Decommissioning Programmes

Alba Floating Storage Unit, Mooring(s) and Riser Systems

Consultation draft

Document Control

Approvals

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Section 29 Notice Holders, etc.	1 electronic

Figures and tables

Abbreviation	Explanation
~	approximately
AHV	Anchor Handling Vessel
AIS	Automatic Identification System
Al	Aluminium
ANP	Alba Northern Platform
AXS	Alba Extreme South
BAT	best available technique
BEP	best environmental practice
BP	BP Exploration Company Limited
c/w	complete with
CEFAS	The Centre for Environment, Fisheries & Aquaculture Science
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
CoCC	Committee on Climate Change (used in section 7)
CoP	Cessation of Production
CSV	Construction Support Vessel
DBBV	Double Block and Bleed Valve
DP	Decommissioning Programme
DSV	Dive Support Vessel
ERRV	Emergency Response and Rescue Vessel
ERT	Environment & Resource Technology Limited (used in section 7)
ESDV	Emergency Shutdown Valve
EUNIS	European Nature Information System
FPSO	Floating Production Storage and Offloading (used in Table 4.4.1)
FSJ	Fixed Steel Jacket (used in Table 1.6.1)
FSU	Floating Storage Unit
GHG	Green House Gas
GMG	Global Marine Group (Statutory Consultee)
GWP	Global Warming Potential
GWP-100	Global Warming Potential over a 100-year period
Harbour	Harbour Energy PLC
HCT	Heading Control Tug (used in Table 4.3.1)
Hs	Significant wave height. In physical oceanography, the significant wave height (SWH or Hs) is defined traditionally as the mean wave height (trough to crest) of the highest third of the waves (H 1/3). The most frequent wave height is ~half the height of the significant wave. A wave of twice the height of a significant wave can be expected to occur ~3 times in 24 hours. Therefore, typical seagoing operations should be prepared for this wave height.
ICES	International Council for the Exploration of the Seas
ID	Identification (used for pipelines in Pipeline Works Authorisations and variations thereof, approved by NSTA)
IMO	International Maritime Organisation
INST	Installation (used in “contents list”)
IoP	The Institute of Petroleum
IPCC	Intergovernmental Panel on Climate Change
Ithaca	Ithaca Oil and Gas Limited
JNCC	Joint Nature Conservation Committee
kgf	Kilogramme force
MARPOL	The International Convention for the Prevention of Pollution from Ships
mm	Millimetre
MSV	Multi-Support Vessel
MWA	Mid-Water Arch (buoyancy tank that provides support for the dynamic flexible risers)
n/a	Not available
NCMPA	Nature Conservation Marine Protected Area
NEO	New European Offshore
NFFO	National Federation of Fishermen’s Organisations (Statutory Consultee)
NIFPO	Northern Ireland Fish Producer’s Organisation (Statutory Consultee)
NCMPA	Nature Conservation Marine Protected Area
No.	Number (of)
NO_2	Nitrogen Dioxide

Abbreviation	Explanation
Nom	nominal
NO_x	Nitrous Oxides
NORM	Naturally Occurring Radiative Material
NSTA	North Sea Transition Authority
OEUK	Offshore Energies UK (formerly Oil and Gas UK)
OGUK	Oil and Gas UK (used in Section 7)
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Oslo-Paris Convention (The Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention')
P/L	Pipeline (used in "contents list")
PLEM	Pipeline End Manifold (towhead)
PPC	Pollution Prevention Control
PWA	Pipeline Works Authorisation
SAC	Special Area of Conservation
SADIE	South Area Drilling and Injection Equipment
SFF	Scottish Fishermen's Federation (Statutory Consultee)
SIMOPS	Simultaneous Operations
SKT	Station Keeping Tug (used in Table 4.3.1)
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SO_x	Sulphur Oxides
SPA	Special Protection Area
Te	Metric tonne (1,000 kgf)
TFSW	Trans Frontier Shipment of Waste
UKCS	United Kingdom Continental Shelf
VOC	Volatile Organic Compound
WT	Wall thickness (used in Table 2.2.1)

1. EXECUTIVE SUMMARY

1.1 Combined Decommissioning Programmes

This document contains two Decommissioning Programmes (DPs) for each set of associated notices served under Section 29 of the Petroleum Act 1998. The DPs are for:

- The Alba Floating Storage Unit (FSU) complete with its mooring system(s) and anchor piles.
- Removal of the associated riser systems between the PLEM and the FSU, including 12in production risers: PL927 (pipeline ID 12-17), PL927A and the 4in diesel riser PL928 (pipeline ID 7-8) and the associated mid-water arch, chain and clump weight.

The rest of the infrastructure associated with the Alba field – including parts of PL927 (pipeline ID 1-11) and PL928 (pipeline ID 1-6), is not being decommissioned at this time and will be included within a separate DP to be submitted by Ithaca. The decommissioning solutions proposed and timescales involved will not prejudice solutions for decommissioning the remaining Alba infrastructure.

1.2 Requirement for Decommissioning Programme(s)

Installations: In accordance with the Petroleum Act 1998, Ithaca Oil and Gas Limited (Ithaca) as operator of the Alba field, and the Section 29 notice holders (Table 1.4.2), are applying to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to obtain approval for decommissioning the installations as detailed in Section 1.4.1 of this document. Letters of support from the Section 29 notice holders will be included in the Appendix following public and statutory consultation.

Pipelines: In accordance with the Petroleum Act 1998, Ithaca Oil and Gas Limited (Ithaca) as operator of the Alba field, and the Section 29 notice holders (Table 1.4.4), are applying to OPRED to obtain approval for decommissioning the pipelines as detailed in Section 1.4.2 of this document. Letters of support from the Section 29 notice holders will be included in the Appendix following public statutory consultation.

In conjunction with public, stakeholder and regulatory consultation, the DPs contained herein are submitted in compliance with national and international regulations and OPRED guidance notes. The five-year schedule outlined in this document is for the decommissioning of the associated installations and infrastructure to be undertaken between 2025 to 2029 with pipeline cleaning commencing in 2024. A schedule is included in Figure 6.3.1.

1.3 Introduction

Discovered in 1984 and located in block 16/26a on the United Kingdom Continental Shelf, Alba is a heavy oil field and was one of the first shallow Eocene reservoirs to be successfully developed in the North Sea. First oil was achieved in January 1994.

The Alba field lies about 210 km north-east of Aberdeen, Scotland, in the UK Central North Sea, in water depths of ~138 m.

The field facilities include a fixed steel platform, the Alba Northern Platform (ANP), and a Floating Storage Unit, the first to be purpose-built for the UK sector of the North Sea. The field was further developed in 2001 through the addition of the Alba Extreme South (AXS) subsea production centre supported by the Sadie water injection drill centre.

Alba crude oil is offloaded from the stern of the FSU to a shuttle tanker before being transported to refineries in northwest Europe. Alba gas is used for ANP fuel and the ANP is also connected by a 4 km long gas pipeline to the Britannia platform.

The economics and timing of Cessation of Production (CoP) are currently being evaluated with field partners and NSTA and once the wells have been finally shut-in the Alba FSU will no longer be required as production will

no longer be economically viable. The earliest departure of the Alba FSU from the field will be sometime 2025.

The DPs explain the principles of the removal activities for the disconnection and sail away of the Alba FSU supported by a Comparative Assessment [15] for the severance of the mooring lines. It has been agreed with OPRED that it will not be necessary to prepare a comparative assessment or an environmental appraisal in support of the pipeline decommissioning programme as the risers will be removed in accordance with mandatory requirements. The environmental impacts associated with the work in this DP have been assessed and detailed within Section 4 and Marine License applications will be submitted as appropriate. Decommissioning of the pipelines and infrastructure associated with the wider Alba field will be addressed in separate DPs submitted by Ithaca that will be supported by a comparative assessment and an environmental appraisal.

1.4 Overview

1.4.1 Installation(s)

Table 1.4.1: Installation(s) being decommissioned			
Field(s)	Alba	**Production type**	Oil
Water depth (m)	~138m	**UKCS Block**	16/26a
Surface installations			
Number	**Type**	**Vessel mass (Te)**	**Mooring system mass (Te)**
1	FSU	23,674	4,175 (Note 1)
Subsea installations		**Distances**	
Number	**Type**	**Distance to median**	**Distance from nearest UK coastline**
12	FSU mooring system	42.6 km	~210km NE of Aberdeen
1	Mid-Water Arch		
1	MWA clump weight		

NOTES

1. 12x anchor piles, 1.524mØ32-38mmWT, 37m long installed such that the top of the pile is 10m below mean seabed. Mass of each pile is 50.8Te.

Table 1.4.2: Section 29 Notice Holders – installation(s)		
Section 29 Notice Holder	**Registration Number**	**Equity Interest (%)**
Arco British Limited, LLC	FC0057677	0%
Chrysaor (U.K.) Lambda Limited	SF000910	0%
Chrysaor Petroleum Limited	01247477	0%
EnQuest Energy Limited	01019698	0%
EnQuest Heather Limited	02748866	8.00%
EnQuest NWO Limited	08497436	0%
EnQuest Production Limited	01019831	0%
EQ Petroleum Sabah Ltd	07211014	0%
Equinor UK Limited	01285743	0%
Fina Petroleum Development Limited	00740632	0%
Ithaca Oil and Gas Limited	01546623	36.67%
Mitsui E&P UK Limited	07652477	0%
NEO Energy (SNS) Limited	SC291165	0%
NEO Energy Petroleum Limited	03288689	17.00%
Spirit Energy Resources Limited	02855151	12.65%
Waldorf Production UK PLC	05030838	25.68%

1.4.2 Pipeline(s)

Table 1.4.3: Pipeline(s) being decommissioned		
Number of pipelines, cables, umbilicals	3	See Table 2.3.1
NOTE Pipelines PL927, PL927A and PL928 are included in this figure.		

Table 1.4.4: Section 29 Notice Holders – pipeline(s)		
Section 29 Notice Holder	**Registration Number**	**Equity Interest (%)**
Arco British Limited, LLC	FC0057677	0%
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EQ Petroleum Sabah Ltd	07211014	0%
Equinor UK Limited	01285743	0%
Fina Petroleum Development Limited	00740632	0%
Ithaca Oil and Gas Limited	01546623	36.67%
Mitsui E&P UK Limited	07652477	0%
Neo Energy (SNS) Limited	SC291165	0%
Neo Energy Petroleum Limited	03288689	17.00%
Spirit Energy Resources Limited	02855151	12.65%
Waldorf Production North Sea Limited	03518803	0%
Waldorf Production UK PLC	05030838	25.68%

1.5 Summary of proposed Decommissioning Programmes

Table 1.5.1: Summary of Decommissioning Programmes	
Proposed decommissioning solution	**Reason for selection**
1. Surface installations	
Complete removal and recycle. The FSU will be removed and recovered to shore and recycled unless alternative re-use options are found to be viable and more appropriate. Any applications and permits will be submitted for the work associated with removal of the vessel.	Complies with mandatory requirements. Allows the FSU to be removed and maximises opportunity for reuse or recycling or materials. If not reused the decommissioned FSU vessel will be recycled or disposed of in compliance with the applicable laws and regulations of the United Kingdom, EU and Norway as applicable.
2. Subsea installations	
Mooring lines. Partial removal of 12x mooring lines, with the chain ends being cut at seabed level before being buried to a depth 1 m below seabed using suitable dredging equipment. The removed sections will be recovered for reuse or recycling. Small amounts of sediment will be displaced as the mooring lines are recovered. **Anchor piles**. The 12x anchor piles were installed such that the tops of the piles were driven to 10 m below the seabed Given the burial depth, the proposal is to leave the anchor piles *in situ*. **Mid-water arch.** Complete removal. The mid-water arch c/w chain and clump weight will be completely removed with safety measures put in place for mariners for the period between the departure of the FSU and removal of the MWA. Permit applications will be submitted for work associated with removal of the FSU moorings and contingency works for the anchor piles.	Mooring lines, piles: outcome of comparative assessment. Removes a potential obstruction to fishing operations and maximises recycling of materials. Complies with mandatory requirements for clear seabed and maximises reuse opportunities.

Table 1.5.1: Summary of Decommissioning Programmes	
Proposed decommissioning solution	**Reason for selection**
3. Risers	
Complete removal. All three dynamic flexible risers will be flushed and cleaned with seawater. PL927 and PL928 that are still connected to the pipeline end manifold (PLEM) will be flushed from Alba Northern Platform to the FSU. PL927 (pipeline ID 12-17, length 445.4m), PL927A (412m) and PL928 (pipeline ID 7-8, length 407.9m)) between the PLEM and the FSU will be completely removed and recovered to shore for reuse, recycling or disposal as appropriate. Pending future development opportunities and commercial agreements that may result in their re-use, the rest of the pipelines (PL927 ID 1-11) and PL928 (ID 1-6) will meantime be left *in situ* for decommissioning in the future. Applications and permits will be submitted for the work associated with pipeline pigging, flushing, cutting and removal.	Complies with mandatory requirements, removes potential obstructions to fishing operations and maximises recycling of materials.
4. Interdependencies	
No third-party pipeline crossings will be disturbed as a result of the decommissioning proposals. With the FSU no longer being on location, the 500 m safety zone will be relinquished, and so it is recognised that the PLEM will present a hazard to other users of the sea. The mid-water arch, clump weight and risers may be removed a couple of months after the FSU has departed the 500 m safety zone. Therefore, Ithaca will adopt appropriate safety measures to protect the PLEM until it is decommissioned sometime in future. The proposed safety measures will be discussed and agreed with SFF and OPRED before they are implemented. Removal of the Alba FSU and dynamic flexible risers will not affect the operation or future decommissioning of the remaining Alba infrastructure.	

1.6 Field Location including field layout and adjacent facilities

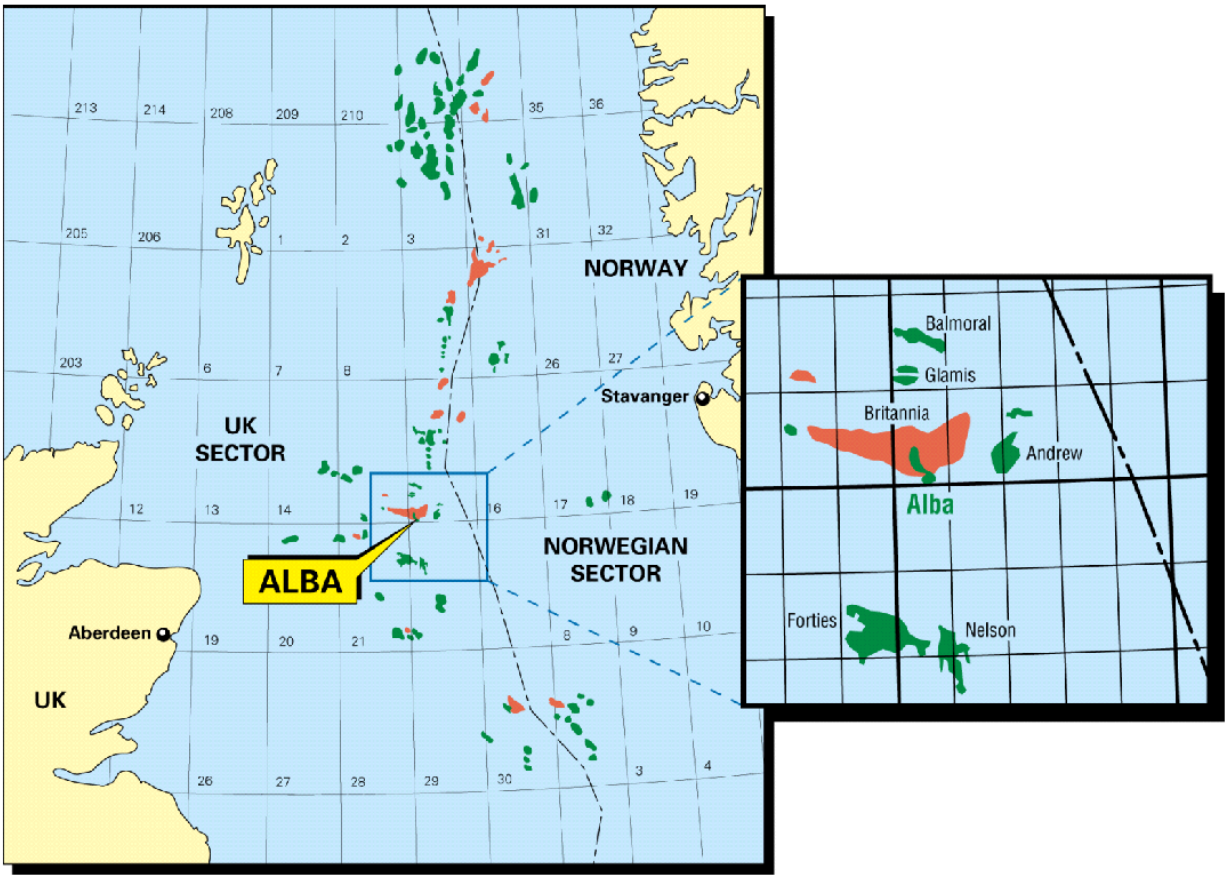
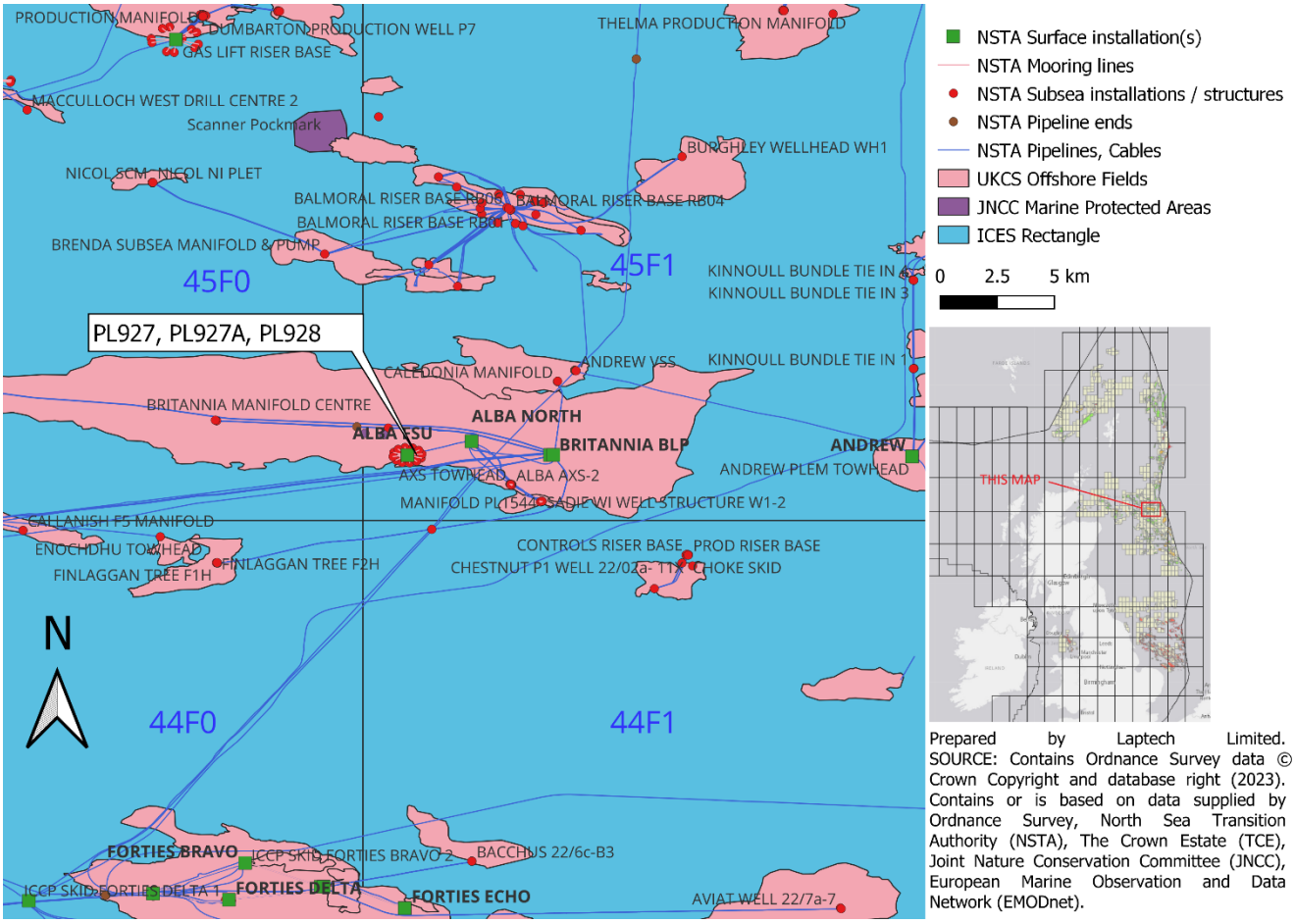


Figure 1.6.1: Location of Alba installations and infrastructure in UKCS



Prepared by Laptech Limited. SOURCE: Contains Ordnance Survey data © Crown Copyright and database right (2023). Contains or is based on data supplied by Ordnance Survey, North Sea Transition Authority (NSTA), The Crown Estate (TCE), Joint Nature Conservation Committee (JNCC), European Marine Observation and Data Network (EMODnet).

Figure 1.6.2: Installations and infrastructure local to Alba in UKCS

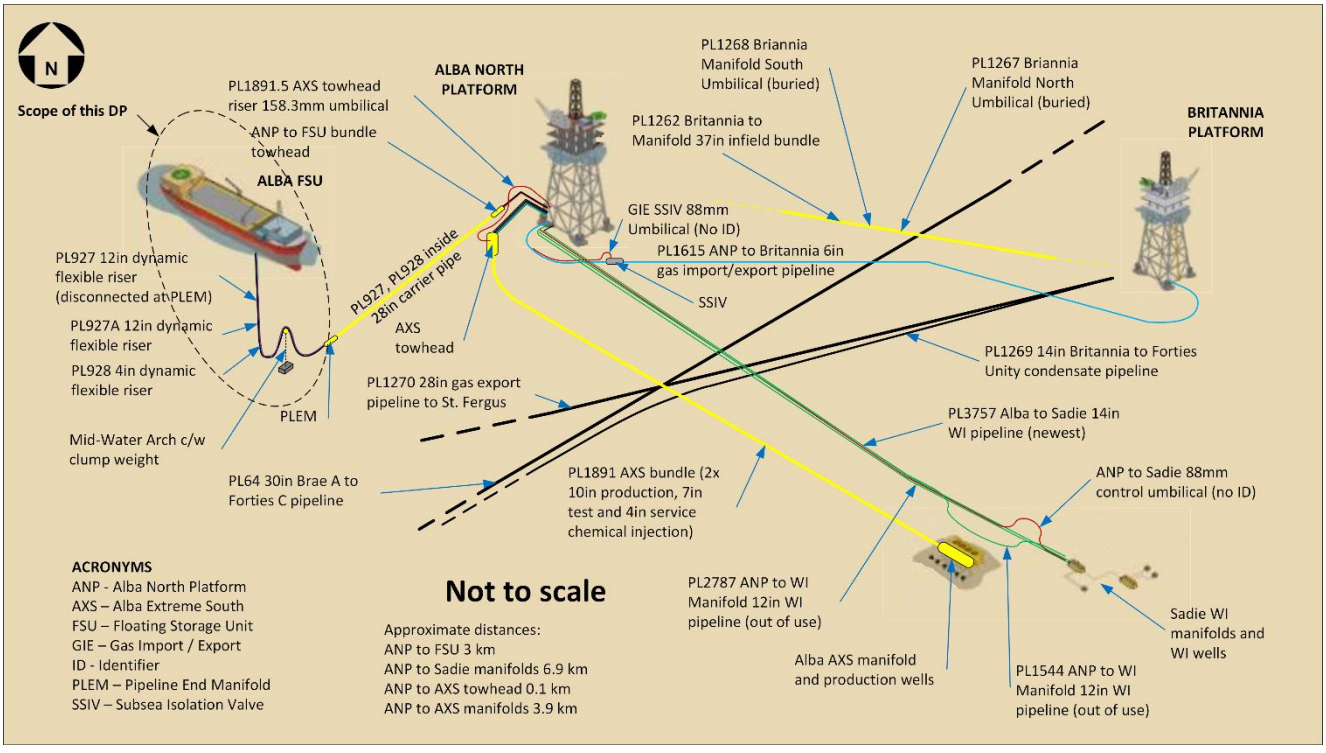


Figure 1.6.3: Alba field installations and infrastructure (not to scale)

1.6.1 Adjacent facilities

Table 1.6.1: Adjacent facilities					
Owner / Operator	**Name**	**Type**	**Distance & Direction from Alba FSU**	**Information**	**Status**
Ithaca Oil and Gas Limited	ANP to FSU towhead	Bundle towhead	ENE, 2.9 km		Operational
	ANP to FSU PLEM	Bundle towhead	NE, 0.3 m	Inside FSU 500 m safety zone	Operational
	ANP	FSJ	ENE, 3.0 km		Operational
	AXS towhead	Towhead	ESE, 5.1 km	Inside ANP 500 m safety zone	Operational
	AXS 2 manifold	Manifold	ESE, 5.1 km		Operational
	Sadie 1 manifold	Manifold	ESE, 6.9 km		Operational
	Sadie 2 manifold	Manifold	ESE, 6.9 km		Operational
	Sadie 3 manifold	Manifold	ESE, 6.9 km		Operational
Harbour Energy PLC	Britannia platform	Fixed Steel Jacket	ENE, 3 km		Operational
BP Exploration Company Limited	Andrew platform	Fixed Steel Jacket	ENE, 6.2 km		Operational
Impacts of decommissioning proposals					
There are no direct impacts on adjacent facilities from the decommissioning works associated with the Alba FSU installation and associated pipeline infrastructure. As part of the operational phase of the decommissioning works any potential environmental impacts will be mitigated in two ways. The first is via direct communication with the parties involved, and the other is via submission of the Master Application Templates and Supplementary Application Templates.					

1.7 Industrial implications

It is Ithaca's intention to develop a contract strategy and Supply Chain Action Plan that will result in an efficient and cost-effective execution of the decommissioning works.

Where appropriate existing framework agreements may be used for decommissioning of the pipelines and pipeline stabilisation features. Should the opportunity arise, Ithaca will try to combine Alba FSU sail away, disconnection and recovery activities with other development or decommissioning activities to reduce fuel requirements and mobilisation costs.

2. DESCRIPTION OF ITEMS TO BE DECOMMISSIONED

2.1 Surface installations

Table 2.1.1: Surface facilities information				
Name & facility type	Location		Topsides / Facilities	
	WGS84 Decimal	WGS84 Decimal Minute	Mass (Te)	No of modules
Alba FSU	58.049784° N 1.034077° E	58°2.9870' N 1°2.0446' E	23,674	1
The overall mass of mooring system is 4,175 Te, including the mass of the anchor piles.				

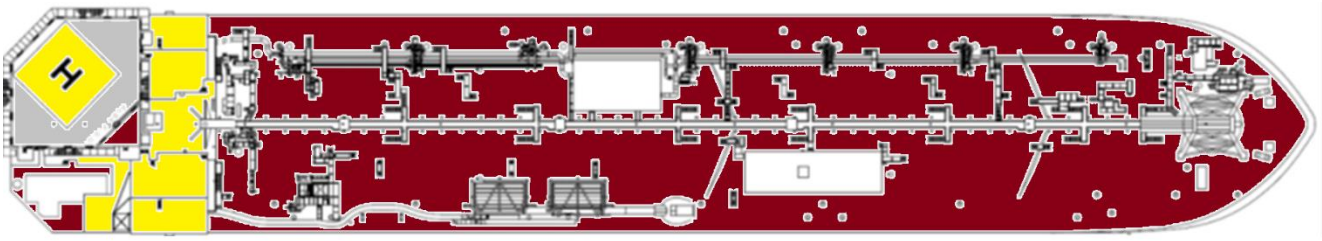


Figure 2.1.1: Alba Floating Storage Unit plan view

2.2 Subsea installations

Table 2.2.1: Subsea installations information					
Subsea Installations Including Stabilisation Features	No.	Size / Dimensions	Location		Comments/ Status
		Mass (Te)	WGS84 Decimal	WGS84 Decimal Minute	
Anchor pile(s)	12	1.524mØ32-38mmWT, 37m long	58.050683° N	58°3.0410' N	'As-built' data records that each pile was driven to a depth such that the top of pile is at least 10m below seabed.
		50.8	1.044679° E	1°2.6807' E	
		1.524mØ32-38mmWT, 37m long	58.047764° N	58°2.8658' N	
		50.8	1.044123° E	1°2.6474' E	
		1.524mØ32-38mmWT, 37m long	58.045389° N	58°2.7234' N	
		50.8	1.040822° E	1°2.4493' E	
		1.524mØ32-38mmWT, 37m long	58.044210° N	58°2.6526' N	
		50.8	1.035809° E	1°2.1485' E	
		1.524mØ32-38mmWT, 37m long	58.044462° N	58°2.6677' N	
		50.8	1.030244° E	1°1.8146' E	
		1.524mØ32-38mmWT, 37m long	58.046175° N	58°2.7705' N	
		50.8	1.025827° E	1°1.5496' E	
		1.524mØ32-38mmWT, 37m long	58.048844° N	58°2.9306' N	
		50.8	1.023529° E	1°1.4117' E	
		1.524mØ32-38mmWT, 37m long	58.051810° N	58°3.1086' N	
		50.8	1.024069° E	1°1.4441' E	

Table 2.2.1: Subsea installations information					
Subsea Installations Including Stabilisation Features	**No.**	**Size / Dimensions**	**Location**		**Comments/ Status**
		Mass (Te)	**WGS84 Decimal**	**WGS84 Decimal Minute**	
		1.524mØ32-38mmWT, 37m long	58.054178° N	58°3.2507' N	
		50.8	1.027321° E	1°1.6393' E	
		1.524mØ32-38mmWT, 37m long	58.055387° N	58°3.3232' N	
		50.8	1.032309° E	1°1.9385' E	
		1.524mØ32-38mmWT, 37m long	58.055074° N	58°3.3044' N	
		50.8	1.037862° E	1°2.2717' E	
		1.524mØ32-38mmWT, 37m long	58.053387° N	58°3.2032' N	
		50.8	1.042371° E	1°2.5422' E	
Mooring lines	12	152mm studlink chain each with a nom. length 17.6m	Each mooring line spans between the Alba FSU and a padeye on each of the mooring anchors.		The quoted length of chain excludes a 152mm Y-link (0.73m long) that connects the 152mm chain to the 149mm sheathed rope. Refer Figure 2.2.1.
		277			
		149mm sheathed wire rope each with a nom. length 100m			The quoted length of 140mm stud link chain excludes a 140mm Y-link (0.68m long) that connects the 149mm sheathed wire rope to the 140mm stud link chain. Refer Figure 2.2.1
		113			
		Combined 140mm & 133mm stud link chain each with a nom. length 290.6m and 34.2m respectively			
		1,965			
		133mm stud link chain each with a nom. length 234.5m			The length of chain quoted for the 133mm stud link chain is final section of the mooring line that connects to a padeye on the anchor pile positioned 19m below seabed. It is estimated that ~80m of mooring chain is buried at it approaches the padeye. Refer Figure 2.2.1, Figure 2.2.2 and Figure 2.2.3.
		1,210			
Mid-Water Arch (MWA)	1	5.85x12.62x9.85	58.060260° N		The MWA is held in position by the clump weight
		42.0	1.079667° E		
Clump weight and chain	1	2.6x7x7	58.060260° N		
		173.9	1.079667° E		
NOTE The overall mass of mooring system is 4,175 Te, including the mass of the anchor piles.					

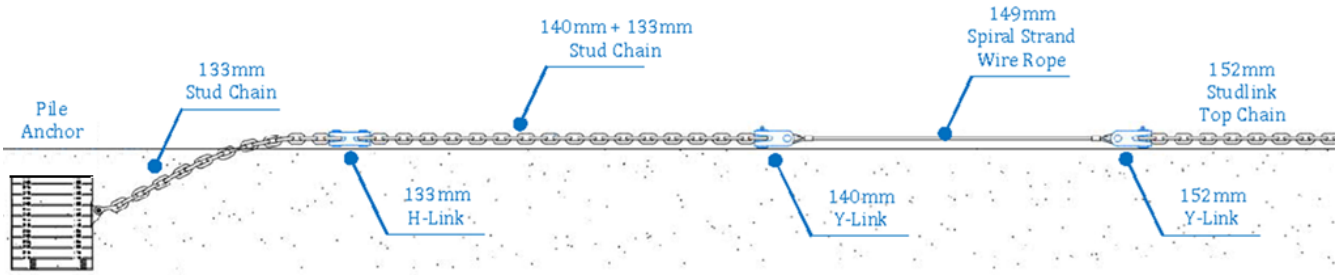


Figure 2.2.1: Alba FSU – typical mooring arrangement(s)

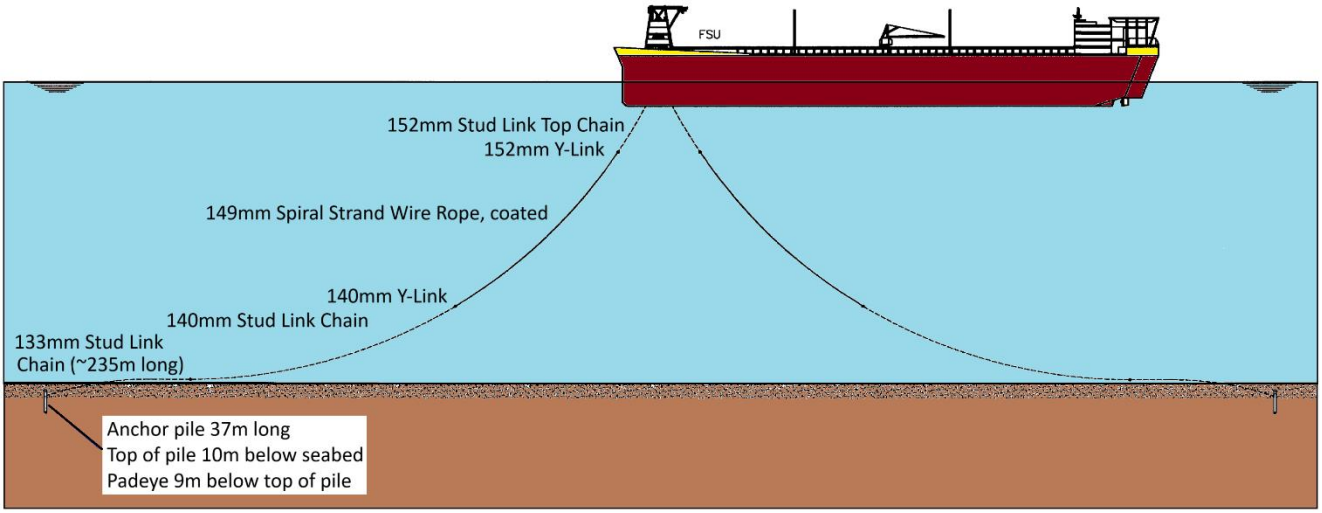


Figure 2.2.2: Alba FSU – typical mooring arrangement catenary

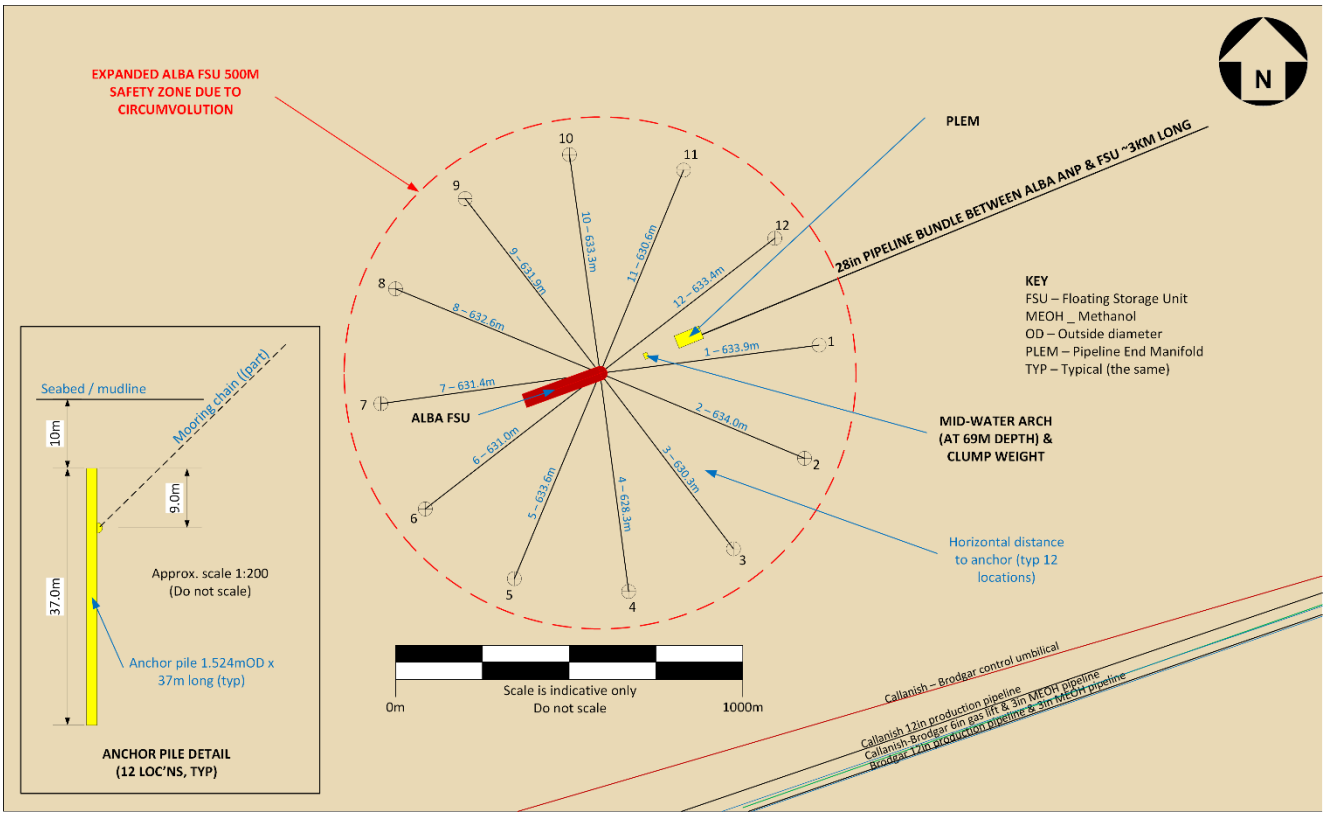


Figure 2.2.3: Alba FSU – anchor pattern

2.3 Pipelines including stabilisation features

Table 2.3.1: Pipeline, flowline and umbilical information									
Description	**Pipeline no.(as per PWA)**	**Diameter (NB) (inches)[1]**	**Length (m)**	**Description of component parts**	**Product conveyed**	**From to end points[2]**	**Burial status**	**Pipeline status**	**Current content**
Export pipeline	PL927 (ID 12)	383.2mm	427.3	Dynamic flexible riser	Crude oil	Closing tie-in spool piece (on PLEM) to Alba FSU ESDV	Suspended in water column	Operating	As produce conveyed
	PL927 (ID 13-17)	12	18.1	Pig launcher, line pipe & valves	Crude oil	Alba FSU ESDV to Alba FSU pig receiver	Fixed to FSU	Operating	As produce conveyed
Production pipeline	PL927A	12	412.0	Dynamic flexible riser	Crude oil	Flexible riser end flange (disconnected) to FSU Turret (Main Deck)	Suspended in water column	Out of use	Treated seawater
Diesel pipeline	PL928 (ID 7)	163.5mm	407.5	Dynamic flexible riser	Diesel	Alba FSU riser tie-In flange to Alba FSU manual isolation valve	Suspended in water column	Out of use	Treated seawater
	PL928 (ID 8)	4	0.3	Isolation valve	Diesel	Alba FSU manual isolation valve to Alba FSU manual isolation valve	Fixed to FSU	Out of use	Treated seawater

NOTES

1. If diameter is expressed in mm it refers to outside diameter of the flexible dynamic riser.
2. Reference Pipeline Works Authorisation (PWA) 9/W/93, 47/V/19 (PL928), 296V19 (PL927 & PL927A) and 147/V/24.
3. Pipeline segments PL927 (ID 1-11) and PL928 (ID 1-6) will remain 'as' is' meantime until the decommissioning of that element is carried out in future.

2.4 Inventory estimate

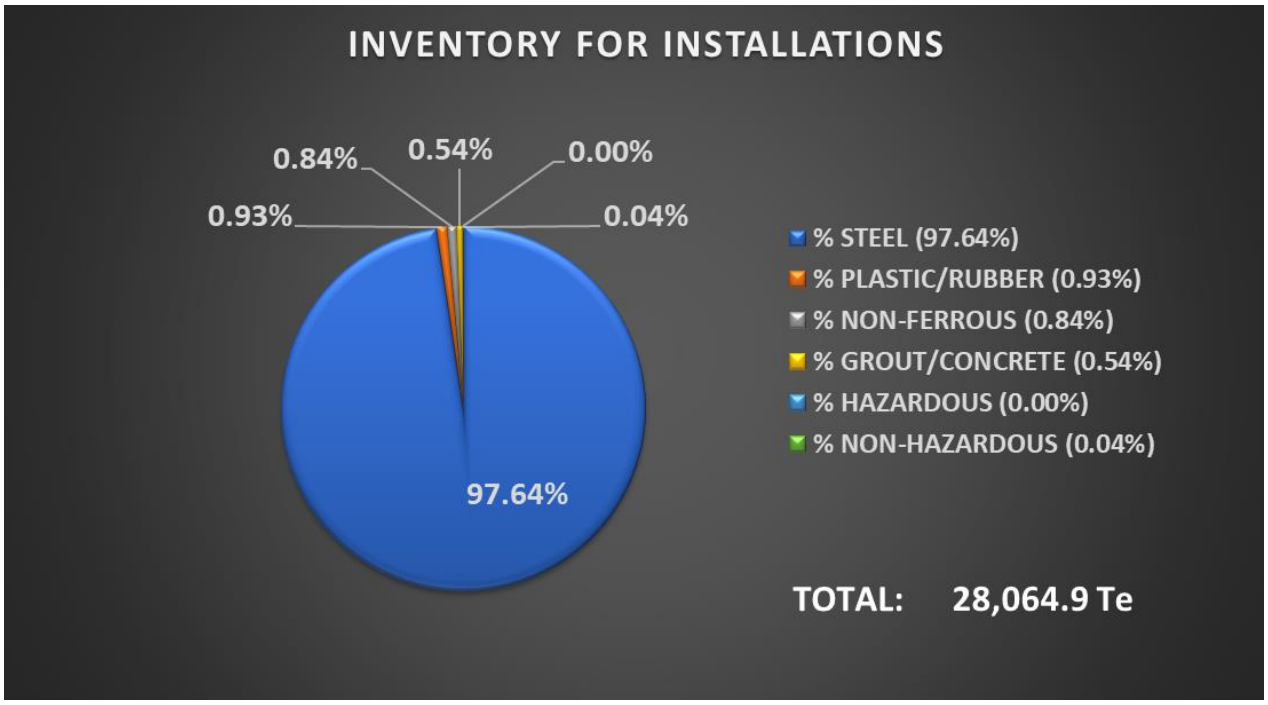


Figure 2.4.1: Inventory of installations (FSU and mooring systems)

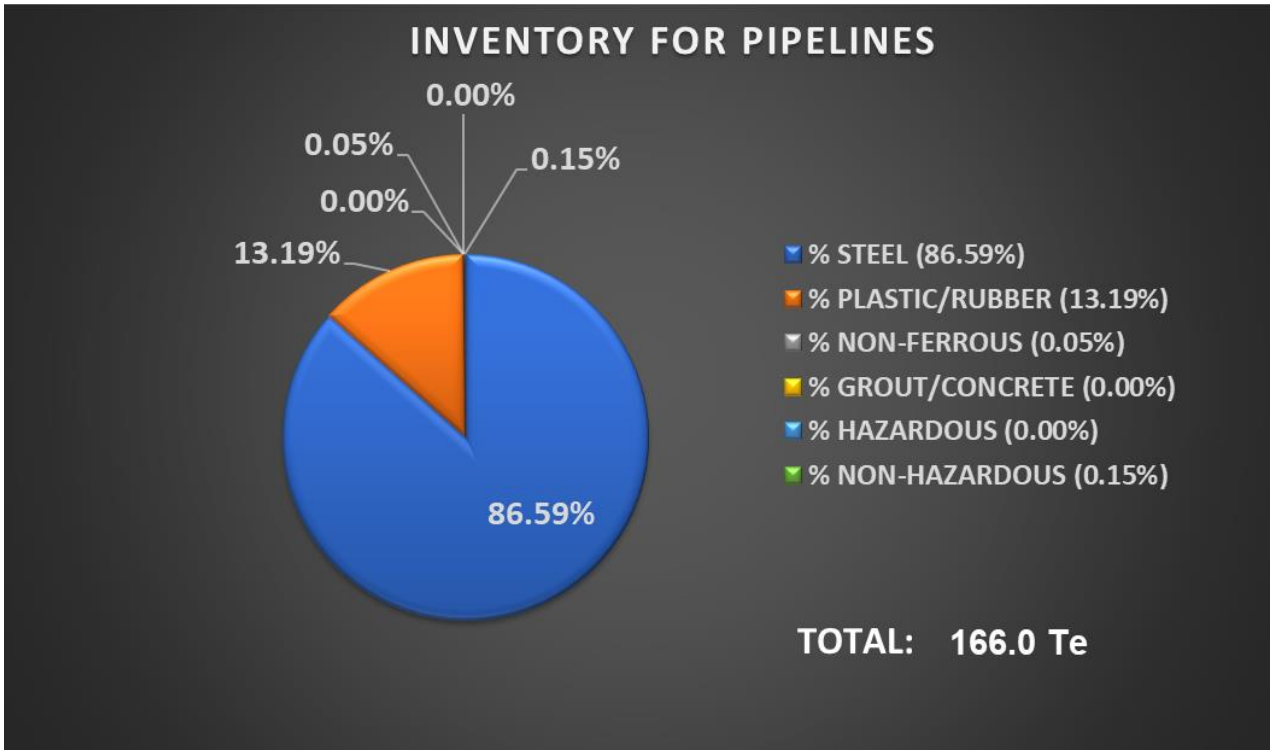


Figure 2.4.2: Inventory of pipelines (and appurtenances)

3. REMOVAL AND DISPOSAL METHODS

The Alba FSU will be taken off station with the assistance of Anchor Handling Vessels (AHV). The mooring lines and risers will thereafter be recovered using AHVs, Construction Support Vessel (CSV), Dive Support Vessel (DSV) or Multi-Support Vessels (MSV) as required. While the riser and mooring disconnection works are underway the FSU will be held in position using Heading Control Tugs (HCT). The FSU will be towed to port using tugs.

Waste will be dealt with in accordance with the Waste Framework Directive. The re-use of an installation, pipeline, or umbilical pipeline or parts thereof, is first in the order of preferred decommissioning options and such options are currently under investigation. Waste generated during decommissioning will be segregated by type and periodically transported to shore in an auditable manner through licensed waste contractors. Steel and other recyclable metals are estimated to account for the greatest proportion of the materials inventory.

Geographic locations of potential disposal yard options may require the consideration of Trans Frontier Shipment of Waste (TFSW), including hazardous materials. Early engagement with the relevant waste regulatory authorities will ensure that any issues with TFSW are addressed.

Removal activities will be performed using all available techniques and methods will be in line with current guidance and best available techniques (BAT) and best environmental practice (BEP). All appropriate permits will be applied for.

3.1 Surface installations

After completion of the operation at its current location, at the discretion of Ithaca, the FSU will be towed from the field and either redeployed or towed to a suitable licensed location for preparation for re-use or decommissioning. The owner will be responsible for taking reasonable measures to assure itself that proposals to re-use the vessel will be credible, and that disposal of the FSU will comply with the IMO Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships [8].

Preparation and cleaning: The methods that will be used to vent and purge the FSU prior to removal to shore are summarised in Table 3.1.1.

Table 3.1.1: Cleaning of FSU for removal

Waste type	Composition of Waste	Disposal Route
On-board hydrocarbons (liquids)	Bulk liquid waste will be produced during the flushing of the Alba field production systems and during the cleaning of the FSU process equipment. Bulk liquids will be offloaded and transported to shore for treatment and disposal.	Where possible, on-board hydrocarbons will be evacuated to a tanker. Should this approach be unsuccessful, on-board hydrocarbons will be returned to shore for separation and use.
Other hazardous materials	The presence of NORM found in fluids during the cleaning activities will be identified.	NORM, if present, will be disposed of in accordance with the appropriate permit.

Table 3.1.2: Topside removal methods

1) Semi-Submersible Crane Vessel ☐; 2) Monohull Crane Vessel ☐; 3) Shear Leg Vessel ☐; 4) Jack up Work barge ☐; 5) Piece small or large ☐; 6) Complete with jacket ☐; 7) Other ☑

Method	Description
Proposed removal method and disposal route	**The FSU will be released from its moorings after all the production and diesel risers have been cleaned and flushed and the flexible dynamic risers disconnected. The FSU will then be towed to port for cleaning and, or refurbishment before being reused, or towed to an alternative location at a licensed facility to be decommissioned.** **The opportunities for reuse will be determined by the vessel owner. OPRED will be notified once a disposal yard or reuse opportunity has been selected.**

3.2 Subsea installations

Severance of the mooring lines has been subjected to a comparative assessment [15]. The decommissioning options considered are as follows:

- **Complete removal** – This would involve the complete removal of the mooring lines (along with the anchor piles) by whatever means most practicable and acceptable from a technical perspective.
- **Partial removal to seabed with subsequent burial to 1 m below the seabed** – This would involve tensioning the mooring line to the point where the chain section enters the seabed and cutting it. Thereafter, the chain would be buried to a depth of at least 1 m below the seabed using a Mass Flow Excavator (MFE). No remedial work involving rock would be required.
- **Partial removal to 3 m below seabed** – This would involve excavating each mooring chain locally to 3.5 m below seabed to enable access to cut the chain. Use rock to backfill excavation.
- **Leave *in situ*** – This would involve leaving the entire mooring system *in situ*.

'As-built' drawings show that the anchor piles are buried to such an extent that they would not present a snag hazard if left *in situ*, and the benefits of removal would be outweighed by the effort required to remove them. The leave *in situ* option is not a consideration and has been discounted. Therefore, only the two 'partial removal' options are considered in this Comparative Assessment. The anchor piles are not included in the assessment.

The comparative assessment concluded that there would be no tangible benefit in excavating the seabed to sever the lower mooring chains at least 3 m below seabed. The quantity of material recovered would be largely the same, and no snagging hazard from the cut chain ends would remain after either option had been implemented. The -3 m option would require a significant overall excavation (total ~2,804 m^3) as well as dispersal of excavated material to the surrounding area. Rock (total ~4,206 Te) would be needed to backfill the excavation, and a much larger area of seabed would need to be remediated after activities had been completed.

For the -1 m option the seabed impacts will be relatively localised (total ~56.5 m^3 disturbed but not excavated) and little material would be dispersed to the surrounding area.

The recommendation of the comparative assessment was that the mooring chain approaching the padeye should be tensioned and cut at seabed level before being buried to a depth of at least 1 m using a mass flow excavator.

Table 3.2.1: Subsea installations & Stabilisation features

Subsea installations and stabilisation features	No.	Option	Disposal Route (if applicable)
FSU anchor piles	12	Leave *in situ*. In the extremely unlikely event that the burial of the piles is found to be shallower than 3 m below the seabed, the piles will be severed at least 3 m below the seabed.	n/a
Mooring lines	12	Complete recovery except for the buried section of mooring chain (up to 80 m long) approaching the mooring pile padeye that will be left *in situ*.	Return to shore for reuse, recycling, or disposal.
MWA	1	Complete remove	
Clump weight and chain	1	Complete removal	

NOTE

1. The anchor piles are buried to such an extent that no recovery is required. This will be confirmed by survey prior to conducting the decommissioning works. OPRED will be informed of the survey findings.
2. In practical terms it is not considered possible to retrieve the full length of the 133mm/140mm studlink chain section down to the padeye, which is 19 m below seabed. In order to recover the full length of the mooring line the seabed would need to be excavated down to the depth of the padeye so that the line can be cut. Following comparative assessment, the approach taken is an appropriate balance of the technical issues, safety implications and environmental impacts. Therefore,

Table 3.2.1: Subsea installations & Stabilisation features			
Subsea installations and stabilisation features	**No.**	**Option**	**Disposal Route (if applicable)**
		the mooring lines will be cut at seabed level with the ends buried using suitable dredging equipment so that they will be at least 1 m below seabed. Should any problems arise with this approach, OPRED will be consulted.	

3.3 Pipelines

The risers and pipelines identified in this document have not been subjected to a full comparative assessment on the basis that the risers are suspended in the water column and that surface laid sections of pipelines would ordinarily be removed in accordance with mandatory requirements. The option to leave the risers *in situ* was not considered a viable alternative.

All pipelines will be flushed and cleaned with seawater to a cleanliness level agreed with OPRED.

Both the dynamic flexible production risers and diesel riser will be completely removed.

Table 3.3.1: Proposals for pipeline & cables		
Pipeline	**Condition and current status**	**Decommissioning options considered**
PL927 (ID 12-17) 12in replacement production pipeline system riser, complete with riser bend stiffeners and buoyancy modules.	Operational. Suspended over the MWA in seawater	Complete removal of PL927 riser.
PL927A (ID 1) 12in disconnected production pipeline system riser, complete with riser bend stiffeners and buoyancy modules.	Out of use. Currently disconnected from the FSU. Suspended over the MWA in seawater	Complete removal.
PL928 (ID 7-8) 4in disconnected diesel riser, complete with riser bend stiffeners and buoyancy modules.	Suspended over the MWA in seawater.	Complete removal of PL928 riser (pipeline ID 7-8).

In order to maximise the efficiency of decommissioning operations the risers may be wet stored locally, near the PLEM.

3.4 Waste streams

3.4.1 Waste Stream Management Methods

Table 3.4.1: Waste stream management methods	
Waste Stream	**Removal and disposal method**
Bulk liquids	Bulk hydrocarbons will be exported to tanker, with any residual hydrocarbons removed from the FSU in accordance with contractual agreements. Any associated bulk seawater from topsides will be cleaned and disposed overboard or to a tanker under permit. The risers will be flushed, and left filled with seawater as appropriate prior to being disconnected at the ends. Any residual fluids from within these pipelines will be released to marine environment under permit prior to removal to shore. Further cleaning and decontamination will take place onshore prior to reuse, recycling or disposal.
Marine growth	Some marine growth is likely to detach itself from the FSU during tow. For subsea equipment, marine growth is likely to dry out and detach itself while it is in transit. Marine growth that remains attached to the subsea equipment and, or the FSU after load-in to the onshore dismantling site will be removed. It will be disposed of in accordance with the regulations in force at the site following the licensed site operator's procedures, guidelines, and company policies.
NORM	Based on production records to date, NORM is expected. Tests for NORM will be undertaken offshore and any NORM encountered will be dealt with and disposed of in accordance with guidelines and company policies.
Asbestos	Asbestos is expected to be present on the FSU installation. Any such material found will be dealt with and disposed of in accordance with guidelines and company policies.
Other hazardous wastes	Will be recovered to shore and disposed of according to guidelines and company policies.
Onshore dismantling sites	Appropriate licensed sites will be selected. Dismantling site must demonstrate proven disposal track record and waste stream management throughout the deconstruction process and demonstrate their ability to deliver reuse and recycling options.

Table 3.4.2: Inventory disposition			
Inventory	**Total inventory (Te)**	**Planned tonnage to shore (Te)**	**Planned left *in situ* (Te)**
Alba FSU c/w mooring system, MWA, chain and clump weight.	28,064.9	27,035.1	1,029.8
Dynamic flexible risers	166.0	166.0	0.0
NOTE 1. The buried parts of the 12x mooring lines (133mm/140mm chain, each up to 80m long). That is, those sections of the mooring lines that will not be recovered.			

Table 3.4.3: Re-use, recycle & disposal aspirations for recovered material			
Inventory	**Re-use**	**Recycle**	**Disposal (e.g., Landfill)**
Alba FSU c/w mooring system	<5%	>95%	<5%
Dynamic flexible risers, MWA & clump weight	<5%	>95%	<5%

4. ENVIRONMENTAL APPRAISAL

4.1 Environmental sensitivities

The key environmental sensitivities in the project area are summarised in Table 4.1.1. Except where referenced, the data have been obtained from various historical survey reports of the Alba area dated between 1992 and 2014; the Alba area includes the FSU that is only 3 km from the ANP. Environmental baseline surveys are planned for 2024, and the data obtained will be used to inform the various permits required for decommissioning operations.

Table 4.1.1: Environmental and societal sensitivities

Environmental receptor	Main features
Physical environment	The water depth at the Alba FSU is approximately 138 m. **Wind:** The central north sea is a harsh operating environment that exhibits a strong seasonality. The most severe winter months are November through February and the calmest summer months are May through August. While November through February are most severe on a day-to-day basis, early- and late-season storms can cause severe events during the autumn and spring months. Prevailing winds in winter are north easterly wind speeds that are typically 10 to 11 m/s but can reach over 24 m/s in storms. In summer the prevailing winds are from the south east, typically 6 to 7 m/s. **Waves:** The seasonal variations in sea states closely mimic those of the winds that generate them. In winter, typical significant wave heights (H_s) can be in the region of 3 m, but can reach over 8 m in severe storms. In summer typical Hs is in the range 1.5 m to 2 m. **Currents:** Currents in the central North Sea are driven primarily by tides, and tides in the Alba area are semi-diurnal (two high and two low tides per day). Tides exhibit a strong spring-neap cycle over the course of an approximate 28 day lunar cycle. In the Alba area tides are typically 0.15 m/s but in extreme winter storms currents can reach almost 0.45 m/s.
Bathymetry and seabed sediments	The seabed in the area is relatively flat, with a few inflexions where the profile crosses existing pipelines. Seabed features include occasional boulders and, seabed depressions, traces of installed infrastructure such as pipelines and various seabed scars from trawling and anchoring. Sediment types across the Alba area range from mud to very fine sands ([9], [10], [11] & [27]), which is typical of the fine grained sediments of the Fladen Ground. The EUNIS classification for the Alba area is Atlantic Offshore Circalittoral Mud. The proportion of silt/clay in the sediments is moderate to high, although with variation between surveys, ranging between 23.55% and 72.08% [9]; 21.41-80.62% [11] and 66.27-75.28% [27]. A habitat assessment was conducted along the SADIE pipeline route in 2014 ([12], [13]) with sample station 1 being the closest to the FSU (3.5 km); the sediments were classified as the biotope complex 'Circalittoral fine mud' (this classification now known as Atlantic Offshore Circalittoral Mud) which is consistent with the high slit/clay content observed in the sediments in this and earlier surveys. The top 30 cm of sediment in the Alba area, including at the FSU will be relatively soft, having been bioturbated by deeply burrowing species such as *Nephrops*.
Fish, spawning and nursery Areas	The Alba field is located in ICES rectangle 45F1, Cefas' reference block F1/45 [1]. **Spawning areas:** Cod (Jan-April) Mackerel (adjacent to spawning area (May-July/Aug)), Norway Pout (March-May), *Nephrops* (Jan-Dec). **Nursery areas:** anglerfish, cod, European hake, herring, ling, spotted ray, spurdog and whiting. Mackerel (adjacent to nursery area), Haddock, Norway Pout, Blue Whiting, Sandeel (*A. marinus*), (adjacent to nursery area), *Nephrops* (adjacent to nursery area). Reference to "adjacent to" is qualified in that the spawning or nursery areas could be listed as being within 45F1 but may not necessarily lie over the infrastructure; these features are dynamic.

Table 4.1.1: Environmental and societal sensitivities	
Conservation	Alba is located within an area where the feature 'submarine structures made by leaking gases' associated with pockmarks are known to occur. Survey data [3] indicate that a number of pockmarks have been recorded in the wider Alba field area, however carbonate structures have not been recorded at Alba. None of the Alba infrastructure is located within a designated area, the nearest is the Scanner Pockmark Special Area of Conservation (SAC), located ca. 24 km to the north. The two closest Nature Conservation Marine Protected Areas (NCMPAs) are the Norwegian Boundary Sediment Plain NCMPA (34 km to the east), designated for the presence of *Arctica islandica* aggregations, including sands and gravels as their supporting habitat and the East of Gannet and Montrose Fields NCMPA (65 km to the south), designated for the presence of *Arctica islandica* aggregations and the presence of offshore deep-sea muds. The SADIE pipeline route habitat assessment [8] identified the OSPAR threatened and declining habitat 'Seapens and burrowing megafauna communities' in circalittoral fine mud' based on the presence of high densities for faunal burrows and seapens (*Virgularia mirabilis* and *Pennatula phosphorea*) observed in seabed video footage. This habitat is widespread within the Fladen Ground and has been recorded in surveys conducted in the wider area including stations from the South East Fladen Ground proposed NCMPA survey ~8 km to the north-west of the Alba field [8]. From the presence of sea pens and evidence of bioturbation, the previous survey reports concluded the presence of the "sea pens and burrowing megafauna communities" habitat is likely; this habitat is therefore expected to be present across the Alba field area, including the FSU location. No Annex I habitats have been observed in any of the previous surveys.
Benthic environment	The faunal composition of the Alba area described during the 1991 (ANP) baseline survey (closest survey locations to FSU ~1.1 km) was characterised by the polychaetes *Levinsenia gracilis*, *Heteromastus filiformis* and *Paramphinome jeffreysii*, the bivalves of the *Thyasira* species complex also regularly occurred in the top five ranked species [9]. The macrofaunal community found during the 2000 survey at stations at 500 m from ANP [10], were dominated by the indicator species *P. jeffreysii* and *Thyasira. sarsi*, consistent with the 1991 survey [9]. Faunal assemblages from the 2005 [27] survey, of stations to the north of ANP indicated that *P. jeffreysii* and *T. sarsi* dominated the stations 200-500 m from ANP. *P. jeffreysii* was present in lower numbers (but still ranked within the three most abundant species) at stations 800 m, 1,200 m, 2,500 m from ANP and absent from the station 5,000 m north, while *T. sarsi* was present in low numbers at the station 800 m north of ANP and absent from other stations. Several species of infauna commonly associated with the habitat 'Seapens and burrowing megafauna in circalittoral fine mud' were present including *Thyasira equalis*, the third most abundant species overall, was present at all stations, *Nephtys hystricis*, the fourth most abundant species overall, was present at all stations with the exception of the closest to ANP (200 m distant) and *Terebellides stroemi* was present in very low numbers at all stations beyond 500 m from ANP. The seapen *Virgularia mirabilis* was recorded in low numbers from stations 800 m from ANP, while individual *Pennatula phosphorea* were recorded in samples at 800 m, 2,500 m and 5,000 m from ANP. The SADIE pipeline route habitat assessment identified (at Station 1) faunal burrows, seapens (*Virgularia mirabilis* and *Pennatula phosphorea*), unidentified fish, starfish (*Astropecten irregularis*), burrowing anemone (*Cerianthus lloydii*) and hermit crab (*Paguroidea*) [12]; the faunal assemblage present was typical of the sediment present.
Marine mammals	Minke Whale, Common Bottlenose Dolphin, White Beaked Dolphin, and Harbour Porpoise have been recorded in the Alba area [21].
Seabirds	The following species have been recorded in the wider area: Atlantic Puffin, Black-legged Kittiwake, Guillemot, Razorbill. The Seabird Oil Sensitivity Index (SOSI) lists 6 of the 12 months as low sensitivity, with 4 of the remaining months classed as low, based on the adjacent moth method, leaving 2 months for which there is no data. Alba is located approximately 210 km from the nearest coast and is remote for sensitive seabird breeding areas on the coast although some breeding bird species (e.g. fulmar) present at these colonies can forage distances that would include the Alba area.
Commercial fishing	The Alba field is located in ICES rectangle 45F1. Although pelagic fishing activities used to be more prominent, since 2017 the demersal and shellfish activities have been prevalent. In 2022, demersal fishing activity in the area accounted for 0.37% of the UK total landings – a slight decrease on 2021 landings, while shellfish accounted for 1.09%, which was a slight increase on 2021 data.
Other offshore industries	Alba is in the north of the central North Sea oil and gas development area with several fields nearby. There are no windfarms nearby.

4.2 Potential environmental impacts and their management

There will be some planned environmental impacts arising from the sail away of the Alba FSU and the decommissioning of the associated appurtenances. Long-term environmental impacts from the decommissioning operations are expected to be low. Incremental cumulative impacts and trans-boundary effects associated with the planned decommissioning operations are also expected to be low.

Ithaca understands the importance of minimising potential for environmental impact in line with safety and technical feasibility issues and will consider how engineering decisions reached for the sail away of the Alba FSU can be made to limit the impact accordingly. Where design decisions cannot alone do this, Ithaca will develop measures to limit the extent of any potential impact. It is acknowledged that environmental permits and approvals will be required.

Table 4.2.1: Environmental Impacts

Activity	Main impacts	Mitigations
FSU sail away	Energy and emissions to air. These are presented in section 4.3.	Refer Table 4.4.1 below.
Recovery of mooring lines	Recovery of the mooring lines at twelve locations will result in temporary disturbance of the seabed from their laydown on the seabed when initially disconnected from the FSU and subsequently recovered for removal by the AHV. This disturbance will include physical impact and the suspension of seabed sediment. Such disturbance will be of short duration and localised in nature to the mooring line laydown areas; some of this area will overlap with areas previously disturbed from catenary action of the mooring lines during operational field life. Note, currents at the FSU location are weak and lateral movement or scour of the mooring lines after laydown are not anticipated; seabed disturbance will be within the initial laydown corridor until recovery by the AHV shortly after. On average the length of each mooring line is ~679 m (12x). If a conservative buffer zone of ~5 m is assumed for each line, as a worst case the total area of seabed directly impacted would be ~40,727 m^2. The volumes and areas of seabed disturbed from decommissioning of the mooring lines, will be localised to these areas with rapid faunal recolonisation of disturbed sediments expected. Seabed disturbance will also occur where the mooring chains are cut and where the cut ends are buried. Burial of the cut end of the mooring chain to 1 m below the seabed will result in an estimated volume of seabed disturbed equivalent of 12 x 4.7 m^3 = 56.5 m^3; For the -1 m option relatively small or no berms would be created. All seabed disturbance will result in direct physical effects which may include mortality as a result of physical trauma, smothering and re-suspended sediment. Species identified during surveys are typical of these circalittoral mud habitats and described in Table 4.1.1 above. The response of benthic macrofauna to physical disturbance has been well characterised, with increases in abundance of small opportunistic fauna and decreases in larger more specialised fauna (e.g. [4], [5], [25], [29]. The duration of effects on benthic community structure are related to individual species' biology and to successional development of community structure. The seabed species recorded in the Alba area are known or believed to have short lifespans - a few years or less, and relatively high reproductive rates, indicating the potential for population recovery, typically between 1 to 5 years [21], such that any effect will be temporary. Mortality of pennatulid sea pens (*Virgularia spp.* and *P. phosphorea*), may be high following physical disturbance, but crustaceans are probably able to restore burrow entrances following limited physical disturbance of the sediment surface (a few cm). *P. phosphorea* spawns annually and its fecundity is high [4], information on the reproduction of *Virgularia spp* is	Following comparative assessment the proposal is to cut the chains at seabed level and bury the remaining ends so that they are at least 1 m below seabed rather than cut the chains 3 m below seabed. Rock will not be required for a shallower burial. The FSU and the mooring system is not located within a conservation designated area, the closest of these being 24 km away. The habitat present at Alba is widespread and the overall footprint of seabed disturbance from recovery of the mooring lines in relation to the wider presence of this habitat is very small. Refer "Seabed disturbance" in Table 4.4.1 below.

Table 4.2.1: Environmental Impacts		
Activity	**Main impacts**	**Mitigations**
	sparse but based on its wide distribution and abundance is considered likely to be similarly fecund. [14] suggest that re-establishment of pennatulids is likely to take in excess of five years due to their slow growth rate (based on the Arctic species *Halipteris willemoesi*). Any mortality of seabed species will be localised to the mooring line laydown locations, and excavated areas. Any potential impacts will be fully assessed in the environmental assessments submitted in conjunction with the relevant environmental permit requirements.	
Anchor piles	Given the depth to the top of the anchor piles is expected to be 10 m, these will be decommissioned by being left *in situ*.	Taking this approach will result in the least environmental impact.
Disconnection and recovering dynamic flexible risers and removal of clump weight	Recovery of the three risers will result in the suspension of seabed sediment. Such disturbance will be of short duration and localised in nature. As a temporary measure the risers may be laid down on the seabed as part of the recovery operations. The length of each of the production and diesel risers is PL927 – 427.3 m, PL927A – 412 m and PL928 – 407.6 m). If a buffer zone of 5m is assumed for each of the three risers, as a worst case the total area of seabed directly impacted would be ~6,234 m^2. The plan dimensions of the clump weight are 7 m x 7 m. If we assume a buffer zone of 5 m for the clump weight, the area of seabed directly impacted will be ~289 m^2. The combined area of seabed impacted by the removal of the risers and clump weight will be ~6,523 m^2. Subject to detailed engineering and design the MWA may either be recovered directly or would be laid down on the seabed. If laid down on the seabed, ss a contingency, assume a 5m buffer zone all around the MWA (12.6 m x 9.85 m) and assume a 5m buffer zone for the anchor chain (~69 m long). On this basis the area of seabed impacted by contingency operations would be ~794m^2. (MWA – 449 m^2, chain 345 m^2)	Refer "Seabed disturbance" in Table 4.4.1 below.
Post sail away seabed verification	Potential seabed interaction, including short-term disturbance to the seabed.	Refer "Seabed disturbance" in Table 4.4.1 below.
Onshore disposal[1]	Energy and emissions to air; potential recycling of materials and disposal of small quantities of material to landfill.	Refer Table 3.4.1 and use of onshore dismantling sites.

The combined area of seabed impacted by decommissioning of the mooring lines (40,740 m^2) and the removal of the risers and clump weight (6,523 m^2) is 47,263 m^2. As a contingency measure the area of seabed impacted the temporary laydown of the MWA and anchor chain is calculated to be an additional ~794 m^2 giving a total of 48,057 m^2.

A summary of mitigation and control measures including more general mitigation measures is presented in Table 4.4.1.

4.3 Atmospheric emissions

Concerns regarding climate change has prompted increasing stakeholder concern regarding the anthropogenic impacts on the environment such as atmospheric emissions and the potential contribution of these greenhouse gas (GHG) emissions to climate change.

The quantification and impact assessment of the emissions is presented in this section of the DPs

[1] 'Onshore disposal' assumes that the FSU has not been reassigned for use elsewhere.

represents atmospheric emissions associated with the proposed Alba FSU decommissioning activities

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

On a local scale, emissions such as sulphur oxides (SO_x), nitrogen oxides (NO_x / NO_2) and carbon monoxide (CO) may affect air quality. These emissions may be assessed against any local air quality guidelines to understand the potential magnitude of impact on human health and the environment.

4.3.1 Description and quantification of impacts

The emissions of relevant GHGs, for which the Global Warming Potentials (GWPs) have been calculated from the estimated total amount of fuel that will be required by vessels in Table 4.3.1. Vessel emissions for combustion gases other than CO_2 were converted into an overall CO_2e using their GWP_{100} as defined by the IPCC. The emissions of individual GHGs were then summed to a single value of CO_2e, to describe different GHGs in a common unit (Table 4.3.2). 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 Alba FSU decommissioning vessel activities with total UKCS emissions and the UK carbon budget.

Table 4.3.1: Alba FSU decommissioning vessel activity

Activity	Vessel	Duration (days)	Fuel use (Te)
FSU and tow to port	AHV, HCT, SKT	20.5	316
FSU station keeping, disconnection of mooring lines and risers, and recovery of riser systems incl. MWA and clump weight	CSV, DSV,HCT, SKT	107.5	2,029
Recovery of mooring lines	AHV	16.5	347
	TOTAL	**144.5**	**2,692**

NOTES

1. Quantity of fuel is either based on [18] or project estimates.
2. Vessel days include mobilisation, demobilisation, transits to and from port and in-field working days and are included in the activities for disconnection of the mooring lines and risers and recovery of the riser systems.
3. At the time of writing it has not been established whether diving activities will be required. This requirement will be established during detailed design. The vessel durations included here assume that diving activities will be required.

Table 4.3.2: Environmental impact – pollutants due to vessel activity

Fuel (Te):	2,692	CO_2	CO	NOx	N_2O	SO_2	CH_4	VOC
Factor for emissions (Te) per Te of fuel [18]:		**3.17**	**0.0157**	**0.059**	**0.00022**	**0.012**	**0.00018**	**0.0024**
Sub-total (Te)		8,532.1	42.3	158.8	0.59	32.3	0.48	6.46
CO_2e factor [19]:		**1**	**1.6±0.5**	**15.6±5.8**	**265**	**n/a**	**30.0**	**5.6±2.8**
CO_2e: (sub-total x CO_2e factor):		*8,532.1*	*67.6*	*2,477.3*	*156.9*	*n/a*	*14.5*	*36.2*
CO_2e (SUB-TOTAL):		***11,285***	*Attributed to vessel activity, based on mid-range CO_2e factors [19].*					

In 2022, UK shipping emissions were 12MTeCO_2e which is equivalent to 3% of UK emissions in 2022 [2]. The vessel activity associated with the DPs contained herein are the equivalent of 0.094% of UK shipping emissions in 2022, or less than 0.003% of UK total emissions in 2022.

4.4 Mitigation and control measures

Table 4.4.1: Summary of mitigation and control measures
General and Existing
• Lessons learnt from previous FPSO sail away scopes - where available, from other operators will be reviewed and implemented where available. • Vessels will be managed in accordance with Ithaca's Marine Assurance Standard. • The vessels' work programme will be optimised to minimise use of vessels. • The OPEP is one of the controls included in a comprehensive management and operational controls plan developed to minimise the likelihood of large hydrocarbon releases and to mitigate their impacts should they occur. • All vessels undertaking decommissioning activities will have an approved ship-board oil pollution emergency plan (SOPEP). • Existing processes will be used for contractor management to assure and manage environmental impacts and threats. • The respective company management of change process will be followed should changes of scope be required.
Underwater Noise
• A SIMOPS plan for vessel activity in the field will be put in place. • Vessel, riser cutting operations will use standard methods and equipment. No explosives will be used.
Discharges and Small Releases to Sea
• All contracted vessels will operate in line with IMO and MARPOL regulations. • If not already done so, all pipelines and spools are to be flushed, filled with seawater, and isolated prior to disconnection. • All discharges will be permitted under applicable UK legislation.
Accidental Events
• All contracted vessels will have a SOPEP in place. • A Collision Risk Management Plan will be developed and implemented. • Agreed arrangements in place with oil spill response organisation for mobilising resources in event of a spill. • Existing field OPEP in place to reduce the likelihood of hydrocarbon release and define spill response in place. • Lifting operations will be planned to manage the risk. • Recovery of any dropped objects will take place. • Vessel contactors will have procedures for fuel bunkering that meet Ithaca's standards. • Where practicable, re-fuelling will take place during daylight hours only.
Physical presence of Vessels and infrastructure
• All vessels will comply with standard marking conditions and consent to locate conditions. • If required, a specific SIMOPS plan for vessel activity in the field will be put in place, noting that a standard DSV SIMOPS Guideline already exists for the asset. • The Alba FSU 500m safety zone will remain in place until the vessel (FSU) has departed. • Following departure of the FSU, the 500m safety zone will meantime be surveyed for oil and gas debris. However, the 500m zone area will not be subject to full survey until the wider Alba ANP-FSU bundle decommissioning activities have been completed. The survey findings will be described in the close out report. • The Alba FSU will depart the field with the mooring systems decommissioned before the risers and MWA, chain and clump weight have been removed, and infrastructure such as the Pipeline End Manifold (PLEM) for the ANP to FSU bundle will remain in place until it is decommissioned in future. With the FSU no longer being on location, the 500 m safety zone will be relinquished, and so it is recognised that the MWA, chain and clump weight (until they are removed later in the decommissioning campaign) and PLEM will present a hazard to other users of the sea. Therefore, Ithaca will adopt appropriate safety measures to protect mariners from these assets until they are decommissioned sometime in future. The safety measures could include an application for a new 500m subsea safety zone around the PLEM, a guard vessel, use of a virtual Automatic Identification System (AIS) and Emergency Response and Rescue Vessel (ERRV), a Cardinal Buoy with AIS or a mixture of these depending on location and suitability of local surface installations. • The remaining Alba infrastructure will meantime remain 'as is' in the interim period between departure of the Alba FSU and final clearance of the 500m safety zone following decommissioning of the wider Alba field.
Energy Use and Atmospheric Emissions
• Time vessels spend in the field will be optimised, with a SIMOPS plan in place; • Reuse or recycling of materials will be the preferred option. • All material taken onshore will be handled by licenced waste management contractors at sites that hold Environmental Permits or Pollution Prevention Control (PPC) permits.

Table 4.4.1: Summary of mitigation and control measures
Waste Production
• Onshore treatment will take place at waste management site with appropriate permits and licenses. • UK waste disposal sites will be used where practicable. • A Waste Management Plan for the DPs will be prepared and implemented in line with the Waste Framework Directive. • All waste will be managed in compliance with relevant waste legislation by a licenced waste management contractor. • As part of Ithaca's standard processes, all sites and waste carriers will have appropriate environmental and operating licences to carry out this work and will be closely managed within Ithaca's contractor assurance processes.
Remaining Infrastructure
• Monitoring will be performed as per usual for the remaining pipeline infrastructure while they remain operational or until they are formally decommissioned. • A notice to mariners will be issued prior to operations commencing to give vessels advance warning of the decommissioning operations. • Kingfisher bulletins issued prior to operations commencing.
Transboundary
If waste is shipped internationally, the Alba FSU Waste Management Plan will present the responsibilities Ithaca has under the 'Duty of Care' legislation and identify appropriately licenced international onshore facilities where the waste can be treated.
Seabed Disturbance
• Activities which may lead to seabed disturbance will be planned, managed, and implemented in such a way that disturbance is minimised as far as practical, in practical terms, this includes controlled lowering of the mooring lines at disconnect and during recovery through controlled manoeuvring, such that lateral movement is minimised, thereby minimising seabed impact. • Decommissioning activities will be undertaken by vessels under dynamic positioning, such that anchors will not be deployed, thus minimising seabed disturbance, • A Marine Licence will be in place for any planned operational disturbance and any potential impacts will be assessed and addressed in the environmental assessment submitted in conjunction with the marine licences. • Seabed disturbance effects will be temporary (with the exception of rock, if this is used to remediate excavated areas) with the footprint localised to areas of laydown and excavated areas (where cut chain ends have been buried). Debris survey undertaken on completion of the activities including a survey of the anchor pile locations. • Minimising disturbance to seabed from overtrawl through liaison with fishing organisations and regulator.
Large Releases to Sea
• All vessel activities will be planned, managed, and implemented in such a way that vessel durations in the field are minimised. • The respective company's existing marine standard will be followed to minimise risk of hydrocarbon releases.

5. INTERESTED PARTY CONSULTATIONS

5.1 Consultation Summary

Table 5.1.1: Summary of Stakeholder Comments		
Who	**Comment**	**Response**
INFORMAL CONSULTATIONS		
NIFPO		
NFFO		
SFF	The decommissioning proposals for the Alba FSU and associated infrastructure were presented and discussed with SFF on 21 Mar 2024.	SFF offered no adverse comments on the decommissioning proposals, with the following notes agreed for reference: • SFF keen to emphasise that a chain mat is used more for remedial activities or where there is a concern that snag hazards are known to exist. More usually standard fishing gear is used for trawl sweeps. • Trawl sweeps – SFF would advise that these are not essential for areas where buried pipelines outside the 500m safety zone have been exposed to fishing, but SFF would have a preference for trawl sweeps to be conducted in areas where decommissioning activities have been conducted. • Scour marks due to mooring lines should be assessed for remedial works, possibly involving the deposition of rock. • Alba FSU departure 500m zone safety proposals with regards to use of virtual AIS and ERRV. SFF had no adverse comment. SFF would not support use of cardinal buoy(s) alone. • Ithaca to consider implementing a Safety Advisory Zone for the FSU Bundle Towhead once considered a viable alternative. • SFF advised that an updated version of FishSAFE is being rolled out; this gives continuous updates online rather than updates on a USB stick every 6 months.
Section 29 Holders		
STATUTORY CONSULTATIONS		
GMG	This part of the table will be completed following the formal Statutory Consultation.	This part of the table will be completed following the formal Statutory Consultation.
NFFO		
SFF		
NIFPO		
NSTA		
Public		

6. PROGRAMME MANAGEMENT

6.1 Project management and verification

An Ithaca project management team will manage the operations of competent contractors selected for all decommissioning activities. The team will ensure the decommissioning is executed safely, in accordance with legislation and Ithaca's Health and Safety principles. In the unlikely event that changes to the DPs are required, they will be discussed with OPRED with any necessary approvals sought.

6.2 Post-decommissioning debris clearance and verification

The Alba FSU installation site and it's 500 m safety zone including the remaining parts of the mooring chains and the anchor pile locations will be subject to verification of a clear seabed.

Once the Alba FSU has departed with the mooring lines and risers removed and the anchor piles decommissioned, infrastructure such as the PLEM, which is the towhead for one end of the ANP to FSU bundle will remain in place until it is decommissioned in future. With the FSU no longer being on location, the 500 m safety zone will be relinquished, and so it is recognised that the PLEM will present a hazard to other users of the sea. Therefore, Ithaca will adopt appropriate safety measures to protect the PLEM until it is decommissioned sometime in future. The safety measures could include application for a new 500m subsea safety zone around the PLEM, a guard vessel, use of a virtual AIS and ERRV, a Cardinal Buoy with AIS or a mixture of these depending on location and suitability of local surface installations. A risk assessment shall be carried out to determine the most appropriate solution. The proposed solution will be discussed and agreed with the SFF and they will remain in place until the wider Alba infrastructure has been decommissioned. The safety measures will also be discussed and agreed with OPRED.

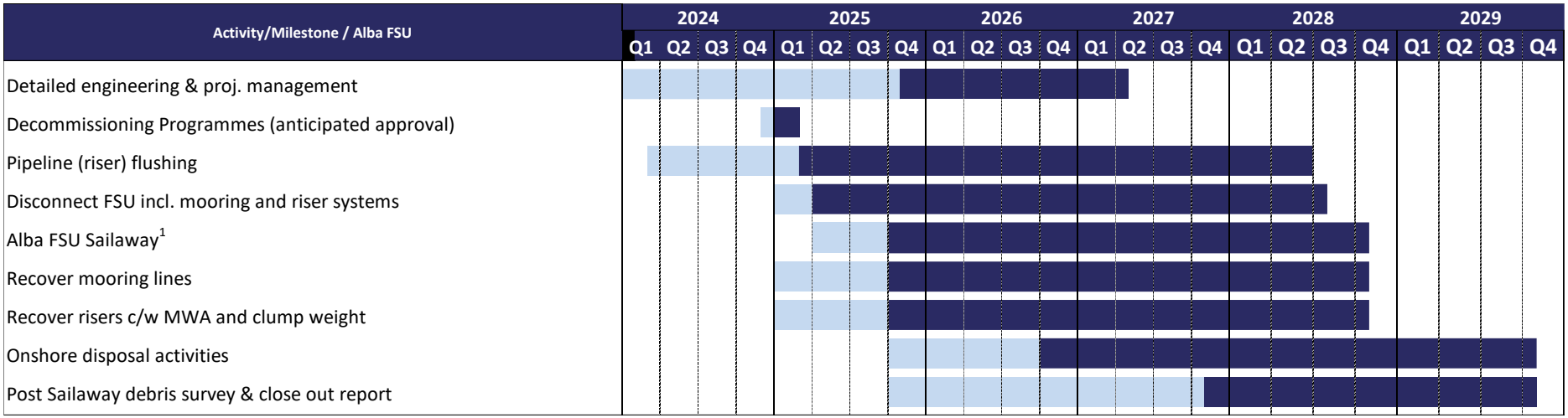
As infrastructure will remain, it would not be possible to demonstrate that the whole of the 500m zone would be clear of infrastructure and oil and gas debris. Therefore, Ithaca would propose to work with OPRED and SFF to investigate use of an evidence-based approach to establish an acceptable clear seabed for infrastructure that has been removed from the existing 500 m safety zone.

Any seabed oil and gas debris will be recovered for onshore disposal or recycling in line with existing disposal methods.

6.3 Schedule

A proposed schedule is provided in Figure 6.3.1. The activities are subject to the acceptance of the DPs presented in this document and any unavoidable constraints (e.g. vessel availability) that may be encountered while executing the decommissioning activities. Therefore, activity schedule windows have been included to account for this uncertainty.

The commencement of offshore decommissioning activities will depend on commercial agreements and commitments.



Notes / Key

Earliest potential activity

Activity window to allow commercial flexibility associated with the decommissioning activities

1. As the APN-FSU bundle and PLEM will remain within the 500m zone the extent of the debris survey will need to be limited for practical reasons.

Figure 6.3.1: Gantt Chart of project plan

6.4 Costs

Decommissioning costs will be provided separately to OPRED.

6.5 Close out

Only the Alba FSU, its mooring system and the three risers including the MWA and its clump weight are being decommissioned at this time. Therefore, post-decommissioning surveys will be limited to 'as-left' surveys inside the FSU 500 m zone and the anchor piles. The findings will be included in the Close Out report as required in the OPRED Guidance Notes. Subject to agreement with OPRED environmental surveys will not be completed following sail away of the FSU and removal of the risers but will be completed once the wider Alba infrastructure and facilities have been decommissioned. The report will explain any variance from the DPs.

6.6 Post-decommissioning monitoring and evaluation

After sail away of the Alba FSU has been completed the exposed sections of the mooring lines will have been removed, with the remaining cut ends buried *in situ*. The anchor piles will be decommissioned *in situ*. The three flexible dynamic risers along with the mid-water arch, clump weight and chain will have been completely removed. The ANP to FSU pipeline bundle will remain in place along with the PLEM, and these will be decommissioned sometime in the future. As proposed in section 6.2, in agreement with key stakeholders, Ithaca will implement appropriate safety measures. As explained in section 6.2 these safety measures will also be discussed and agreed with OPRED.

Future monitoring and survey commitments for the buried sections of mooring chains will be discussed and agreed with OPRED during the acceptable of the Close Out Report.

Residual liability associated with the infrastructure remaining in place or not being decommissioned at this time will remain with the Section 29 notice holders identified in section 1.4.2. Unless agreed otherwise in advance with OPRED, Ithaca will remain the focal point for such matters, such as any change in ownership, for example.

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APPENDIX A PUBLIC NOTICES

APPENDIX B CORRESPONDENCE WITH STATUTORY CONSULTEES

APPENDIX C LETTERS OF SUPPORT