation objectives of internationally / nationally protected sites. - Major transboundary or cumulative effects. - Long-term (>5 year) decrease in the availability or quality of a resource affecting usage. - International public concern.

A.4 Likelihood Determination Method

A: Very Unlikely	B: Unlikely	C: Possible	D: Likely	E: Very Likely
The circumstances under which and event may occur, are special and very rare in the business and operations, maybe not even heard of and therefore cannot be predicted.	The circumstances under which an event could occur are not part of our normal business and operations.	The circumstances, under which an event could occur, are part of the normal business and operations or at least occur at regular intervals.	The circumstance under which an event could occur are part of the normal business and operations.	The circumstances under which an event could occur are part of the normal business and operations.
Industry standard practices and safeguards should be sufficient to prevent an event from occurring.	The control measures that would need to fail are commonly recognised as effective control measures.	The control measures that would need to fail are commonly recognised as effective control measures but may not always meet sight and emerging changes in circumstances.	The control measures/barriers that could fail are recognised as weak points and instances are known of where they failed before.	This event will occur if existing measures/barriers are not properly implements or identified.

A.5 Risk Determination Method

	Likelihood					
0: No Effect	LL	LL	LL	LL	LL	Severity
1: Minimal	LL	LL	L	L	L	
2: Minor	LL	L	L	M	M	
3: Significant	L	L	M	M	H	
4: Major	L	M	M	H	H	
5: Catastrophic	M	M	H	H	H	
	A: Very Unlikely	B: Unlikely	C: Possible	D: Likely	E: Very Likely	

Low Low (LL): Tolerable Risk	Low (L): Tolerable Risk	Medium (M): Manageable Risk	High (H): Intolerable Risk
Risk Management is effective, however there is a small potential for hazards to realise harm and care should be maintained when proceeding with the activity.	Risk Management is effective; however moderate risk levels remain, and caution is required when proceeding with activity. Control measures should be reviewed to ensure risk level is at ALARP.	Risk Management is effective; however, significant risk levels remain, and a high level of alert is required to be monitored throughout activity. Control measures should be reviewed to ensure risk level is at ALARP condition.	Risk Management is insufficient and Intolerable risk levels exist. Therefore, the activity cannot be permitted to proceed. Alternatives should be sought, in activity and controls.

APPENDIX B HSE POLICY

Health, Safety, Security & Environment (HSSE) Policy

Our policy

The safety of our people and assets, and respect for the environment are two of our core values and are an integral part of how we do business. We believe strong Health, Safety, Security and Environmental (HSSE) performance creates strong commercial performance.

Accountability

The Chief Executive Officer (CEO) has overall accountability to the Dana Board of Directors for the management of HSSE.

Scope

Our policy applies to all employees (staff, contract and temporary), officers and directors of Dana Petroleum Limited (collectively referred to as 'employees') in each of our operating units worldwide and anywhere that we conduct business or visit in the course of our business. It also extends to all our joint ventures business, in all countries in which we or our subsidiaries and associates operate. Where we have a minority interest we will encourage the application of this policy amongst our business partners including contractors, suppliers and joint venture partners.

Policy in practice

Dana strives to continually improve its HSSE performance by setting and monitoring clear objectives, supported by its HSSE Standards. This requires the commitment of everyone at Dana and a culture where people are encouraged and feel able to intervene and report on HSSE issues of concern. It is expected that each individual will recognise their responsibility to put our policy into practice.

We will:

- Provide a safe working environment that protects against injury and minimises work-related ill health
- Provide appropriate security protection for employees and assets
- Commit to protect the environment, and so minimise the impact of Dana's operations
- Ensure compliance with applicable legislation and apply Dana's standards and oil industry best practice in locations where local laws do not exist
- Identify and manage HSSE risks in a systematic way as part of Dana's risk management framework
- Create clear accountabilities and expectations for HSSE at every level of the organisation
- Provide resources to successfully manage HSSE risk
- Identify and manage any form of change in our organisation
- Ensure that our employees and contractors are competent and able to perform the work we are asking them to undertake
- Ensure that our employees and contractors understand their HSSE accountabilities and are aware of the behaviours expected by Dana
- Identify and manage operational interfaces internally and with third parties
- Communicate standards based on oil industry best practice which are consistent with legal and regulatory requirements in all operating areas
- Communicate and report openly on HSSE objectives and performance
- Actively engage with relevant stakeholders to understand and take account of their concerns
- Make sure that appropriate emergency response, crisis management and business continuity plans are in place and are regularly tested
- Investigate HSSE incidents, identify root causes, take effective action to prevent recurrence and identify opportunities for organisational learning
- Strive for continuous improvement of Dana's HSSE performance

Jongwoo Kim
Chief Executive Officer

2020

APPENDIX C ENVID

Environmental Impact Review					Controls, Mitigations, Review and Ranking								Identified Actions		
						Initial Ranking				Residual Ranking					
Operational Phase	Project Element	Aspect / Operation	Activity	Summary of Potential Environmental Impacts	Existing Controls (Standards, Legislative, or Prescriptive)	Severity	Likelihood	Risk Category	Dana / Project-Specific Controls and Mitigation	Severity	Likelihood	Risk Category	Screened In / Screened Out	Comment	Action
General	Vessels	Physical presence	Hazard to Navigation	Disturbance to other users of the sea (e.g., fisheries and other maritime users); disturbance to marine species	- Safety zones (where / when applicable and being mindful that arrangements will change at certain stages of the project) - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings - Use of Automatic Identification Systems (AIS) and other navigational controls	1	B	L	- Dana Stakeholder Engagement Management Plan / Process	1	B	L	Out	Additional control does not reduce Residual Ranking but affords the relevant stakeholders the opportunity to engage in consultation.	- Develop Stakeholder Engagement Plan (Dana)
			Discharges to sea	Vessel discharge of grey water, bilge water, etc.	- Treatment and maceration to IMO standards - Bilge management procedures - Good operating practices - Vessel equipment maintained according to manufacturer's recommendations	1	B	L	- Dana Vessel Assurance process / procedure	1	B	L	Out	Additional control does not reduce Residual Ranking but demonstrates due diligence and assurance that Existing Controls are appropriately implemented.	
			Noise	Underwater noise (engines and operations) - behavioural modifications to marine mammals and potentially fish.	- Vessel noise unlikely to be far above ambient noise levels. - No use of explosives.	1	E	L		1	E	L	Out		
		Power generation	Fuel use / emissions	- Impact on climate change / consumption of finite resource -Gaseous emissions to atmosphere cause increased degradation of local / regional air quality (NOx and particulates) - Transboundary air pollution - Contributing to global warming (CO_2)	- Minimal number of vessels deployed - Use of low sulphur diesel - Vessel equipment maintained according to manufacturer's recommendations	1	E	L	- Dana Vessel Assurance process / procedure - Third Party Contractor Assurance process / procedure - Dana-commissioned Energy and Emissions Report	1	E	L	In	Additional controls do not reduce Residual Ranking but demonstrate due diligence and assurance that Existing Controls are appropriately implemented.	- Produce Energy and Emissions Report (Xodus)
	Waste	Waste management	Onshore	- Use of landfill - Radioactive waste / NORM	- Use of appropriately authorised waste management contractor(s) and facilities - Compliance with Waste Hierarchy.	1	D	L	- Detailed inventories (including IHM) - Active Waste Management Plan - Compliance with Western Isles Decommissioning Waste Management Plan - Project Waste Management Targets - SCAP	1	D	L	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled.	- Develop / Commission inventories (Dana) - Commission IHM (Dana) - Produce AWMP / WMP (Dana) - Develop Waste Management Targets (Dana) - Develop SCAP (Dana)
	FPSO	Physical presence	Nesting Seabird Habitat Disturbance	- Disturbance of nesting seabirds on installation as per the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (which transpose the EU Wild Birds Directive).	- Adherence with "Undertaking of Seabird Survey Methods for Offshores Installations: Black-legged kittwakes", JNCC (2021)	2	B	L	- No history of nesting seabirds on the installation - Implementation of a Nesting Seabird Monitoring Plan in the lead up to execution phase	2	B	L	Out	Additional controls do not reduce Residual Ranking but demonstrate due diligence and assurance that Existing Controls are appropriately implemented.	- Development of Nesting Seabird Monitoring Plan (Dana)

Environmental Impact Review					Controls, Mitigations, Review and Ranking								Identified Actions		
						Initial Ranking				Residual Ranking					
Operational Phase	Project Element	Aspect / Operation	Activity	Summary of Potential Environmental Impacts	Existing Controls (Standards, Legislative, or Prescriptive)	Severity	Likelihood	Risk Category	Dana / Project-Specific Controls and Mitigation	Severity	Likelihood	Risk Category	Screened In / Screened Out	Comment	Action
Preparation	FPSO	COTs (Group 1)	Discharge of contents	- Chemical / residual oil discharge to sea - organic enrichment and chemical contaminant effects in water column and seabed sediments. Planktonic organisms most vulnerable - Potential NORM impacts	- Appropriate Risk Assessment through the MATs / SATs (OCR) system	3	C	M	- Flushing and cleaning of COTs followed by three clean line volumes - Selection of flushing chemicals with lesser potential for environmental impact - Bullhead contents of COTs into reservoir via disposal well / transfer of crude oil to shuttle tanker for onshore management / remaining slops brought ashore with FPSO. - Compliance with Western Isles Decommissioning Waste Management Plan	1	A	LL	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled..	
		Dynamic Flexible Risers (Group 4) / Dynamic Umbilicals (Group 5)	Discharge of contents	- Chemical / residual oil discharge to sea - organic enrichment and chemical contaminant effects in water column and seabed sediments. Planktonic organisms most vulnerable - Potential NORM impacts	- Appropriate Risk Assessment through the MATs / SATs (OCR) system	2	C	M	- Flushing and cleaning of subsea system - Selection of flushing chemicals with lesser potential for environmental impact - Send flushing chemicals back to FPSO then bullhead contents of COTs into reservoir via disposal well / transfer to shore with FPSO for onshore management	1	A	LL	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled - discharge will still happen but with reduced severity.	
	Subsea Installations	WHPS (Gp. 10), Bundle Toweads (Gp. 10), Mid-Water Arches (Gp. 6), Mooring Lines (Gp. 2) and Anchor Piles (Gp.12)	Discharge of contents (Group 10)	- Chemical / residual oil discharge to sea - organic enrichment and chemical contaminant effects in water column and seabed sediments. Planktonic organisms most vulnerable - Potential NORM impacts	- Appropriate Risk Assessment through the MATs / SATs (OCR) system - Compliance with RSA authorisation	2	C	M	- Flushing and cleaning of subsea system - Selection of flushing chemicals with lesser potential for environmental impact - Send flushing chemicals back to FPSO then bullhead contents of COTs into reservoir via disposal well / transfer to shore with FPSO for onshore management	1	E	L	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled - discharge will still happen but with reduced severity.	
			Marine growth removal (Groups 2, 6 & 10)	Use of landfill (in the case of hard marine growth)	- Use of appropriately authorised waste management contractor(s) and facilities - Special consideration must be given if *Desmophyllum pertusum* (*Lophelia pertusa*) is likely to be brought ashore and / or exported. - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	1	C	L	- Offshore removal of Marine Growth with seabed deposition authorised under Marine Licence - Compliance with Western Isles Decommissioning Waste Management Plan	1	C	L	Out	Offshore remediation is the best way of managing marine growth waste. CITES considerations if *Desmophyllum pertusum* (*Lophelia pertusa*) is being shipped / exported.	- Develop AWMP / WMP (Dana)
	Pipelines, Flowlines & Umbilicals (Bundles, Rigid Pipelines, Spools & Jumpers)	Bundles (Group 6), Rigid Pipelines (Group 7), Spools (Group 8) and Jumpers (Group 9)	Discharge of contents	- Chemical / residual oil discharge to sea - organic enrichment and chemical contaminant effects in water column and seabed sediments. Planktonic organisms most vulnerable - Potential NORM impacts	- Appropriate Risk Assessment through the MATs / SATs (OCR) system	2	C	M	- Flushing and cleaning of COTs followed by three clean line volumes - Selection of flushing chemicals with lesser potential for environmental impact - Bullhead contents of COTs into reservoir via disposal well / transfer of crude oil to shuttle tanker for onshore management / remaining slops brought ashore with FPSO. - Compliance with Western Isles Decommissioning Waste Management Plan	1	A	LL	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled..	

Environmental Impact Review					Controls, Mitigations, Review and Ranking								Identified Actions		
						Initial Ranking				Residual Ranking					
Operational Phase	Project Element	Aspect / Operation	Activity	Summary of Potential Environmental Impacts	Existing Controls (Standards, Legislative, or Prescriptive)	Severity	Likelihood	Risk Category	Dana / Project-Specific Controls and Mitigation	Severity	Likelihood	Risk Category	Screened In / Screened Out	Comment	Action
Execution	FPSO	Mooring Lines (Group 2)	Cut and Recovery	- Fuel use / atmospheric emissions - Onshore waste management	- Minimal number of vessels deployed - Use of low-sulphur diesel - Vessel & equipment maintained according to manufacturer's recommendations - Use of appropriately authorised waste management contractor(s) and facilities	1	E	L	- Compliance with Dana Vessel and Waste Management Contractor Assurance processes / procedure - Compliance with Waste Hierarchy - Compliance with Western Isles Decommissioning Waste Management Plan - Investigate redeployment / re-use opportunities	1	E	L	Out	Additional controls do not reduce Residual Ranking but demonstrate due diligence / assurance that Existing Controls are appropriately implemented and ensure that associated waste is appropriately managed at all stages of the process.	- Develop AWMP / WMP (Dana) - Consider Waste Management audit / assurance activities (Dana)
		Dynamic Flexible Risers (Group 4) / Dynamic Umbilicals (Group 5)	Disconnect and Recovery	- Fuel use / atmospheric emissions - Onshore waste management - Use of landfill - Discharge of residual contents	- Minimal number of vessels deployed - Use of low-sulphur diesel - Vessel & equipment maintained according to manufacturer's recommendations - Use of appropriately authorised waste management contractor(s) and facilities	1	E	L	- Compliance with Dana Vessel and Waste Management Contractor Assurance processes / procedure - Compliance with Waste Hierarchy - Compliance with Western Isles Decommissioning Waste Management Plan - Investigate redeployment / re-use opportunities	1	E	L	Out	Additional controls do not reduce Residual Ranking but demonstrate due diligence / assurance that Existing Controls are appropriately implemented and ensure that associated waste is appropriately managed at all stages of the process.	- Develop AWMP / WMP (Dana) - Consider Waste Management audit / assurance activities (Dana)
		FPSO (Group 1)	Sail away	- Fuel use / atmospheric emissions - Disturbance to other users of the sea (e.g. fisheries and other maritime users)	- Minimal number of vessels deployed - Use of low sulphur diesel - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings - Use of Automatic Identification Systems (AIS) and other navigational controls	1	E	L	- Compliance with Dana Vessel Assurance processes / procedure - Compliance with Dana Stakeholder Engagement Management Plan - Dana-commissioned Energy and Emissions Report	1	E	L	Out	Additional controls do not reduce Residual Ranking but demonstrate due diligence / assurance that Existing Controls are appropriately implemented , ensure that relevant stakeholders are kept informed and that due consideration has been given to atmospheric emissions.	- Develop Stakeholder Engagement Plan (Dana) - Produce Energy and Emissions Report (Xodus)
	Subsea Installations (WHPS, Bundle Towheads, Mid-Water Arches and Anchor Piles)	Full removal	Cutting (Group 10)	- 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.	- Noise associated with this activity will be temporary and generated very close to the seabed, where absorption rates are highest.	1	E	L		1	E	L	Out		
				- Chemical / residual oil discharge to sea - organic enrichment and chemical contaminant effects in water column and seabed sediments. Planktonic organisms most vulnerable	- Treated water discharged to sea after cleaning. - Appropriate Risk Assessment through the MATs / SATs (OCR) system	2	E	M	- Flushing and cleaning of subsea system - Selection of flushing chemicals with lesser potential for environmental impact	1	E	L	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled - discharge will still happen but with reduced severity.	
				- Seabed disturbance - localised physical seabed disturbance resulting in community change. - Displacement of ballast (grout) within towheads - Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion - Smothering of organisms following settlement of resuspended particles.	- Use of DP vessels - no requirement for anchor deployment - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M	- Minimise excavation as far as practicable	2	E	M	In		

Environmental Impact Review					Controls, Mitigations, Review and Ranking								Identified Actions		
						Initial Ranking				Residual Ranking					
Operational Phase	Project Element	Aspect / Operation	Activity	Summary of Potential Environmental Impacts	Existing Controls (Standards, Legislative, or Prescriptive)	Severity	Likelihood	Risk Category	Dana / Project-Specific Controls and Mitigation	Severity	Likelihood	Risk Category	Screened In / Screened Out	Comment	Action
			Sinking of Mid-Water Arches (Group 3)	- Seabed disturbance - localised physical seabed disturbance resulting in community change	- Activities undertaken within existing 500 m zone - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	1	E	L	- Implementation of post-sail away safety zone(?) - Subsequent recovery of Mid-Water Arches	1	E	L	Out	Further discussion required regarding safety zones, wet store duration and perception of risk	
			Lifting and removal (Groups 3 & 10)	- 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.	Lifting and removal will not generate significant sound levels.	1	E	L		1	E	L	Out		
				- Seabed disturbance - localised physical seabed disturbance resulting in community change.	- Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation. - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	1	E	L		1	E	L	In	Scoped in as part of cumulative seabed disturbance impact / footprint	
		Decommissioned *in situ* (portion of anchors)	Physical Presence (Group 12)	- Hazard to other users of sea	- Notify UKHO to update Admiralty Charts	1	E	L	- Cut anchors to -3m beneath surface - Compliance with Dana Stakeholder Engagement Management Plan	1	E	L	Out		
	Pipelines, Flowlines & Umbilicals (Bundles, Rigid Pipelines, Spools & Jumpers)	Spools (Group 8) and Jumpers (Group 9) General	Cutting & Recovery	- 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.	- Noise associated with this activity will be temporary and generated very close to the seabed, where absorption rates are highest.	1	E	L		1	E	L	Out		
				- Chemical / residual oil discharge to sea - organic enrichment and chemical contaminant effects in water column and seabed sediments. Planktonic organisms most vulnerable - High toxicity fluids within towheads(?)	- Treated water discharged to sea after cleaning. - Appropriate Risk Assessment through the MATs / SATs (OCR) system - Discharges are minimal	1	E	L		1	E	L	Out		
				- Seabed disturbance - minimal localised physical seabed disturbance, potentially resulting in community change. Potential use of debris baskets. - Smothering of organisms following settlement of resuspended particles.	- Use of DP vessels - no requirement for anchor deployment - Seabed disturbance associated with this activity is minimal - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	1	E	L		1	E	L	Out		
		Bundles (Group 6) General	Cutting of Bundles	- 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.	- Noise associated with this activity will be temporary and generated very close to the seabed, where absorption rates are highest.	1	E	L		1	E	L	Out		
				- Chemical / residual oil discharge to sea - organic enrichment and chemical contaminant effects in water column and seabed sediments. Planktonic organisms most vulnerable	- Treated water discharged to sea after cleaning. - Appropriate Risk Assessment through the MATs / SATs (OCR) system	2	E	M	- Flushing and cleaning of subsea system - Selection of flushing chemicals with lesser potential for environmental impact	1	E	L	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled - discharge will still happen but with reduced severity.	

Environmental Impact Review					Controls, Mitigations, Review and Ranking								Identified Actions		
						Initial Ranking				Residual Ranking					
Operational Phase	Project Element	Aspect / Operation	Activity	Summary of Potential Environmental Impacts	Existing Controls (Standards, Legislative, or Prescriptive)	Severity	Likelihood	Risk Category	Dana / Project-Specific Controls and Mitigation	Severity	Likelihood	Risk Category	Screened In / Screened Out	Comment	Action
				- Seabed disturbance - localised physical seabed disturbance resulting in community change..	- Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation. - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M		2	E	M	In		
		Bundles (Group 6) Decommissioned *in situ*	Residual discharges	- Liquid / solid discharge to sea - Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	- Treated water discharged to sea after cleaning. - Appropriate Risk Assessment through the MATs / SATs (OCR) system	2	E	M	- Flushing and cleaning of subsea system - Selection of flushing chemicals with lesser potential for environmental impact	1	E	L	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled - discharge will still happen but with reduced severity.	
			Free spans	- Snagging risk to trawl and other demersal fisheries	- As-left surveys - Adherence with "clear seabed" policy - Notify UKHO to update Admiralty Charts - Remediation where required	5	B	M	- Dana Stakeholder Engagement Management Plan / Process - Ongoing monitoring for an agreed period	5	A	M	In	Ongoing monitoring (and remediation if / where required) will minimise risk of any spans becoming a snag risk	
			Rock Placement over the entire line (3A)	- Introduction of new substrate over large area which will alter habitat architecture, influencing water movement, sediment accumulation and light conditions. - Seabed disturbance - physical seabed disturbance resulting in community change over large area. - Lethal / sub-lethal effects on benthic and epibenthic fauna from physical abrasion - Smothering of organisms.	- Use of flexible fall pipe vessel for rock placement - DP vessels (no anchors) - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	3	E	H	- Compliance with Dana Stakeholder Engagement Management Plan	3	E	H	In	Additional control will have no bearing on Residual Ranking. 3 severity assigned on basis of full length rock-placement.	
			Trench & Bury the entire line (3B)	- Seabed disturbance over large area- physical seabed disturbance resulting in community change over large area. - Lethal / sub-lethal effects on benthic and epibenthic fauna from physical abrasion - Smothering of organisms. - Recovery over time	- Adherence with "clear seabed" policy - Notify UKHO to update Admiralty Charts - Remediation where required - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M	- Compliance with Dana Stakeholder Engagement Management Plan	2	E	M	In	Additional control will have no bearing on Residual Ranking.	
			Remove ends and remediate snag risk (5)	- Localised introduction of new substrate which may alter habitat architecture, influencing water movement, sediment accumulation and light conditions. - Seabed disturbance - localised physical seabed disturbance resulting in community change. - Lethal / sub-lethal effects on localised benthic and epibenthic fauna from physical abrasion - Smothering of organisms.	- Use of flexible fall pipe vessel for rock placement - DP vessels (no anchors) - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M	- Compliance with Dana Stakeholder Engagement Management Plan	2	E	M	In	Additional control will have no bearing on Residual Ranking.	
		Bundles (Group 6) Full removal	Cut & lift (2A)	- 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.	- Vessel noise unlikely to be far above ambient noise levels. - No use of explosives.	1	E	L		1	E	L	Out		

Environmental Impact Review					Controls, Mitigations, Review and Ranking									Identified Actions		
						Initial Ranking				Residual Ranking						
Operational Phase	Project Element	Aspect / Operation	Activity	Summary of Potential Environmental Impacts	Existing Controls (Standards, Legislative, or Prescriptive)	Severity	Likelihood	Risk Category	Dana / Project-Specific Controls and Mitigation	Severity	Likelihood	Risk Category	Screened In / Screened Out	Comment	Action
				- Liquid / solid discharge to sea - Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	- Treated water discharged to sea after cleaning. - Appropriate Risk Assessment through the MATs / SATs (OCR) system	2	E	M	- Flushing and cleaning of subsea system - Selection of flushing chemicals with lesser potential for environmental impact	1	E	L	Out	Additional controls will ensure that risks are adequately identified, assessed, managed and controlled - discharge will still happen but with reduced severity.	
				- Seabed disturbance (MFE dredging, baskets) - Localised physical seabed disturbance resulting in community change. - Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	- Minimise basket drops - DP vessels (no anchors) - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M	- Basket deployment plan	2	E	M	In	Additional control will have no bearing on Residual Ranking.	
		Rigid Pipelines (Group 7) Decommissioned *in situ* (Option 5)	Cutting of pipeline ends	- 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.	- Noise associated with this activity will be temporary and generated very close to the seabed, where absorption rates are highest.	1	E	L		1	E	L	Out		
				- Seabed disturbance - localised physical seabed disturbance resulting in benthic community change.	- Volume of sediment mobilised proportional to area of sediment disturbed - expected to be minor and in dynamic environment with frequent natural sediment mobilisation. - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M		2	E	M	In		
			Exposures	- Snagging risk to trawl and other demersal fisheries	- As-left surveys - Adherence with "clear seabed" policy - Notify UKHO to update Admiralty Charts - Remediation where required	5	B	M	- Dana Stakeholder Engagement Management Plan / Process - Ongoing monitoring for an agreed period	5	A	M	In	Ongoing monitoring (and remediation if / where required) will minimise risk of any exposures becoming a snag risk	
			Rock placement to remediate cut ends	- Introduction of new substrate which may alter habitat architecture, influencing water movement, sediment accumulation and light conditions. - Seabed disturbance - localised physical seabed disturbance resulting in community change. - Lethal / sub-lethal effects on benthic and epibenthic fauna from physical abrasion - Smothering of organisms.	- Minimise introduction of material where possible - Use of flexible fall pipe vessel for rock placement - DP vessels (no anchors) - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M	- Compliance with Dana Stakeholder Engagement Management Plan	2	E	M	In	Additional control will have no bearing on Residual Ranking.	
		Rigid Pipelines (Group 7) Full removal (Option 2B)	Reverse Reel with De-burial	- 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.	- Vessel noise unlikely to be far above ambient noise levels.	1	E	L		1	E	L	Out		

Environmental Impact Review					Controls, Mitigations, Review and Ranking								Identified Actions		
						Initial Ranking				Residual Ranking					
Operational Phase	Project Element	Aspect / Operation	Activity	Summary of Potential Environmental Impacts	Existing Controls (Standards, Legislative, or Prescriptive)	Severity	Likelihood	Risk Category	Dana / Project-Specific Controls and Mitigation	Severity	Likelihood	Risk Category	Screened In / Screened Out	Comment	Action
Legacy				- Seabed disturbance (dredging / localised ca. 120m corridor redistribution of rock placement) - physical seabed disturbance resulting in benthic community change over length of pipeline. - Lethal / sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended rock / sediment particles.	- DP vessels (no anchors) - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	2	E	M		2	E	M	In	Additional control will have no bearing on Residual Ranking.	
	Surveys	Surveys for post-decommissioned infrastructure left *in situ*	Geotechnical survey activities - may include grab sampling	- Seabed disturbance - minor, localised physical seabed disturbance resulting in community change.	- Assessment undertaken for Survey SAT / notification - Use of DP vessel (no anchors)	1	E	L	- Pre-determined survey / sampling regime aligned with industry best practise	1	E	L	Out	Additional control will have no bearing on Residual Ranking.	- Develop post-decommissioning survey / sampling strategy (Dana)
			Geophysical survey activities	- Underwater noise - Physiological harm, behavioural modifications to marine mammals and potentially fish. - Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	- Assessment undertaken for Survey SAT / notification - Minimal number of vessel days - JNCC (2017) Guidelines will be employed for mitigation of noise impacts to marine mammals for future survey work involving seismic survey equipment.	1	E	L	- Pre-determined survey / sampling regime aligned with industry best practise	1	E	L	Out	Additional control will have no bearing on Residual Ranking.	- Develop post-decommissioning survey / sampling strategy (Dana)
	Degradation / Remediation	Remediation of future spans / exposures	Rock placement / reburial	- Introduction of new substrate which may alter habitat architecture, influencing water movement, sediment accumulation and light conditions. - Seabed disturbance - localised physical seabed disturbance resulting in community change. - Lethal / sub-lethal effects on benthic and epibenthic fauna from physical abrasion - Smothering of organisms.	- Minimise introduction of material where possible - Use of flexible fall pipe vessel for rock placement - DP vessels (no anchors) - Appropriate Risk Assessment through the MATs / SATs (MCAA) system	3	C	M	- Dana Stakeholder Engagement Management Plan / Process - Ongoing monitoring for an agreed period	3	C	M	In	Additional control will have no bearing on Residual Ranking.	
Unplanned Events	Vessels / ROVs / Associated Tooling	Hydrocarbon or Chemical release	Unplanned loss of hydrocarbon / chemicals to sea	- Loss of diesel / chemical inventories to the site, resulting in pollution of the marine ecosystem - Organic enrichment and chemical contaminant effects in water column and seabed sediments.	- OPEP / SOPEP - MARPOL Compliance - Nav Aids - Safety Zones - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings	2	B	L	- Compliance with Dana Vessel Assurance process / procedure - Client Representatives on board vessel	2	B	L	Out	Additional control does not reduce Residual Ranking but demonstrates due diligence and assurance that Existing Controls are appropriately implemented.	
		Dropped Objects	Unplanned loss of material to sea	- Seabed disturbance - localised physical seabed disturbance resulting in community change. - Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion - Smothering of organisms following settlement of resuspended particles. - Hazard to other sea users.	- Lift Plans / Procedures / Processes to reduce the potential for dropped objects - All lifting equipment will be tested / certified - No live subsea infrastructure - PON2 Reporting	2	B	L	- Compliance with Dana Vessel Assurance process / procedure - Client Representatives on board vessel	2	B	L	Out	Additional control does not reduce Residual Ranking but demonstrates due diligence and assurance that Existing Controls are appropriately implemented.	

APPENDIX D EMISSIONS FACTORS

Emissions factors (kg/Te)		CO2	N_2O	CH_4	CO	VOC	NOx	SO_2	Source data
Marine diesel		3.17	0.00022	0.00018	0.0157	0.0024	0.059	0.000013	IoP (2000) and EEMS (2008)
Diesel (Articulated HGV)		0.67	0.05	0.00000032	0.3	0.027	0.6	0.003	NAEI (2022)
Recycling	Steel	0.96	ND	ND	ND	ND	0.0016	0.0038	IoP (2000)
	Non-ferrous (Aluminium)	1.08	ND	ND	ND	ND	0.0013	0.017	IoP (2000)
New Manufacture	Steel	1.89	ND	ND	ND	ND	0.0035	0.0055	IoP (2000)
	Non-ferrous (Aluminium)	3.59	ND	ND	ND	ND	0.0041	0.025	IoP (2000)
	Concrete	0.88	ND	ND	ND	ND	0.0054	0.0001	IoP (2000)
	Plastics	3.18	ND	ND	ND	ND	ND	ND	IoP (2000)
Venting		ND	ND	0.9	ND	0.1	ND	ND	EEMS (2008)

APPENDIX E DEPTH OF BURIAL

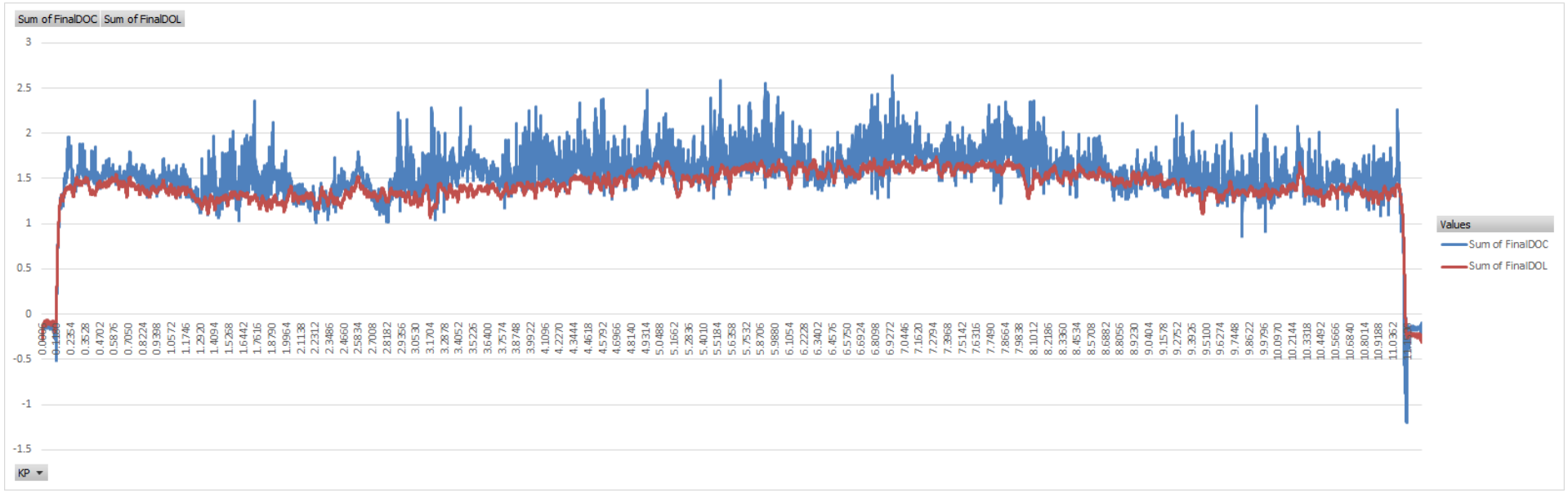

Figure E.1 PL3186 depth of burial (2014)

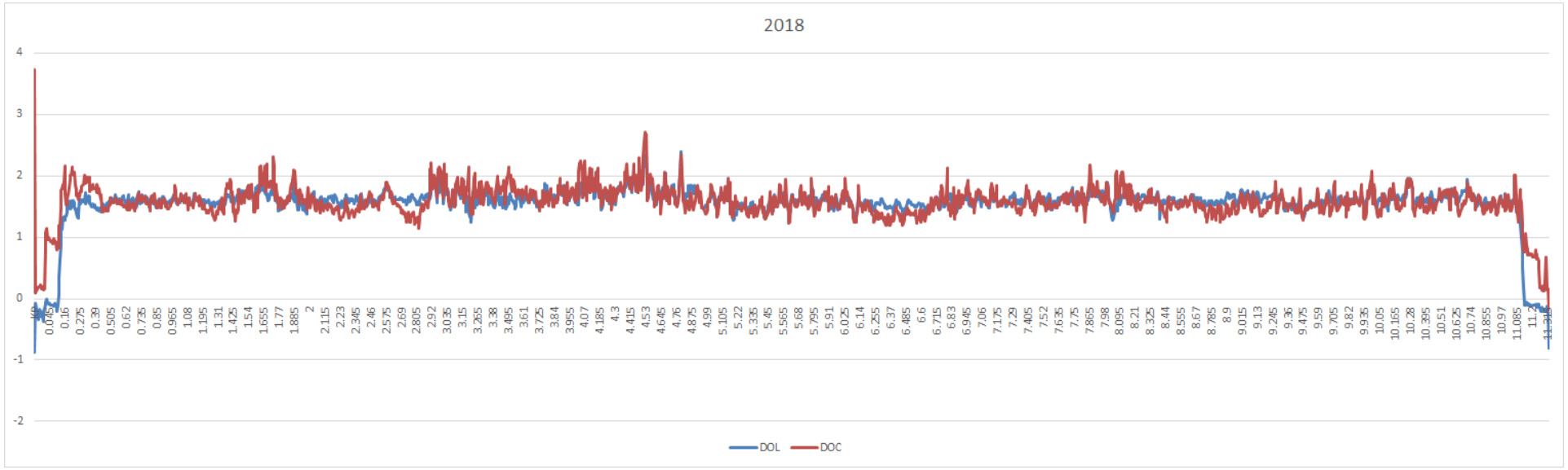

Figure E.2 PL3186 Depth of burial (2018)

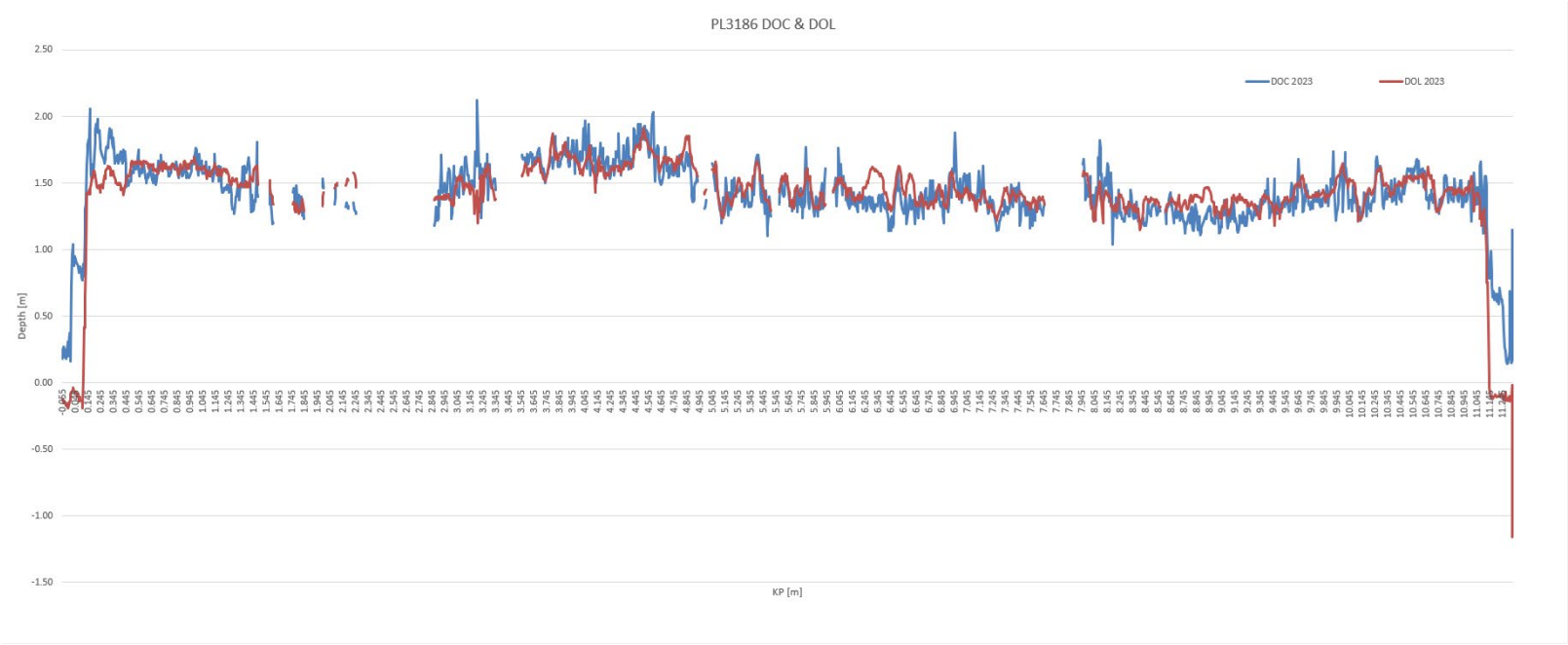

Figure E.3 PL3186 Depth of burial (2023)[4]

[4] *In areas where no DOC / DOL are reported for 2023, Fugro can confidently state that due to a combination of the ROV flying altitude at the time and the detection capabilities of the 440 Pipe tracker system for a 6" pipeline, the pipeline is out of range and therefore must have a depth of burial of over 1 m.*

APPENDIX F DECOMMISSIONING SUMMARY

Western Isles subsea decommissioning summary		
Selected Option	**Reason for Selection**	**Proposed Decommissioning Solution**
Topsides		
N/A	N/A	N/A
Substructures (Jackets/FPSO etc)		
N/A	N/A	N/A
Subsea Installations		
Bundle Towheads – Full Removal	To remove all seabed structures and leave a clear seabed	The bundle towheads will be disconnected from the main length of the bundle, recovered and transported onshore for re-use, recycling or appropriate treatment and disposal.
Mid-water arches – Full Removal	To remove all seabed structures and leave a clear seabed	The mid-water arches and their associated base frames will subsequently be fully recovered and transported onshore for re-use, recycling or appropriate treatment and disposal. As a contingency, the mid-water arches may be punctured and sunk for temporary wet storage in the event that direct recovery to surface is not practicable at the time of execution.
Mooring Line Anchor Piles & remaining chains- Full Removal	The anchor pile will be cut a minimum of 3m below the seabed, the upper section of the pile will be recovered along with the lower chain section	Recover to shore and transport for re-use, recycling or appropriate treatment and disposal. The lower section (-3m) of the anchor pile left in place along with a short 18m section of chain which is buried below the seabed.

Wellhead protection frames – Full Removal	To remove all seabed structures and leave a clear seabed	Wellhead protection frames will be recovered and transported onshore for recycling or appropriate treatment and re-use or disposal.
Pipelines, Flowlines & Umbilicals		
Bundles (North & South)	Decommission *in situ*. Remove ends and remediate snag risk	Both North and South bundles are designed to be over trawlable. The towheads will be disconnected and recovered. The exposed ends will be rock covered.
Rigid Pipeline (PL3186)	Decommission *in situ*. Remove ends and remediate snag risk	PL3186 is trenched and buried along its length. The surface laid ends and trench transition sections of the pipelines will be recovered. The exposed ends will then be rock covered.
Spools and jumpers - Full removal	To remove snagging risk and leave a clear seabed	Spools and jumpers will be disconnected and recovered either as a complete item or (depending on size) recovered in smaller sections and transported onshore for re-use, recycling or appropriate treatment and disposal.
Stabilisation Features		
Concrete Mattresses	To remove all seabed structures and leave a clear seabed	Concrete mattresses will be recovered and transported onshore for recycling or appropriate treatment and re-use or disposal.
Grout Bags	To remove all seabed structures and leave a clear seabed	Grout bags will be recovered and transported onshore for recycling or appropriate treatment and re-use or disposal.
Wells		
Abandoned in accordance with Offshore Energies UK Guidelines for the Suspension and abandonment of Wells.	Meets North Sea Transition Authority and Health and Safety Executive regulatory requirements.	Requisite Portal Environmental Tracking System (PETS) applications under the relevant regulations will be submitted in support of works carried out.

Interdependencies
The only crossing associated with the decommissioning proposal is of TAQA Cladhan 7” WI flexible riser which is crossed by 6” gas import/export pipeline PL3186 adjacent Tern SSIV. Detailed engineering shall be performed to minimise disturbance during decommissioning activities. Subsea infrastructure and pipelines shall have been flushed and cleaned prior to the commencement of subsea decommissioning operations. This EA covers the gas import/export pipeline, bundles, spools, wells and subsea structures associated with the WI fields (mooring line anchors and remaining chains, mid-water arches, towheads and MWA gravity bases).