



# **Brynhild Decommissioning Programme Final**

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**26 May 2020**

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## Document Control

### Approvals

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## Terms and Abbreviations

Abbreviation	Explanation
AS	Aksjeselskap
BAT/BEP	Best Available Techniques / Best Environmental Practices
CA	Comparative Assessment
C&P	Contracting and Procurement
CNS	Central North Sea
CoP	Cessation of Production
DP	Decommissioning Programme
DPN	Disused Pipeline Notice issued by DTI, DECC
EA	Environmental Appraisal
e.g.	for example (exempli gratia)
ENVID	Environmental Impact Identification
EUNIS	European Nature Information System
FEED	Front End Engineering Design
FJSS	Flexible Jumper Support Structures
FPSO	Floating Production Storage Offloading
GRP	Glass Reinforced Plastic
GMS	Global Marine Systems Limited
GVI	General Visual Inspection
ICES	International Council for Exploration of the Sea
IRM	Inspection, Repair, Maintenance
ITS	Integrated Template Structure
JNCC	Joint Nature Conservation Committee
km	Kilometre
Lundin	Lundin Energy Norway AS
m	Metre
m <sup>2</sup>	Square Metres
m <sup>3</sup>	Cubic Metres
mm	Millimetre
MAT	Master Application Template
MCZ	Marine Conservation Zone
MDS	Main Drill Site
Msm <sup>3</sup>	Million Standard Cubic Metres
NCMPA	Nature Conservation Marine Protected Area
NMPi	National Marine Plan interactive

NNW	North North West
NORM / LSA	Naturally Occurring Radioactive Material / Low Specific Activity
NCS	Norwegian Continental Shelf
N/A	Not Applicable
OD	Outside Diameter
ODU	Offshore Decommissioning Unit
OGA	Oil and Gas Authority
OGUK	Oil and Gas UK
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	from Oslo/Paris, the Convention for the Protection of the Marine Environment of the North East Atlantic
OSPAR 2006/5	OSPAR Recommendation on a Management Regime for Offshore Cuttings Piles
PIP	Pipe in Pipe
PL	Pipeline
PLET	Pipeline End Termination
PFM	Priority Marine Feature
PVA	Particularly Valuable Area
PWA	Pipeline Works Authorisation
P&A	Plug and Abandon
Q	Quarter
RBM	Riser Base Manifold
RBS	Riser Base Structure
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SEPA	Scottish Environmental Protection Agency
SFF	Scottish Fishermen's Federation
SIMOP	Simultaneous Operations
SNH	Scottish Natural Heritage
SOPEP	Shipboard Oil Pollution Emergency Plan
SPS	Subsea Production System
SSS	Side Scanner Sonar
SW	South West
S29	Section 29
Te	Tonnes
TFSW	Trans Frontier Shipment of Waste
UKCS	United Kingdom Continental Shelf
WI	Water Injection

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## **1 EXECUTIVE SUMMARY**

### **1.1 Decommissioning Programme**

This document contains the Decommissioning Programme (DP) for the two pipelines and one umbilical that make up the Brynhild Field that tie back to the Haewene Brim Floating Production, Storage and Offloading (FPSO) vessel serving the Pierce Field. The Brynhild pipelines are operated by Lundin Energy Norway AS (herein after referred to as Lundin). Bluewater (Haewene Brim) N.V. is the Operator and Duty Holder of the Haewene Brim FPSO, whilst Shell and partners (see below) are the Pierce Field licence holder.

Pierce Field Licence Holders:

- Shell EP Offshore Ventures Limited
- Shell Upstream Overseas Services (I) Limited
- Enterprise Oil Limited
- Ithaca Energy (UK) Limited

The DP covers the Brynhild infrastructure in the United Kingdom Continental Shelf (UKCS) only as the infrastructure in the Norwegian Sector is covered by a separate Disposal Plan already submitted to the Norwegian Regulators.

A summary of the pipelines and umbilical is provided and detailed in the Tables in Section 1.4.2 below.

### **1.2 Requirement for Decommissioning Programme**

#### **Installations**

There are no surface installations covered by this DP, the Brynhild development consists of a subsea tie-back to the Haewene Brim FPSO located in the Pierce field. The FPSO will continue to operate after decommissioning of the Brynhild Field and the DP for the FPSO will be the responsibility of the FPSO licence holders at the appropriate time (See also Section 8 - Partner Letters of Support).

#### **Pipelines**

In accordance with the Petroleum Act 1998, the S29 notice holders of the Brynhild Field pipelines (see Table 1.5) are applying to OPRED to obtain approval for decommissioning the pipelines, umbilical and associated subsea structures detailed in Section 2.3 of this programme.

In conjunction with public, stakeholder and regulatory consultations, the DP is submitted in compliance with national and international regulations and OPRED guidelines. The schedule outlined in this document is for a decommissioning project of some two years covering selection and definition of options and execution, due to begin in Quarter 2 2020.

### **1.3 Introduction**

Brynhild is an oil field located in the southern part of the Norwegian sector in the North Sea, in block 7/7, bridging the border between blocks 7/7 and 7/4. It is located 10 kilometres from the UK sector boundary and approximately 246 kilometres from the Aberdeen coast.

Whilst Brynhild is in the Norwegian Sector, the production pipeline, water injection (WI) pipeline and control umbilical cross over into the UKCS at block 23/22b and connect to Haewene Brim FPSO in block 23/27a which is 12km from the median line crossing (only 12km of each line and the umbilical is within the UKCS). Water depths along the pipeline route varies from 80 m at the Brynhild drill centre to 86.5 m at the FPSO location.

See Figure 1-1 for field location and pipeline route.

Brynhild was developed as a subsea tie-back to the Haewene Brim FPSO. The FPSO is operated by Bluewater (Haewene Brim) N.V. and will continue in operation after the Brynhild tie-back has been decommissioned. The FPSO therefore, does not form part of this DP.

Brynhild consists of four wells (two production wells and two water injection wells), drilled from a single location. The production well stream was transported in a single 6" OD Pipe in Pipe (PIP) pipeline, with 10" OD carrier pipe, to Pierce 38 km from the drill centre. A 6" OD water injection pipeline from Pierce was brought onstream in December 2014 to maintain the pressure in the field.

Control and chemical injection at the field was provided remotely from the Haewene Brim FPSO via a 127mm OD umbilical.

Production commenced in December 2014; with peak production of 0.254927 MSm<sup>3</sup> oil in 2015 and total recovery of 0.491876 MSm<sup>3</sup> oil during field life. Cessation of Production (CoP) occurred on 21 January 2018. The last barrier test of all four wells was conducted 16 June 2018 as the status of the wells was redefined to "Temporarily abandoned without monitoring".

A Service Agreement with the Pierce Operator is in place that provides for monitoring of the wells, the pipeline and the template but the well status is independent of continuous monitoring capability.

Due to capacity challenges on the FPSO, i.e. being unable to process the increased produced water rates being experienced, and when the operator of the FPSO could not present plans for realizing the revised operational conditions for the continued operation of Brynhild, the Brynhild partnership concluded that it was not commercially viable, and that ongoing operation would entail an unacceptable high risk to continuing the production agreement.

As there is no alternative infrastructure in the area that is appropriate to receive and process the remaining Brynhild reserves, the decision to terminate the production agreement was taken; the agreement with the FPSO/Pierce operator and field licence holder was subsequently terminated on 8<sup>th</sup> May 2018.

Studies have been carried out for possible reuse of Brynhild pipelines and umbilical. These studies have highlighted no reuse options in their current location. Re-use of recovered equipment has also been studied, however, there is uncertainty regarding material integrity, for example technical status after recovery and quality of welding. In addition, there is major uncertainty regarding the costs of excavation work on the seabed and recovery of pipelines onto vessel (i.e. Reel-lay vessel).

A feasibility study on the reuse of Brynhild facilities on the Norwegian shelf is positive for the reuse of the subsea template, manifold and valve trees (i.e. re-use after recovery). However, no re-use options for infrastructure in the UKCS has been identified.

As a result, the Brynhild field is currently scheduled for decommissioning between 2019 – 2021. Plugging and abandonment of wells will commence in Q2 2020 and is scheduled for completion by Q3 2020.

The DP explains the proposed decommissioning activities and these proposals are supported by a Comparative Assessment (CA) [Ref: 1] for the pipelines and umbilical and an Environmental Appraisal (EA) [Ref: 2]. The stabilisation features are predominantly rock cover and will be decommissioned in situ; the few mattresses that are exposed in the field will be removed and returned onshore for treatment in line with the waster hierarchy, recycle and disposal.

## 1.4 Overview of Pipeline Systems Being Decommissioned

### 1.4.1 Installations

There are no surface installations associated with Brynhild. Tables below illustrate subsea structures which are part of the pipeline systems in the UK sector (Table 1.1). Subsea structures in the Norwegian sector (Table 1.2) are provided here for reference only as only subsea structures in the UK sector are covered by this DP.

There are no wells in the UK Sector.

Table 1.1: Pipeline Systems Being Decommissioned (UK Sector)			
<b>Field:</b>	Brynhild	<b>Production Type</b>	Oil
<b>Water Depth (m)</b>	86.5 m	<b>UKCS blocks</b>	23/22a and 23/27a
<b>Surface Installations</b>			
<b>Number</b>	<b>Type</b>	<b>Topsides Weight (Te)</b>	<b>Jacket Weight (Te)</b>
0 <sup>1</sup>			
<b>Pipeline Systems and associated materials</b>		<b>Number of Wells<sup>3</sup></b>	
<b>Number<sup>2</sup></b>	<b>Type</b>	<b>Platform</b>	<b>Subsea</b>
1	Pipeline End Termination (PLET)	0	0
2	PLET Support Frames		
3	PLET Protection Covers		
2	Flexible Jumper Support Structures (FJSS) <sup>2</sup>		
2	Riser Base Manifold (RBM) Protection Covers <sup>2</sup>		
<b>Pipeline Systems and associated materials</b>		<b>Distance to median</b>	<b>Distance from nearest UK coastline</b>
		0 km up to 2.4 km	246km
<b>Drill Cuttings pile</b>		<b>Distance to median</b>	<b>Distance from nearest UK coastline</b>
<b>Number of Piles</b>	<b>Total Estimated volume (m<sup>3</sup>)</b>	<b>km</b>	<b>km</b>
0	N/A <sup>3</sup>	N/A	N/A

Notes:

1. Haewene Brim FPSO and the Pierce Field remain operational after Brynhild decommissioning is completed, The FPSO and Pierce subsea infrastructure will therefore be the subject of a separate DP at the appropriate time.
2. The RBM remains operational after decommissioning of Brynhild as part of the Pierce Field infrastructure, the RBM will therefore be the subject of a separate DP at the appropriate time. The protection covers associated with Brynhild tie-ins adjacent to the RBM and infrastructure below the GRP covers are currently within the scope of this DP. i.e. the FJSS associated with the Brynhild pipelines will be removed as part of this DP. The GRP covers will be reinstated, to protect a remaining Pierce field tie-in and will be decommissioned at a later date as part of the Pierce Field DP.

3. There are no wells in the UKCS as the drill centre is in Norwegian Sector.

Table 1.2: Infrastructure being decommissioned (Norwegian Sector)			
<b>Field:</b>	Brynhild	<b>Production Type</b>	Oil
<b>Water Depth (m)</b>	80 m	<b>NCS block</b>	7/7 and 7/4
Surface Installations			
<b>Number</b>	<b>Type</b>	<b>Topsides Weight (Te)</b>	<b>Jacket Weight (Te) <sup>(Note 1)</sup></b>
0			
Pipeline Systems and associated materials		Number of Wells	
Number	Type	Platform	Subsea
1	Integrated Template Structure (ITS)	0	4
2	Subsea Production System (SPS) Template Protection Covers		
1	Manifold		
2	Pipeline End Termination (PLET)		
2	PLET Support Frames		
6	PLET Protection Covers		
4	Flexible Jumper Support Structures (FJSS)		

Infrastructure in the Norwegian sector is provided for reference only and are not covered by this DP. Wells are in the Norwegian sector and are provided for reference only and not covered by this DP.

Table 1.3: Installations Section 29 Notice Holders Details		
Section 29 Notice Holders	Registration Number	Equity Interest (%) <i>If zero show 0%</i>
There are no installations associated with this DP.		

#### 1.4.2 Pipelines and Umbilicals

Table 1.4: Pipelines and Umbilicals Being Decommissioned		
Number of Pipelines	2	(See Table 2.3)
Number of Umbilicals	1	(See Table 2.3)

Table 1.5: Pipelines and Umbilicals Section 29 Notice Holders Details		
Section 29 Notice Holders	Registration Number	Equity Interest (%)
<b>PL3083 (production), PL3084 (Water Injection)</b>		
Lundin Energy Norway AS	986 209 409	51%
CapeOmega AS	995 152 142	49%
Repsol Norge AS	993 787 787	0%
<b>PLU3085 (umbilical)</b>		
Lundin Energy Norway AS	986 209 409	51%
CapeOmega AS	995 152 142	49%
Repsol Norge AS	993 787 787	0%

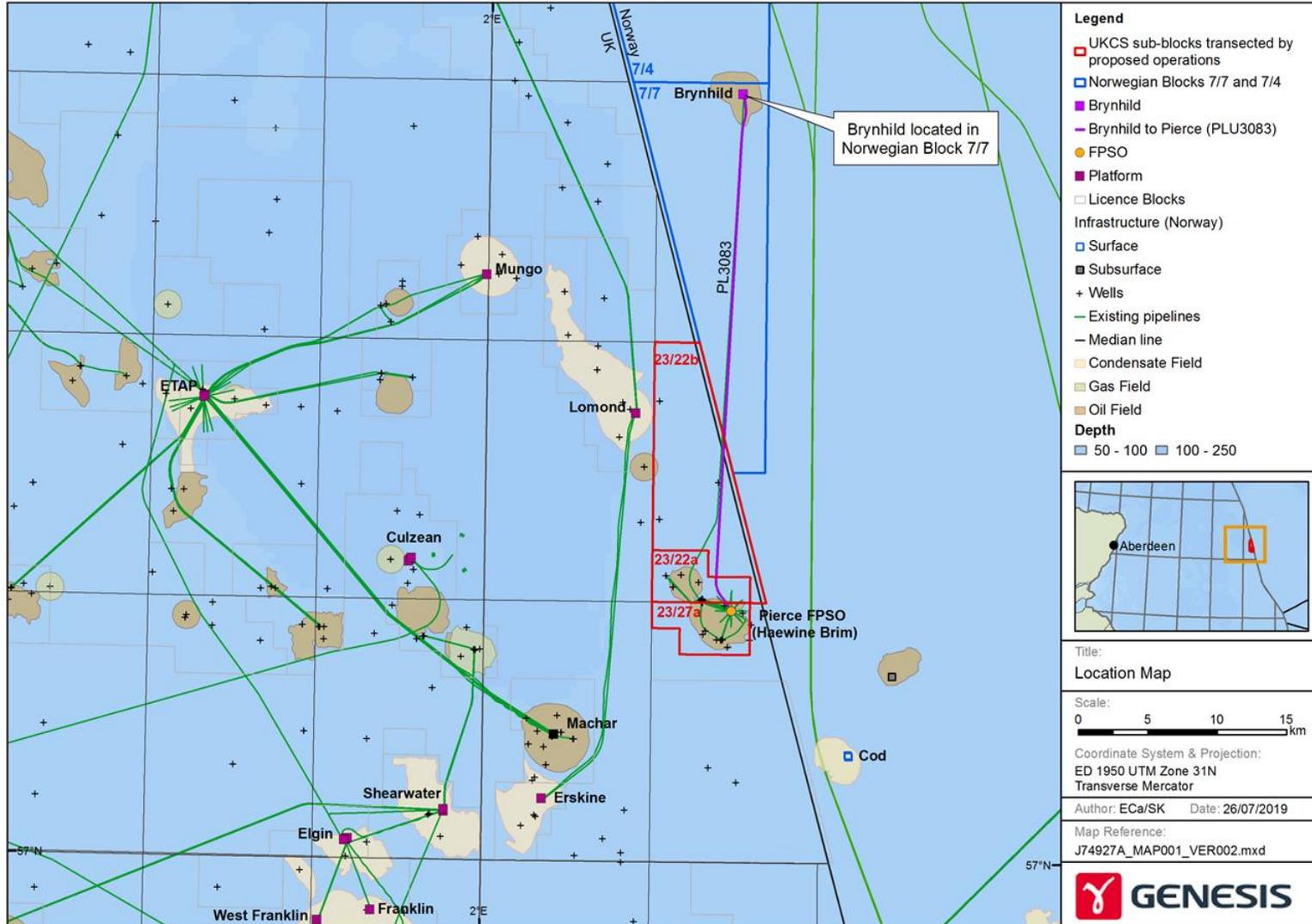
## 1.5 Summary of Proposed Decommissioning Programme

Table 1.6: Summary of Decommissioning Programme		
Selected Option	Reason for Selection	Proposed Decommissioning Solution <sup>1</sup>
<b>1. Topsides</b>		
N/A		
<b>2. Jacket(s) / Floating Facility (FPSO etc)</b>		
N/A	See Notes on Table 1.1	
<b>3. Subsea Installations</b>		
N/A		
<b>4. Pipelines, Flowlines &amp; Umbilical's and Associated Materials</b>		
<p>PL3083/ PL3084/ PLU3085 Decommission in-situ where buried. Remediate any exposed sections.</p> <p>PLET incl. support frames, Glass Reinforced Plastic (GRP) protection covers and materials below the GRP protection covers adjacent to RBM<sup>1</sup> (e.g. jumper spools and FJSS). Complete removal to shore.</p>	<p>All pipelines are trenched and buried for most of their length; there are NO mid line exposures; and will not affect other users of the sea. Pipelines have been flushed and cleaned.</p> <p>To leave a clear seabed. Removes any potential obstruction to fishing operations and maximises recycling of materials.</p>	<p>The trenched and buried sections of pipelines and umbilicals will be decommissioned <i>in situ</i>. Burial depth information provided in Appendix A. The exposed sections at each pipeline end and umbilical will be remediated by either cut with removal to shore, trench and burial or rock cover. The five exposed flexible concrete mattresses will be recovered and returned onshore for treatment in line with the waste hierarchy, recycle/ disposal.</p> <p>Complete removal and recycle/ disposal onshore.</p>
<b>5. Wells</b>		
N/A	Wells are in Norwegian Sector and covered by the Norwegian Disposal Plan	
<b>6. Drill Cuttings</b>		
N/A		
<b>7. Interdependencies</b>		
<p>The GRP cover protecting the approach piping and tie-ins at the RBM<sup>1</sup> also protect a production line serving the Pierce Field, which is to remain in operation. It will be necessary to re-instate the GRP cover at the RBM after the Brynhild jumper spools, umbilical and FLSS below have been decommissioned. In these circumstances final decommissioning the GRP covers at the RBM will become the responsibility of the Pierce Field operator at the time of Pierce decommissioning.</p> <p><sup>1</sup>The RBM is part of the Pierce field infrastructure and is not within the Brynhild DP responsibility.</p>		

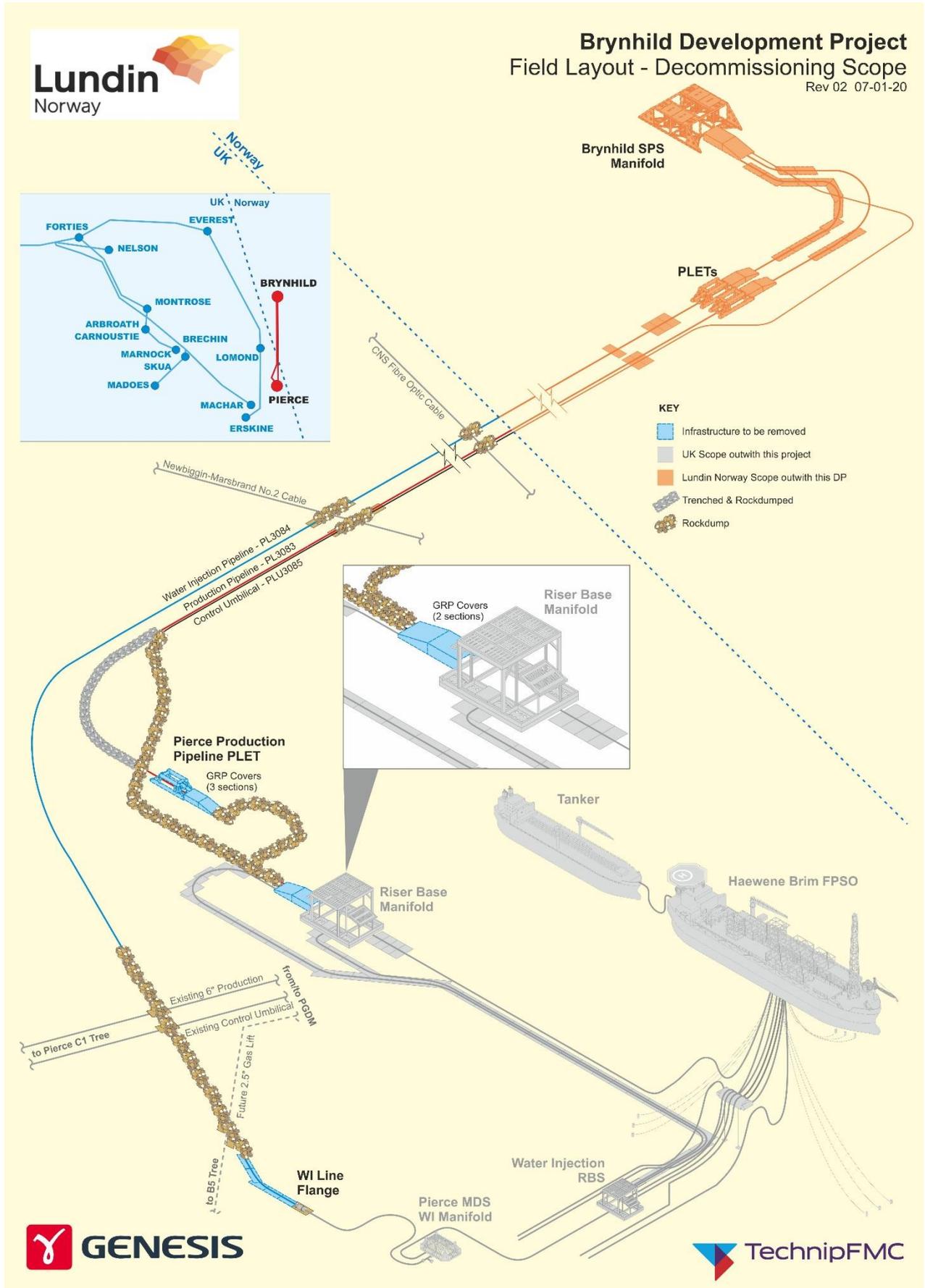
1. Any permit applications required for any work associated with the proposed decommissioning solutions will be submitted as appropriate.

## 1.6 Field Location Including Field Layout and Adjacent Facilities

Figure 1-1: Field Location



**Figure 1-2: Field Layout**



**Table 1.7: Adjacent Facilities**

Owner	Name/Block	Type	Distance/Direction	Information	Status
Enterprise Oil Limited	Pierce 23/27	FPSO	0 – used as ref point		Operational
BP Exploration Operating Company Limited	Machar 23/26a	Subsea wells	15.5km SW	Subsea development with 35km tie-back to ETAP	Operational
Chrysaor Limited	Lomond 23/21a	Platform	15.5km NNW	Fixed steel jacket, manned platform processing Lomond and Erskine Fields	Operational
Ithaca Oil and Gas Limited	PL1257	Pipelines	Running South to North and parallel to the Brynhild lines. 7.5km west of the Brynhild line	24” condensate pipeline Erskine to Lomond	Operational
Ithaca Oil and Gas Limited	Erskine 23/26A	Platform	19km SW	Fixed steel jacket, normally un-manned platform.	Operational

**Impacts of Decommissioning Proposals**

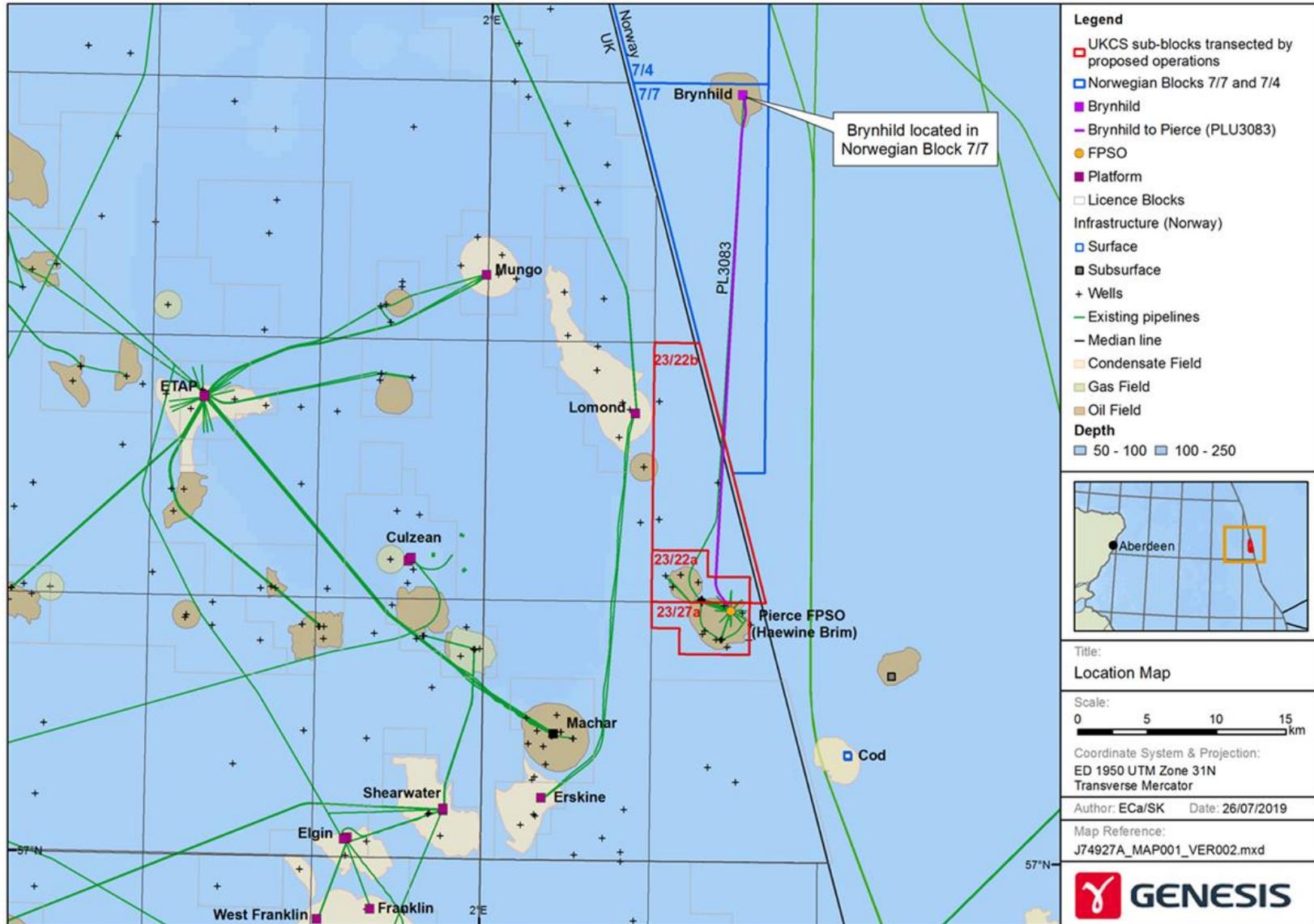
No Impact is anticipated on Machar, Lomond and Erskine infrastructure and PL1257, either during execution of the decommissioning project or upon completion of the decommissioning.

There are interfaces to be managed with the Operator of the Pierce field as most of the decommissioning work is to be carried out within the Pierce 500m exclusion zone. The interfaces are being managed between Lundin and the Pierce Operators by regular interface meetings. Responsibility for decommissioning of shared facilities (e.g. GRP covers) has been decided. See Table 1.6, section 7 for more detail.

There are pipeline/ cable crossings associated with a CNS fibre optic cable and a Newbigging – Marsbrand cable inside the UKCS, both cables cross underneath both Brynhild pipelines and umbilical see Figure 1.2. The cables are trenched and buried and at the point where the crossings occur are rock covered and are intended to be decommissioned in-situ. There is therefore no impact to the existing cables at these crossings.

There is an existing 6” production line and control umbilical associated with the Pierce Field that are trenched and buried and cross below PL3084 (WI Pipeline) see Figure 1.2. The point where the crossings occur are rock covered and PL3084 is intended to be decommissioned in-situ. There is therefore no impact to the Pierce pipeline and umbilical at these crossings.

**Figure 1-3: Field Nearby Developments**



The closest operative field is the Lomond Gas field, located approximately 5 km to the West of the Brynhild pipelines/umbilical.

On the UKCS the Brynhild pipelines/umbilical crosses blocks 23/22a and 23/27a, both operated by Shell (the Pierce operator). In block 23/22a there is one abandoned well close to the pipeline routes, the well location has been observed on the surveys and is 3 kilometres northwest of the Brynhild field.

## 1.7 Industrial Implications

It is Lundin’s intention to develop a contract strategy that will result in an efficient and cost-effective execution of the decommissioning works. Lundin will also try to combine Brynhild decommissioning activities with other developments or decommissioning activities to reduce mobilisation and demobilisation costs should the opportunity arise. Geographic locations of potential disposal yard options may require the consideration of Trans Frontier Shipment of Waste (TFSW), including hazardous materials. Where this is the case, the relevant permits/licences will be sought. The decommissioning schedule is extended to allow flexibility for when decommissioning operations are carried out and completed.

Lundin will demonstrate this intention by:

- Publishing information on the decommissioning project and timelines on its decommissioning website;
- Working closely with the OGA and other industry bodies in engagement sessions with the decommissioning supply chain on issues relating to the DP and timelines, including engaging directly with disposal yards that serve the North Sea;
- Competitively tendering all removal scopes, including the onshore disposal scope;
- Aligning supply chain and decommissioning activity, wherever possible, with Operators of adjacent infrastructure to optimise efficiencies and cost reduction.

## 2 DESCRIPTION OF ITEMS TO BE DECOMMISSIONED

### 2.1 Installations : Surface Facilities (Topsides/Jackets)

Table 2.1: Surface Facilities Information								
N/A no surface facilities associated with this DP								
Name	Facility Type	Location		Topsides/Facilities		Jacket (if applicable)		
				Weight (Te)	No of modules	Weight (Te)	Number of legs	Number of piles
N/A								

### 2.2 Installations: Subsea including Stabilisation Features

Table 2.2: Subsea Installations and Stabilisation Features				
N/A no subsea installations associated with this DP				
Subsea installations including Stabilisation Features	Number	Dimensions (m)/ Total Weight (Te)	Location	Comments/Status
N/A				

## 2.3 Pipelines Including Stabilisation and other Features

The Tables below have been split into Pipelines/ Umbilicals and stabilisation features. Only Tables 2.3 and 2.5 are covered by this DP. Tables 2.4 and 2.6 covers infrastructure in the Norwegian Sector and is provided for reference only.

Table 2.3: Pipeline/Flowline/Umbilical Information (UK sector)									
Description	Pipeline Number (as per PWA)	Diameter (inches)	Length (km)	Description of Component Parts	Product Conveyed	From – To End Points	Burial Status <sup>2</sup>	Pipeline Status	Current Content
Production Pipeline	PL3083	6" OD/ 10" OD PiP	11.970	6" production pipeline (DNV 13%Cr2.5Mo FPD) in a 10" Carbon steel Carrier pipe (DNV415PD)	Oil	From UK Median Line to Pierce production Pipeline PLET	Trenched and buried with some areas of rock cover	Out of use	Treated Freshwater
Production Flexible Jumper	PL3083	6" ID	0.138	6" ID flexible with Cofoam MO01 insulation	Oil	From PLET structure to RBM	Rock covered	Out of use	Treated Freshwater
Water injection line	PL3084	6" OD	12.280	6" OD x 11mm w.t. pipeline (DNV450FPD) with 3mm 3LPP insulation	Water	WI Line tie-in flange to UK Median Line	Trenched and buried plus mattress covered with some areas of rock cover	Out of use	Inhibited seawater
Control Umbilical	PLU3085	127mm OD	12.063	Plastics & misc. coatings/Carbon Steel/ Corrosion Resistant Alloy/ Copper	Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua	From UK Median Line to RBM	Trenched and buried with some areas of rock cover	Out of Use	Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua

**Table 2.4: Pipeline/Flowline/Umbilical Information (Norwegian sector)**

Description	Norwegian Pipeline Number	Diameter (inches)	Length (km)	Description of Component Parts	Product Conveyed	From – To End Points	Burial Status <sup>2</sup>	Pipeline Status	Current Content
Production Pipeline	PL148 <sup>1</sup>	6" OD/ 10" OD PiP	25.027	6" production pipeline (DNV 13%Cr2.5Mo FPD) in a 10" Carbon steel Carrier pipe (DNV415PD)	Oil	From Brynhild SPS Manifold to UK median line	Trenched and buried	Out of use	Treated Freshwater
Water injection line	PL148 <sup>1</sup>	6" OD	24.968	6" OD x 11mm w.t. pipeline (DNV450FPD) with 3mm 3LPP insulation	Water	From UK median line to Brynhild SPS Manifold	Trenched and buried	Out of use	Inhibited seawater
Control Umbilical	PL148 <sup>1</sup>	127mm OD	25.285	Plastics & misc. coatings/Carbon Steel/ Corrosion Resistant Alloy/ Copper	Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua	From UK median line to Brynhild SPS Manifold	Trenched and buried	Out of Use	Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua

1 All Brynhild pipelines are listed under production licence number PL148 in the Norwegian sector, no individual pipeline numbers are available.

2 Burial Depth information provided in Appendix A.

**Table 2.5: Pipeline systems associated materials and stabilisation features (UK sector)**

Stabilisation Feature	Total Number	Weight (Te)	Geographical Location(s)	Exposed/Buried/Condition
PLET including:	1	6.38	57° 09' 49.923" N 2° 17' 28.597" E	Exposed
PLET support frames	2	37	below PLET	below PLET
FJSS at PLET	2	2.72	within PLET boundary	Under GRP cover
GRP cover at PLET	3	30.81	covering tie-ins at PLET	Plastic – 11.64 Te Concrete – 19.17 Te
Rock Cover on GRP Covers at PLET	-	2100	At PLET	Rock cover skirt located around GRP Cover base
FJSS at RBM	1	2.75	Supporting pipeline tie-in at RBM	beneath GRP cover at RBM
GRP covers at RBM	2	32.88	immediately adjacent to RBM	Plastic – 13.63 Te Concrete – 19.25 Te
Rock Cover on GRP Covers at RBM	-	2000	at RBM	Rock cover skirt located around GRP Cover base
Mattresses	31	197	Stabilisation under PL3083/ PL3084/ PLU3085	Buried below rock cover
Mattresses	5	42	PL3084 protection	Exposed above pipeline, and in good condition
Grout bags	432	11	Under PL3083/ PL3084/ PLU3085	Buried below rock cover
Rock cover	–	40,255	PL3083/ PL3084/ PLU3085 Protection	Exposed

1. All structures in this table are located within the Haewene Brim FPSO 500 m exclusion zone
2. There are no structures associated with the Water Injection Pipeline or Umbilical in the UKCS.

3. The Brynhild pipeline installations have utilised mattresses and rock cover for protection within the Pierce 500m exclusion zone and to alleviate possible upheaval buckling, additionally rock cover was used on the CNS cable crossing to protect the pipeline/ umbilical crossing and ensure ability to over-trawl. Additionally, GRP protection covers were installed at both the PLET and RBM. All rock cover was restricted to <1.5m height and rock used graded between 1” – 5”; non-corrosive, non-magnetic and clear and free from cohesive material.

Table 2.6: Subsea Pipeline associated materials and stabilisation Features (Norwegian sector)				
Stabilisation Feature	Total Number	Weight (Te)	Location(s)	Exposed/Buried/Condition
Mattresses	19	147.5	Under Production / WI Pipelines and umbilical Plus WI pipeline protection	Various
Grout bags	0	0	N/A	N/A
Rock cover	–	12233	Production / WI Pipelines and umbilical protection	Exposed

1. All Brynhild pipelines are listed under production licence number PL148 in the Norwegian sector, no individual pipeline numbers are available.

## a. Wells

Table 2.7: Well Information			
Platform Wells	Designation	Status	Category of Well
None			
Subsea Wells			
7/7-A-1 AH	Oil Production	Shut-In	N/A
7/7-A-3 AH	Oil Production	Shut-In	N/A
7/7-A-2 HT4 <sup>1</sup>	Water Injection	Shut-In	N/A
7/7-A-4 H	Water Injection	Shut-In	N/A

<sup>1</sup> Originally Oil producer, converted to Water injector March 2016

All Wells are in the Norwegian sector and are identified here for reference only. They are not covered by this DP.

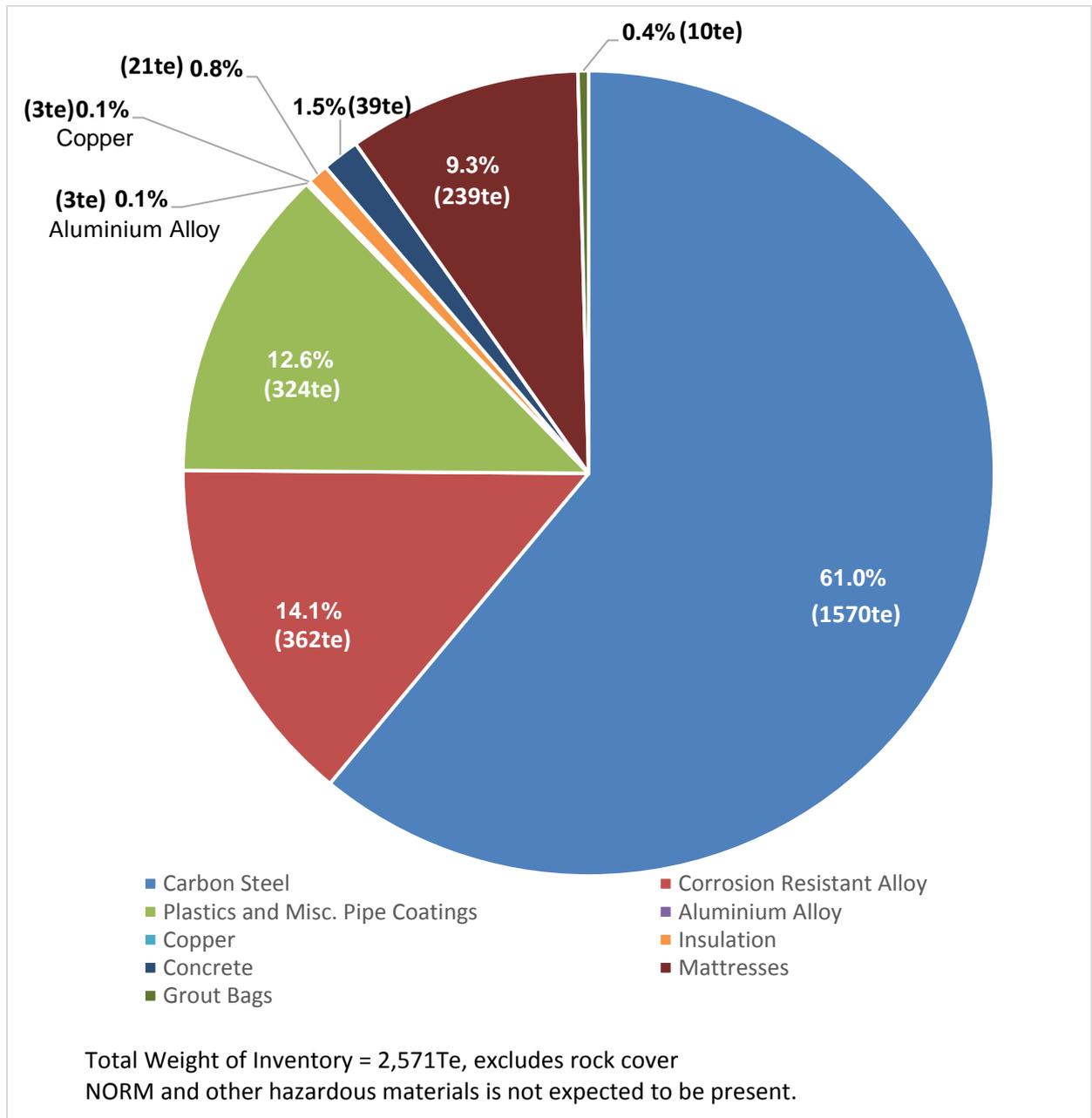
## 2.5 Drill Cuttings

Table 2.8: Drill Cuttings Pile Information		
Location of Pile Centre (Latitude/Longitude)	Seabed Area (m <sup>2</sup> )	Estimated volume of cuttings (m <sup>3</sup> )
None		

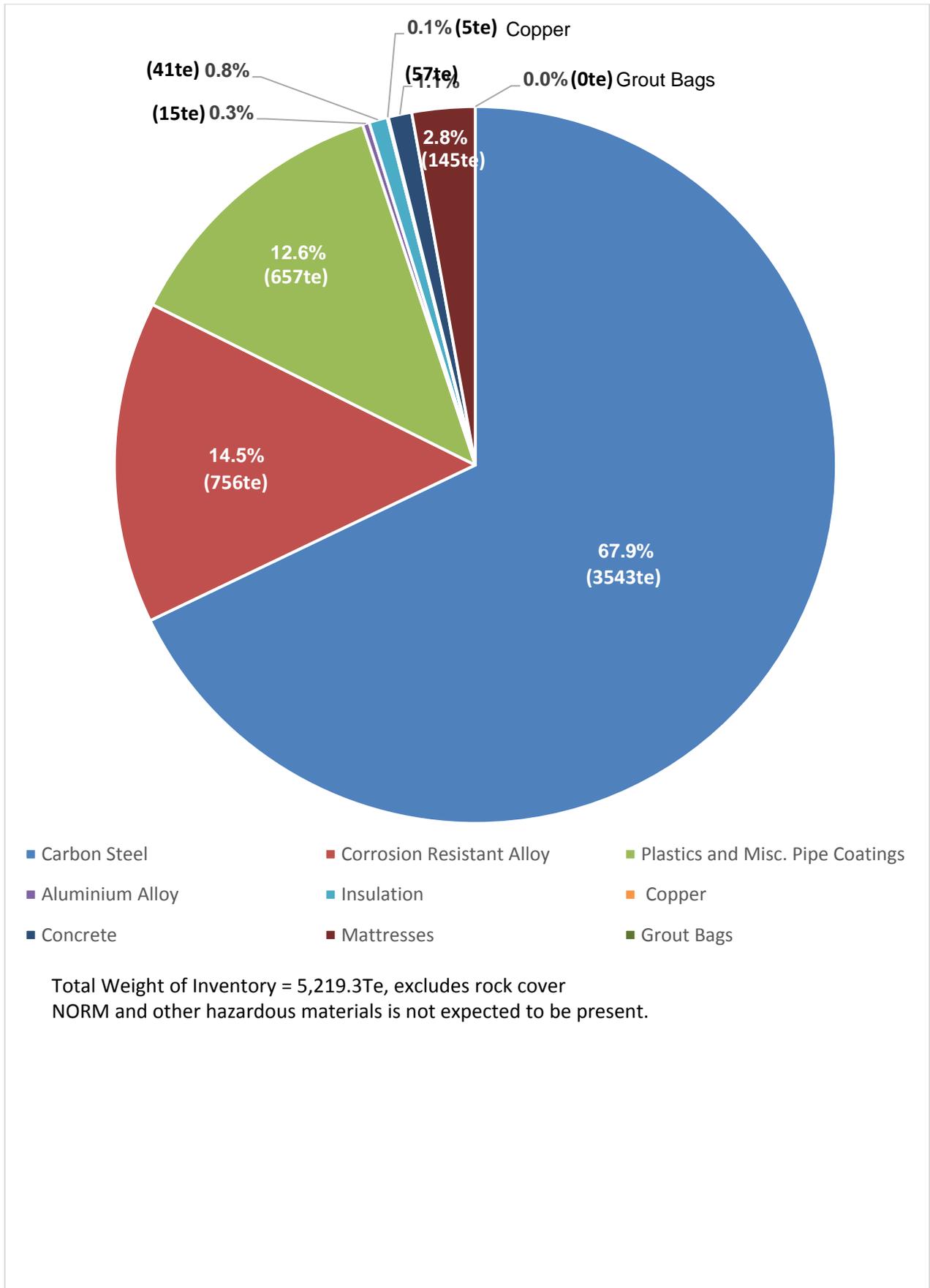
## 2.6 Inventory Estimates

The pie charts (Figure 2-1 and Figure 2.2) show the inventory estimates for different elements of the DP contained in this document.

**Figure 2-1: Materials Inventory Summary (UK Sector)**



**Figure 2-2: Materials Inventory Summary (Norwegian Sector)**



### 3 REMOVAL AND DISPOSAL METHODS

In line with the waste hierarchy, Lundin have considered other reuse options for the facilities, and this was a key consideration leading to a final decision on the nature and timing of field decommissioning.

Further field life extension options were also investigated; all were found to be sub-economic and consequently the facilities are to be decommissioned. Lundin will ensure the principles of the waste hierarchy in accordance with the Waste Framework Directive and will ensure segregation by type and transport to shore in an auditable manner through licensed waste contractors. It is anticipated that the chosen waste management provider's/disposal yards shall follow the waste management hierarchy in the handling of materials from Brynhild Decommissioning to maximize the amount of material from the projects which is reused or recovered/recycled.

Lundin and the selected removal contractor(s) will monitor and review the disposal route of all materials and waste to the point of final reuse, recycling or disposal. It is anticipated that there will be relatively small quantities of equipment and materials returned onshore (<170 Tonnes).

#### Preparation/Cleaning:

Table 3.1: Cleaning of Topsides for Removal		
N/A as no surface installations are associated with this DP		
Waste Type	Composition of Waste	Disposal Route

#### Removal Methods:

Table 3.2: Topsides Removal Methods	
N/A as no surface installations are associated with this DP	
Method	Description

Table 3.3: Jacket Decommissioning Methods	
N/A as no Jackets are associated with this DP	
Method	Description

### 3.3 Subsea Installations, Stabilisation and Other Features

Table 3.4: Subsea Installations, Stabilisation and other Features			
N/A no subsea installations associated with this DP			
Subsea installations and stabilisation features	Number	Option	Disposal Route (if applicable)

### 3.4 Pipelines

#### Decommissioning Options:

\*Key to Options:

1) Total removal – by reverse reeling

2a) Remediation in-situ – exposed sections rock covered

2b) Remediation in-situ – exposed sections trenched and buried

2c) Remediation in-situ – exposed sections cut and removed

3) Leave in-situ

Table 3.5: Pipeline or Pipeline Groups Decommissioning Options			
Pipeline or Group (as per PWA)	Condition of line/group	Whole or part of pipeline/group	Decommissioning Options considered
PL3083 PL3084 PLU3085	Offshore: <ul style="list-style-type: none"> <li>• Rigid pipeline/ Umbilical</li> <li>• Stainless Steel, Carbon Steel, Plastics, Copper, Corrosion Resistant Alloy</li> <li>• Trenched and buried and spot rock cover berms at crossings and transitions, no spanning</li> </ul>	All	1, 2a, 2b, 2c, 3

#### Comparative Assessment Method:

A comparative assessment was carried out for both pipelines and the umbilical in line with the recommendations in OPRED Guidance Notes. The comparative assessment considered Technical, Environmental, Safety, Societal and Economic Impacts. The assessments closely followed the Guidelines on Comparative Assessments in DPs published by Oil and Gas UK.

A workshop was held by Lundin (representatives from the environmental and subsea decommissioning teams were present) using established terms of reference, detailed data on field facilities and recorded results approved by participants.

**Outcome of Comparative Assessment:**

Table 3.6: Outcomes of Comparative Assessment		
Pipeline or Group	Recommended Option	Justification
PL3083 PL3084 PLU3085	Option 2c: Decommission by leaving trenched and buried and already rock covered sections in-situ. Decommission exposed sections at tie-in-ends by cut and lift and return onshore for recycle. <sup>1</sup>	Total removal options were discounted for the already trenched and buried and rock covered sections of pipeline as excessive seabed disturbance in uncovering the pipeline would occur, also more risk exposure time to project personnel both offshore and onshore in having to handle large pipelines lengths was a concern.  Technically full removal of the lines would be difficult.  There will be minimum legacy risk to other users of the seas in leaving the pipelines in-situ as the trenched and buried and already rock covered sections of the pipeline will remain so. The rock cover berms have been designed and specified to be over trawled.  Exposed ends will be remediated by cut and lift <sup>1</sup> as the residual safety risk to other users of the seas if left exposed on the seabed and potential deterioration was deemed unacceptable.

<sup>1</sup>Option 2c Remediation pipeline/ umbilical in-situ – with exposed sections cut and removed is the proposed decommissioning option for both pipelines and the umbilical. However, the conclusion of the CA was that there is no significant differentiator on each of the three remediate in-situ sub-options for the exposed sections of pipeline or umbilical. i.e.:

- 2a) Remediation pipeline/ umbilical in-situ – with exposed sections rock covered;
- 2b) Remediation pipeline/ umbilical in-situ – with exposed sections trenched and buried;
- 2c) Remediation pipeline/ umbilical in-situ – with exposed sections cut and removed.

As such Lundin intend to carry out a Contracting and Procurement (C&P) engagement exercise and tendering process on all three sub-options and note that any change in preference from the proposed decommissioning option (2c), will require discussion with OPRED and prior agreement to any change.

### 3.5 Pipeline Stabilisation and Other Features

Table 3.7: Pipeline Stabilisation and Other Features			
Stabilisation features	Number	Option	Disposal Route (if applicable)
PLET	1	Full removal	Return to shore for reuse/ recycling/ disposal
PLET support frames	2	Full removal	Return to shore for reuse/ recycling/ disposal
Flowline Jumper Support Structures (FJSS)	2	Full removal	Return to shore for reuse/ recycling/ disposal
GRP Protective Covers (3 x PLET and 2 x RBM)	5	Base case full removal	Return to shore for reuse/ recycling/ disposal
Prefabricated Concrete Mattresses, providing stabilisation under PL3083/ PL3084/PLU3085	31	Remain In-situ (below existing rock cover)	N/A
Prefabricated Concrete Mattresses, protecting the exposed section of PL3084	5	Full removal	Return to shore for reuse/ recycling/ disposal
Flexible concrete mattresses	5	Full removal	Return to shore for reuse/ recycling/ disposal
	31	To remain <i>in situ</i> as already rock covered	N/A
Grout bags	432	To remain <i>in situ</i> as already rock covered	N/A
Rock Cover (Berms)	44,355Te	Remain In-Situ	N/A

Mattresses and grout bags providing stabilisation beneath crossings are already rock covered and as such will be decommissioned in-situ.

The exposed mattresses above PL3084 (5 off) were installed in 2011 and are expected to be in good condition and will therefore be recovered and returned onshore for re-use/recycle or disposal.

OPRED expectation is full removal of any surface laid / exposed mattresses. In the event of practical difficulties removing the mattresses to shore Lundin will be required to discuss and agree an appropriate course of action with OPRED.

### 3.6 Wells

Table 3.8: Well Plug and Abandonment	
N/A; Wells are in the Norwegian sector and are not covered by this DP.	

### 3.7 Drill Cuttings

N/A

### 3.8 Waste Streams

Table 3.9: Waste Stream Management Methods	
Waste Stream	Removal and Disposal method
Bulk liquids	The production pipeline (including the flexible jumper) is currently filled with treated freshwater containing oxygen scavenger and is expected to contain limited volumes of hydrocarbons. The water injection pipeline is currently filled with inhibited seawater. No further flushing or cleaning is proposed for the both pipelines. The umbilical cores will be round trip flushed from a vessel located at the well location (i.e. in Norwegian waters). Contents of the cores will be collected in the vessel and shipped to shore. The cores will be left filled with freshwater
Marine growth	Marine growth is not anticipated to be present on the materials to be recovered. However, if found to be present it will be cleaned from the materials immediately recovered on site and before the materials are transported onshore.
NORM/LSA Scale	NORM is not anticipated to be present. However, tests for NORM will be undertaken and work will be carried out in full compliance with all relevant regulations and under the appropriate permit, where required.
Asbestos	N/A
Other hazardous wastes	N/A
Onshore Dismantling sites	Appropriate licensed sites will be selected. Only dismantling sites that can demonstrate waste stream management throughout the deconstruction process will be considered.

As part of the Contracting Strategy, Lundin will ensure the selection of waste competent Contractor(s), experienced in the handling of all wastes associated with the Decommissioning of Oil and Gas pipelines. The waste management provider's/disposal yards shall follow the waste management hierarchy in the handling of materials from Brynhild Decommissioning to maximize the amount of material from the projects which is reused or recovered/recycled. Lundin and the selected removal contractor(s) will, monitor and review the disposal route of all materials and waste to the point of final reuse, recycling or disposal and reserves the right to audit to fulfil any Duty of Care responsibilities.

It is anticipated that up to 67% of the returned material will be reused or recovered/recycled.

Table 3.10: Inventory Disposition (UK Sector)			
	Total Inventory Te	Planned tonnage to shore	Planned left <i>in situ</i>
Installations	N/A	N/A	N/A

Subsea structure	113	113	N/A
Pipelines/Umbilical's	2194	8	2186
Mattresses	239	42	197

## 4 ENVIRONMENTAL APPRAISAL OVERVIEW

The Environmental Appraisal Report has been issued separately for OPRED review and feedback, when received, will be incorporated for next issue and before the publication of the 3<sup>rd</sup> pre-draft DP.

### 4.1 Environmental Sensitivities (Summary)

Table 4.1: Environmental Sensitivities	
Environmental Receptor	Main Features
Conservation interests	<p>The closest designated area in UK waters is the East of Gannet and Montrose Fields Nature Conservation Marine Protected Area, located c. 48 km west of the Haewene Brim FPSO. This site has been designated for the presence of <i>Arctica islandica</i> (ocean quahog) aggregations (including sands and gravels as their supporting habitat), and offshore deep-sea muds. At this distance none of the proposed activities are expected to impact on this area or any other designated areas in the UKCS.</p> <p>The Brynhild infrastructure located within Norwegian waters occurs within an area considered valuable for its mackerel spawning grounds and is therefore considered a Particularly Valuable Areas (PVA). None of the proposed decommissioning activities (either in UK or Norwegian waters) are expected to have a significant impact on spawning mackerel in the area.</p>
Seabed	<p>Two broad habitat types occurred along the pipeline route: Circalittoral Muddy Sand (EUNIS Code A5.26) and Circalittoral Mixed Sediment (EUNIS Code A5.44), whilst at the Pierce Field a single habitat 'Deep Circalittoral Sand' (EUNIS Code A5.27) has been found to be present. No Annex I habitats have been identified near the Brynhild infrastructure. Further details are provided in the EA.</p>
Fish	<p>Several fish species are known to use the area as a spawning and/or nursery ground. Species known to use the area for spawning include lemon sole, sandeel, cod, Norway pout, plaice mackerel. Apart from lemon sole, each of these species also have recognised nursery grounds in the area. In addition, haddock, ling, whiting, herring, anglerfish, blue whiting, hake, spurdog, and spotted ray are among the species known to have nursery grounds in the area.</p> <p>Of the fish species identified in the area, anglerfish, herring, mackerel, ling, blue whiting, cod, sandeels and whiting have been assessed by SNH and JNCC as Priority Marine Features (PMFs) in Scotland.</p>
Fisheries	<p>The Brynhild infrastructure within the UKCS occurs within ICES (International Council for Exploration of the Sea) rectangle 43F2. A review of the information collated by the Scottish Government suggests that fishing effort in the area is relatively low in comparison to the surrounding area. Landings reported by</p>

Table 4.1: Environmental Sensitivities	
	Scottish Government indicate that demersal species make up the majority of the landings that are reported. Further details are provided in the EA.
Marine Mammals	Distribution maps based on telemetry data (1991 - 2012) and count data (1988 – 2012) indicate that neither grey seals or harbour seals occur near the Brynhild infrastructure. Dependent on the time of year, harbour porpoise, white-beaked dolphin, minke whale, and <i>Lagenorhynchus</i> sp. (which refers to white-beaked and Atlantic white-sided dolphin combined where it was not possible to distinguish between the two species) have been sighted in the area. Further information from the Small Cetacean Abundance in the North Sea (SCANS-III) reports is provided in the EA.
Birds	Bird species known to occur in the area include the northern gannet, northern fulmar, black-legged kittiwake, little auk, herring gull, black-headed gull, common guillemot and the Atlantic puffin. Based on several factors which are considered to contribute to the sensitivity of seabirds to oil pollution (e.g. annual productivity, adult survival rate, habitat flexibility etc), sensitivity of birds to hydrocarbon pollution near the Brynhild infrastructure is considered low. Further details are provided in the EA.
Onshore Communities	Waste generated during decommissioning will be transported to shore in an auditable manner through licensed waste contractors. The waste management hierarchy of 'reduce, re-use, recycle' will be followed. Lundin intends to engage approved waste management contractors to handle, store and dispose of all waste generated by the decommissioning activities.
Other Users of the Sea	Based on available data shipping activity around the Brynhild infrastructure is considered low. In addition, there are no telecommunications cables, aggregate extraction areas, military exercise areas or renewable energy developments within the vicinity of the proposed decommissioning activities.
Atmosphere	Emissions to atmosphere offshore will arise from the vessels used to decommission the Brynhild infrastructure. Onshore emissions will result from the yard activities including recycling of the steel etc. associated with the structures returned to shore. Further details are provided in the EA.

## 4.2 Potential Environmental Impacts and their Management

### Environmental Impact Appraisal Summary:

Table 4.2: Environmental Impact Management		
Activity	Main Impacts	Management
Topsides Removal	N/A	N/A
Jacket Removal	N/A	N/A
Decommissioning Pipelines	<p>Decommissioning of the pipelines <i>in situ</i> will require cutting and removal of exposed pipeline ends.</p> <p>The principal environmental and societal impacts include:</p> <ul style="list-style-type: none"> <li>• Physical presence of vessels;</li> <li>• Energy use and atmospheric emissions;</li> <li>• Underwater noise from vessels;</li> <li>• Discharges to sea from vessels;</li> <li>• Disturbance to the seabed from cutting, trenching and burying activities;</li> <li>• Production of waste materials.</li> </ul> <p>Potential impacts resulting from accidental events include discharges to sea as a result of hydrocarbon releases (e.g. a loss of diesel inventory due to vessel collision).</p> <p>Following the mitigations summarised in this table (detailed in the EA Report) the environmental and societal significance of the planned activities are considered low.</p>	<p>During decommissioning of the pipelines, a number of mitigation measures will be adhered to, in order to minimise the environmental and socio-economic impacts. These are detailed in the EA Report and are summarised here:</p> <ul style="list-style-type: none"> <li>• Notice to mariners will be circulated.</li> <li>• Lundin will carry out a detailed assurance process on all vessels prior to contract award and all contractors will originate from countries signed up to the International Maritime Organisation and will adhere to their guidelines.</li> <li>• Vessel use will be optimised</li> <li>• Work procedures will be in place to minimise duration of activities and minimise likelihood of dropped objects.</li> <li>• A waste management plan will be developed which will describe and quantify waste</li> <li>• Waste management options will take account of the waste management hierarchy.</li> <li>• SIMOPS (simultaneous operations) will be managed through bridging documents and communications.</li> <li>• Emergency response plans in place including SOPEP's (Shipboard Oil Pollution Emergency Plan)</li> </ul>

		<ul style="list-style-type: none"> <li>• Flushing and cleaning of the hydrocarbon pipelines has been completed in line with BAT/BEP requirements.</li> <li>• Vessels carrying out these activities will use dynamic positioning thus minimising impact on the seabed.</li> <li>• The pipelines or umbilical decommissioned <i>in situ</i> will be marked on FishSafe and communicated accordingly.</li> <li>• Verification of seabed clearance will be provided.</li> <li>• A survey strategy will be agreed with OPRED for monitoring the buried pipelines.</li> </ul>
<p>Decommissioning Stabilisation Features</p>	<p>The base case is to leave the rock cover and those mattresses associated with crossing and already rock covered in situ. All other stabilisation features (e.g. GRP covers, and the five exposed mattresses will be recovered.</p> <p>The principal environmental and societal impacts include:</p> <ul style="list-style-type: none"> <li>• Physical presence of vessels;</li> <li>• Energy use and atmospheric emissions;</li> <li>• Underwater noise from vessels;</li> <li>• Discharges to sea from vessels;</li> <li>• Disturbance to the seabed from recovery activities;</li> <li>• Production of waste materials.</li> </ul> <p>Potential impacts resulting from accidental events include:</p> <ul style="list-style-type: none"> <li>• Discharges to sea as a result of hydrocarbon releases (e.g. a loss of diesel inventory due to vessel collision).</li> </ul> <p>Following the mitigations summarised in this table (detailed in the EA Report) the environmental and societal significance of the planned activities are considered to be low.</p>	<p>During decommissioning of the stabilisation features a number of mitigation measures will be adhered to, in order to minimise the environmental and socio-economic impacts. These are detailed in the EA Report and are summarised here:</p> <ul style="list-style-type: none"> <li>• Notice to mariners will be circulated.</li> <li>• Lundin will carry out a detailed assurance process on all vessels prior to contract award and all contractors will originate from countries signed up to the International Maritime Organisation and will adhere to their guidelines.</li> <li>• Vessel use will be optimised</li> <li>• Work procedures will be in place to minimise duration of activities and minimise likelihood of dropped objects.</li> <li>• A waste management plan will be developed which will describe and quantify waste</li> <li>• Waste management options will take account of the waste management hierarchy.</li> <li>• SIMOPS (simultaneous operations) will be managed through bridging documents and communications.</li> </ul> <p>Emergency response plans in place including SOPEPs (shipboard oil pollution emergency plan).</p> <ul style="list-style-type: none"> <li>• Vessels carrying out these activities will use dynamic positioning thus minimising impact on the seabed.</li> </ul>

		<ul style="list-style-type: none"> <li>• Verification of seabed clearance will be provided.</li> <li>• If any stabilisation features cannot be recovered Lundin will consult with OPRED to discuss alternative approaches.</li> <li>• A survey strategy will be agreed with OPRED for monitoring any stabilisation features that will be decommissioned <i>in situ</i>.</li> </ul>
Decommissioning Drill Cuttings	N/A	N/A

## 5 INTERESTED PARTY CONSULTATIONS

### Consultations Summary:

On 12<sup>th</sup> March 2019, as part of the informal stakeholder engagement process Lundin issued the Environmental Scoping Report to the statutory stakeholders identified in Table 5.1 below and as advised by OPRED.

The Scoping Report provided an overview of the Brynhild Field, the proposed decommissioning activities and an overview of the impacts to be assessed in the EA. Statutory Stakeholders were invited to comment on the Scoping Report with respect to any concerns they may have. Those that responded provided no opposing comments on the strategies proposed.

Table 5-1 captures feedback following formal consultation.

Table 5.1: Summary of Stakeholder Comments		
Who	Comment	Response
<b>Statutory Consultations</b>		
Scottish Fishermen’s Federation (SFF)	Advisory comments were received. SFF confirmed that they are aligned with the proposed decommissioning plan for the project. They request that should any rock cover be deployed, that the size and profile of the rock aligns with industry standards. SFF also advised that any rock cover berms are incorporated into the post decommissioning debris clearance trawls sweeps to verify that they do not pose a risk to fishing.	Noted. Any rock cover laid will align with industry standard and any debris clearance survey will include any rock berms associated with the project.
The National Federation of Fishermen's Organisations (NFFO)	No response received following formal consultation	
Northern Ireland Fish Producers Organisation Ltd (NIFPO)	No response received following formal consultation	
Global Marine Systems Limited (GMS)	No response received following formal consultation	
Public	No comments were received	
<b>Informal Consultations prior to Public Consultation</b>		
OGA	EA Scoping Report issued, no response received.	

Table 5.1: Summary of Stakeholder Comments		
Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)	EA Scoping Report issued, no response received.	
Marine Scotland	Scoping Report issued, response received 05/04/19, no opposing comments on the proposed strategy, advice provided on availability on new features in NMPi available only.	Latest NMPi data has been used to support the EA where relevant.
Joint Nature Conservation Committee (JNCC)	Scoping Report issued, response received 10/04/19. Providing advice on survey data to be used and recommended minimising the introduction of new hard substrate materials to the seabed.	The recommended option for exposed sections of pipelines (See Table 3.6) aligns with this recommendation.
Scottish Environmental Protection Agency (SEPA)	Scoping Report issued, response received 10/04/19, no opposing comments on the proposed strategy, advice provided on Duty of Care with respect to Wastes and requirements for Trans-Frontier Shipment of wastes only.	See Section 3.8.
Scottish Fisherman's Federation (SFF)	EA Scoping Report issued, no response received.	

## 6 PROGRAMME MANAGEMENT

### 6.1 Project Management and Verification

Lundin has established a multi-disciplinary team lead by a Project Manager responsible for the implementation of activities and co-ordination of all services. An execution plan will align with established Lundin Health, Safety and Environment policies and meet all relevant legislative requirements. A contracting strategy will be based on Lundin procurement and contracts policies, including competitive tendering for all contractor services. Where possible, activities will be co-ordinated with other decommissioning operations and take account of any initiatives promoted by the OGA. Lundin will report regularly on the execution of the DP to OPRED and discuss any changes in plans in advance.

### 6.2 Post-Decommissioning Debris Clearance and Verification

As built installation data combined with IRM (GVI) 2015 & 2017 were utilised to identify debris within the installations' 500 m zones and within the 100 m pipeline corridors. Excluding the FPSO 500m zone, a post decommissioning site survey will be carried out along a 100 m corridor of the pipeline (50m) along each existing pipeline route to identify and remove any debris related to offshore oil and gas activities which will be recovered for onshore recycling or disposal in line with existing waste management policies. Debris removal will form part of the subsea decommissioning execution scope of work. The clear seabed will be validated by a verification survey, over the installation sites and pipeline corridors, non-over-trawl techniques such as Side Scan Sonar (SSS)/ ROV, or by the post decommissioning survey; the methods used will be discussed and agreed with the OPRED. The post decommissioning survey will provide further verification.

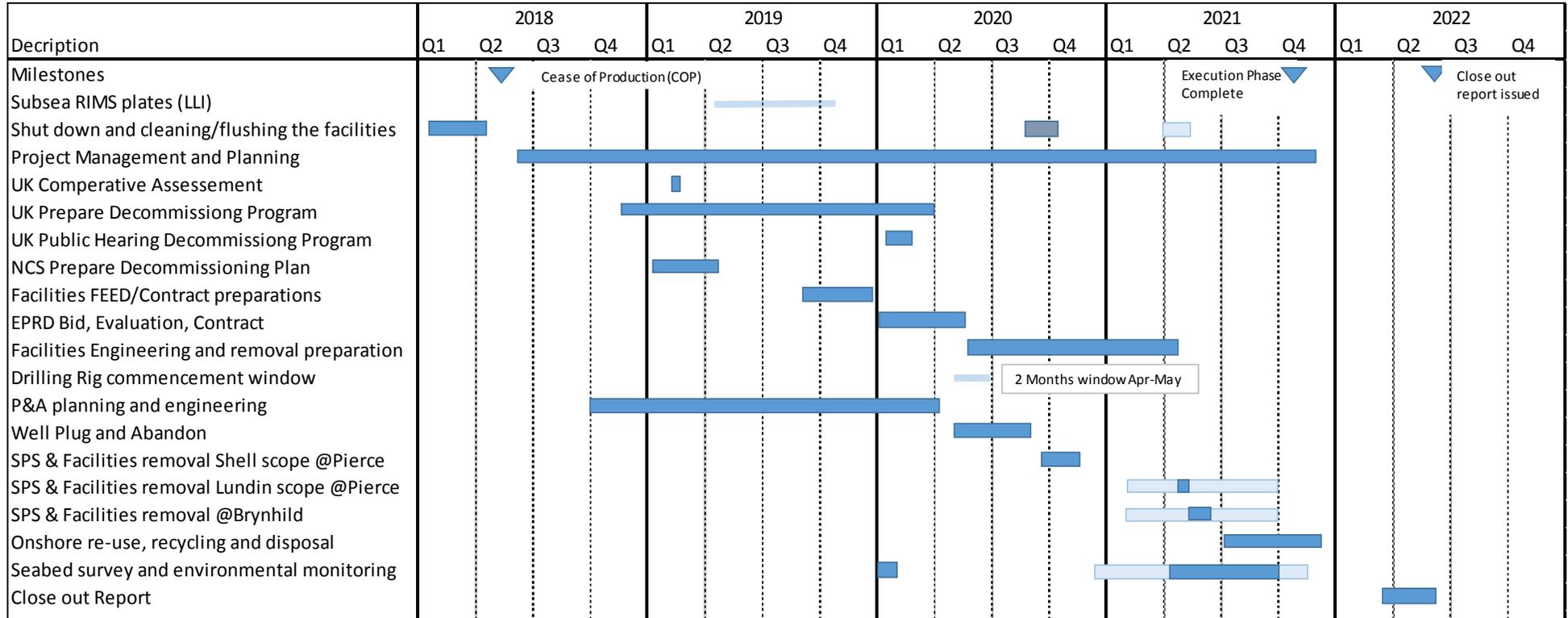
### 6.3 Costs

Table 6.1: Provisional Decommissioning Programme costs	
Item	Estimated Cost (£m)
Platforms /Jackets - Preparation / Removal and Disposal	N/A
Pipelines Decommissioning	Confidential <sup>1</sup>
Subsea Pipeline associated materials and stabilisation Features	Confidential <sup>1</sup>
Well Abandonment	N/A
Continuing Liability – Future Pipeline and Environmental Survey Requirements	Confidential <sup>1</sup>
<b>TOTAL</b>	Confidential <sup>1</sup>

<sup>1</sup> Estimated Costs are confidential and have therefore been provided separately to OPRED.

## 6.4 Schedule

Figure 6-1: Brynhild Decommissioning Schedule



The main milestones for the Brynhild DP are:

- CoP: 2018 Q2
- Wells P&A: To commence on 1<sup>st</sup> April 2020, at the earliest.
- Facilities Removal: To be completed during 2021
- Close-out report: 2022, Q2

Note: The offshore execution schedule for the subsea facilities is not time-critical and therefore not fixed, except that the Drilling rig P&A activities shall be planned to commence by 1<sup>st</sup> April 2020 and the overall project execution will be completed in 2021.

The Facilities execution contractor will be offered schedule flexibility during 2020/2021 to reduce risk and cost.

## **6.5 Close Out**

A close out report will be submitted to OPRED within 12 months of the completion of decommissioning activities, including debris clearance and post-decommissioning surveys. Any material changes to the DP will need to be discussed and agreed by OPRED prior to any change.

## **6.6 Post-Decommissioning Monitoring and Evaluation**

A post decommissioning environmental seabed survey, covering pipeline routes and infrastructure, will be carried out when decommissioning activity has been concluded. The survey will focus on chemical and physical disturbances due to the decommissioning. Results of the survey will be forwarded to OPRED and a risk-based post decommissioning pipeline monitoring regime will be discussed and agreed with OPRED.

## **6.7 Management of Residual Liability**

This information will be included in the project Close Out Report (COR) when it is submitted for review and circulated to consultees for comment.

## 7 SUPPORTING DOCUMENTS

Table 7.1: Supporting Documents	
<i>Document Number</i>	<i>Title</i>
J74927A-A-RT-00006	<b>Comparative Assessment Report</b>
J74927A-Y-RT-24003	<b>Environmental Appraisal Report</b>

Web link for all stakeholder / interested parties

<https://lundin-norway.no/2020/01/03/public-notice/?lang=en>

## **8 PARTNER LETTERS OF SUPPORT**

Signed and dated Partner Letters will be included with the final version of the Brynhild DP.

**Offshore Petroleum Regulator for Environment and Decommissioning**

Department for Business, Energy & Industrial Strategy

3rd Floor, Wing C

AB1 Building

Crimon Place

Aberdeen

AB10 1BJ

**27.05.2020**

Dear Sir or Madam

**BRYNHILD DECOMMISSIONING PROGRAMME PETROLEUM ACT 1998**

We acknowledge receipt of your letter dated 26.05.20.

We, CapeOmega AS confirm that we authorise Lundin Energy Norway AS to submit on our behalf an abandonment programme relating to the Brynhild facilities as directed by the Secretary of State on 26.05.2020.

We confirm that we support the proposals detailed in the Brynhild Decommissioning Programme dated 26.05.2020, which is to be submitted by Lundin Energy Norway AS in so far as they relate to those facilities in respect of which we are required to submit an abandonment programme under section 29 of the Petroleum Act 1998.

Yours faithfully



Frode Losnedal

SVP Projects

For and on behalf of **CapeOmega AS**



Verven 4  
Postboks 649 – Sentrum  
4003 Stavanger

Tel.: (+47) 52 00 20 00  
Fax: (+47) 52 00 15 00  
Org. nr.: NO 993 787 787 MVA

Offshore Petroleum Regulator for  
Environment & Decommissioning  
Department for Business, Energy &  
Industrial Strategy  
AB1 Building (Wing C) 3<sup>rd</sup> Floor  
Crimon Place  
Aberdeen. AB10 1BJ  
Attn.: Kim Wood

Your ref.:

Our ref.:

Date: 3 June 2020

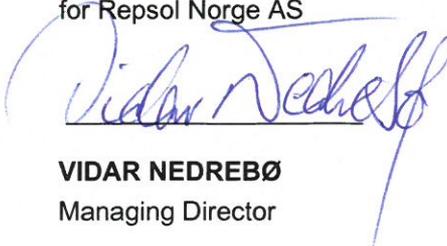
**BRYNHILD DECOMMISSIONING PROGRAMME PETROLEUM ACT 1998**

We acknowledge receipt of your letter dated 26.05.2020.

We, Repsol Norge AS confirm that we authorise Lundin Energy Norway AS to submit on our behalf an abandonment programme relating to the Brynhild facilities as directed by the Secretary of State on 26.05.2020.

We confirm that we support the proposals detailed in the Brynhild Decommissioning Programme dated 26.05.2020, which is to be submitted by Lundin Energy Norway AS in so far as they relate to those facilities in respect of which we are required to submit an abandonment programme under section 29 of the Petroleum Act 1998.

Yours sincerely,  
for Repsol Norge AS



**VIDAR NEDREBØ**

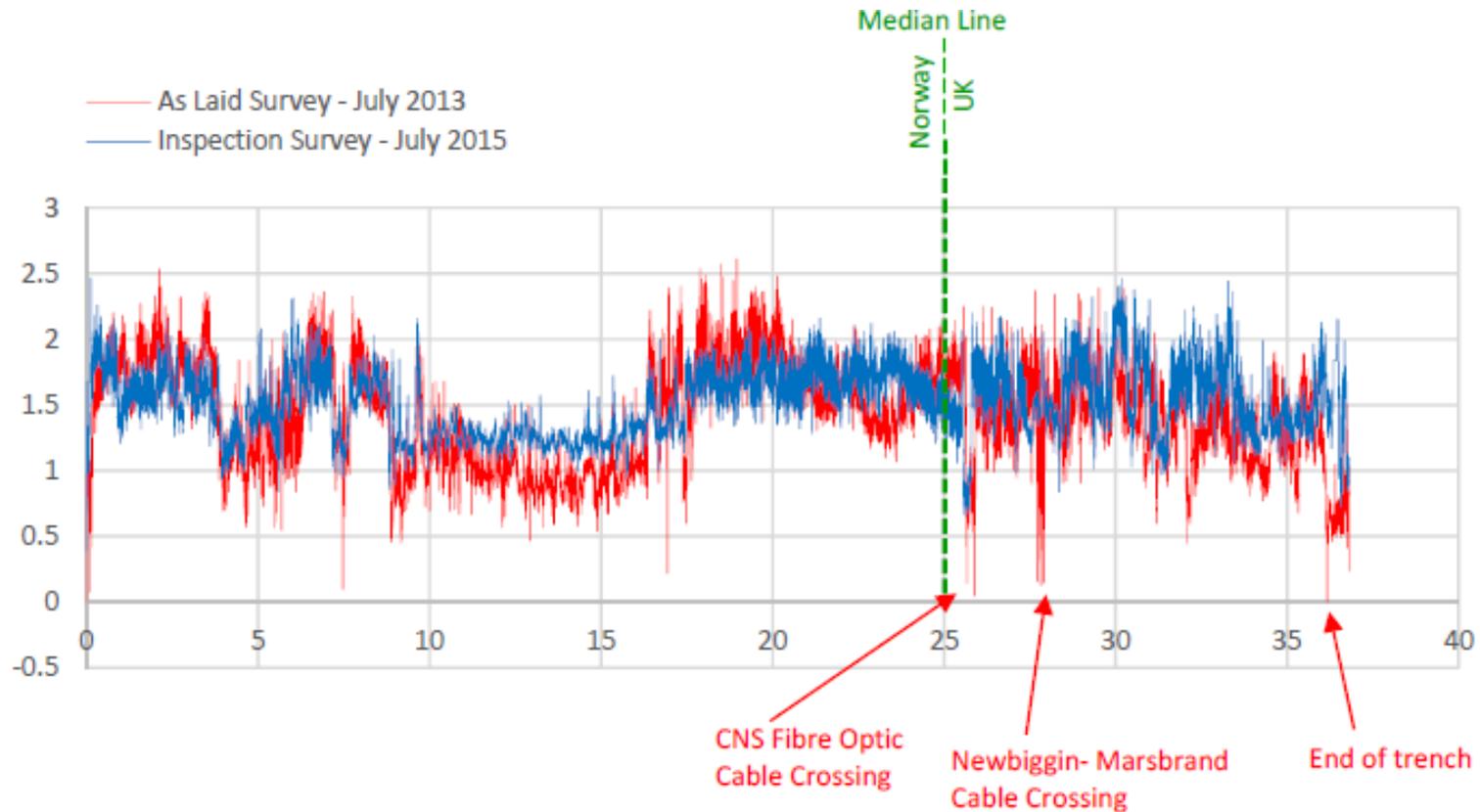
Managing Director

## 9 APPENDIX A: PIPELINE BURIAL DEPTH INFORMATION

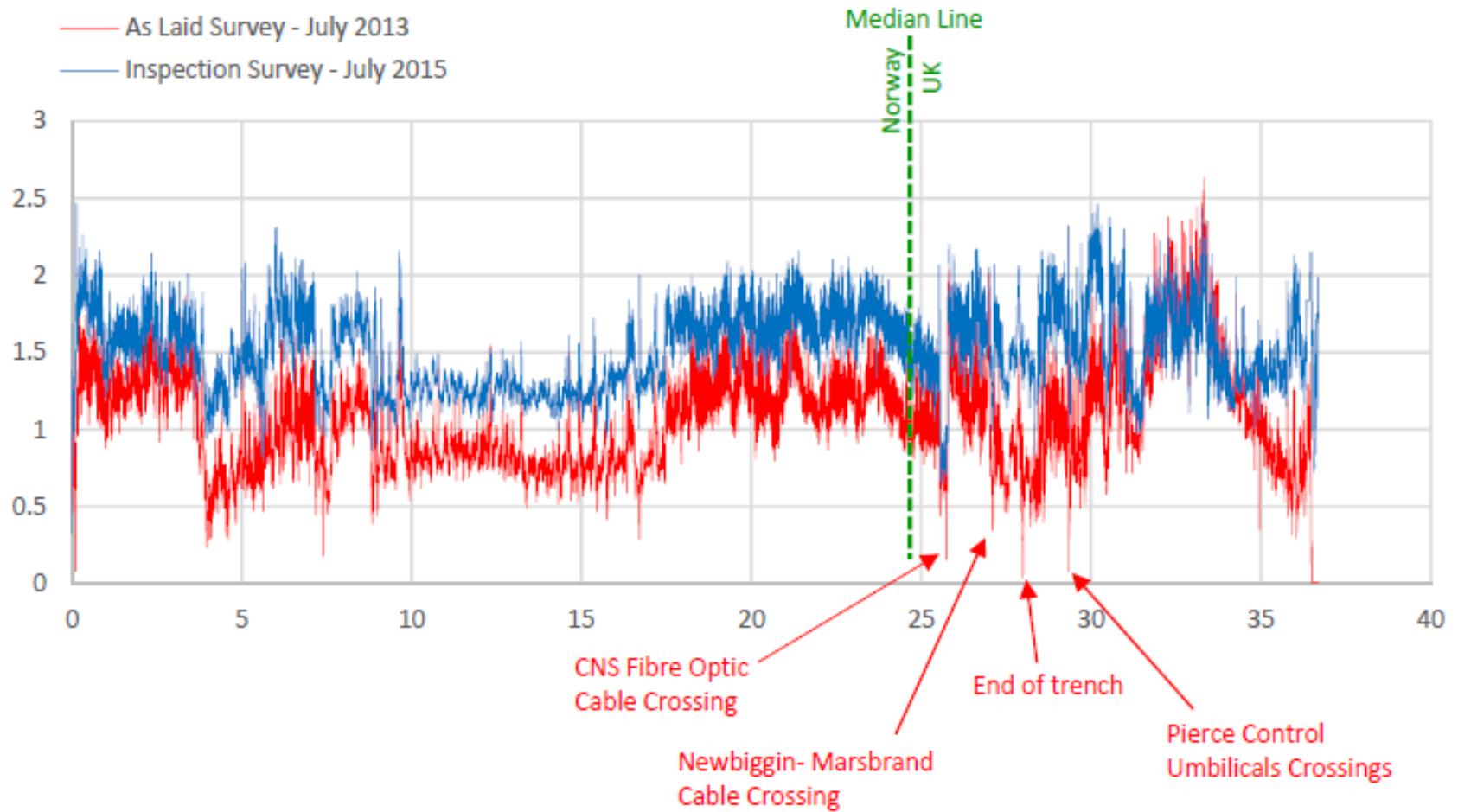
The graphs below show the measured depth of cover along the full length of each pipeline and umbilical, below seabed (0 being seabed level) from two separate surveys, a) an As-laid survey completed at the end of the pipelines installation in 2013 and b) an inspection survey carried out in July 2015.

Note PL3083 and PLU3085 share a common trench until they exit the trench near to Pierce, at this point the pipeline and umbilical diverge but are fully rock covered on the surface and up to the tie-ins at Pierce RBM.

**Figure 9-1: Production Pipeline / Umbilical (PL3083/ PLU3085) Burial Depth**



**Figure 9-2: Water Injection Pipeline (PL3084) Burial Depth**



Graph vertical axis is in metres and horizontal axis is in kilometres.  
 2013 As Laid survey data excludes rock cover.  
 2015 Inspection Survey includes rock cover.

## 10 APPENDIX B: PUBLIC NOTICES

### **PUBLIC NOTICE**

#### **The Petroleum Act 1998**

#### **BRYNHILD PIPELINES AND UMBILICAL**

Lundin Norway AS has submitted, for the consideration of the Secretary of State for Business Energy and Industrial Strategy, a draft Decommissioning Programme for the Brynhild pipelines and umbilical in accordance with the provisions of the Petroleum Act 1998. It is a requirement of the Act that interested parties be consulted on such decommissioning proposals.

The items/facilities covered by the Decommissioning Programme are the:

Brynhild infrastructure in the United Kingdom Continental Shelf (UKCS) comprising a production pipeline, a water injection pipeline and a control umbilical tied back to the Haewene Brim Floating, Production, Storage and Offloading (FPSO) vessel serving the Pierce field (the FPSO is not part of the decommissioning programme).

The Brynhild field is located in the southern part of the Norwegian Continental Shelf (NCS), approximately 246 km east of Aberdeen. The pipelines and the umbilical cross over to UKCS at block 23/22b and connect to the Pierce field infrastructure in block 23/27a.

Lundin Norway AS hereby gives notice that a summary of the Brynhild Decommissioning Programme can be viewed at the internet address:

**<https://lundin-norway.no/2020/01/03/public-notice/?lang=en>**

Alternatively, a hard copy of the Programme can be inspected at the following locations during office hours:

Genesis Oil & Gas Consultants Limited (Contact: Adnan Hossain / John Wilson)  
Aspect 32, Pavilion 3, Prospect Road, Arnhall Business Park  
Westhill, AB32 6FE

Representations regarding the Brynhild Decommissioning Programme should be submitted in writing to the nominated contact below, by closing date 18.02.2020 and should state the grounds upon which any representations are being made.

Date: 20.01.2020

Lundin Norway AS  
Strandveien 4  
1366 Lysaker  
Norway

Linda Hanken  
Brynhild Decommissioning  
Project Manager

## **11 APPENDIX C: STATUTORY CONSULTEE CORRESPONDENCE**



Our Ref: SA/04/02

Your Ref:

6 February 2020

Scottish Fishermen's Federation  
24 Rubislaw Terrace  
Aberdeen, AB10 1XE  
Scotland UK

T: +44 (0) 1224 646944  
F: +44 (0) 1224 647058  
E: [sff@sff.co.uk](mailto:sff@sff.co.uk)

[www.sff.co.uk](http://www.sff.co.uk)

Linda Hanken  
Brynhild Decommissioning Project Manager  
Lundin Norway AS  
Strandveien 4  
1366 Lysaker  
Norway

Dear Linda,

### **Brynhild Field Decommissioning Programme (UKCS infrastructure– Statutory Consultation Draft**

I refer to the Consultation on Draft Decommissioning Programme (DP) and key supporting documentation provided by email link on 20 January 2020.

The Scottish Fishermen's Federation (SFF) appreciates the clearly laid out and detailed explanation of Lundin Norway AS' proposals for the decommissioning of the elements of the Brynhild field infrastructure that are installed on the United Kingdom Continental Shelf (UKCS) and place on record our appreciation of the information provided and discussions held at earlier briefing sessions.

As highlighted to your colleagues previously, the concerns of fishermen remain primarily that of safety and the physical impact on the fishing grounds of the long term presence of oil industry infrastructure on the seabed.

It is noted that there are no surface installations in the UKCS associated with the Brynhild Field and that this particular DP covers the production pipeline, water injection pipeline and control umbilical that cross over into the UKCS (12 km of each line and umbilical are within the UKCS). It is further noted that final decommissioning of the GRP covers at the Riser Base Manifold will become the responsibility of the Pierce Field operator at the time of Pierce decommissioning.

In relation to the offshore pipelines and umbilical, given that these are trenched and mostly buried along their length, we accept the reasoning behind the recommendation (based on the outcome of the comparative assessment of feasible options) of leaving these in situ with minimum intervention in order to minimise seabed disturbance. We are pleased to note that the five identified exposed flexible concrete mattresses will be recovered and returned onshore for treatment.

Members:

Anglo Scottish Fishermen's Association · Fife Fishermen's Association · Fishing Vessel Agents & Owners Association (Scotland) Ltd · Mallaig & North-West Fishermen's Association Ltd · Orkney Fisheries Association · Scottish Pelagic Fishermen's Association Ltd · The Scottish White Fish Producers' Association Ltd · Shetland Fishermen's Association

VAT Reg No: 605 096 748

As you will be aware, any pipelines left on the seabed represent a legacy issue and will require on going monitoring. Where rock cover is deployed, we would look for the size and profile of the rock to follow normal industry standards and would recommend that such rock dump berms are incorporated into the post decommissioning debris clearance trawl sweeps to verify that, at the time of deposit, they did not pose a risk to fishing.

We would highlight to Lundin that the Federation's decommissioning preference(s) with regard to pipelines and flowlines can be summarised as follows:

- *Pipelines & flowlines (including trunk lines, pipeline bundles and umbilicals): **total removal to shore.*** Failing that; trenching and burial with a proactive monitoring programme put in place. With regard to *pipeline ends, where a trenched and buried pipeline is cut and removed at the point where it previously emerged from the trench to tie-in to a subsea installation*, preference is for burial along with an element of rock dump returning to mean seabed level.

\* The SFF's Oil and Gas Decommissioning Policy and accompanying Key Principles document can be viewed via the SFF's website using the following link: <https://www.sff.co.uk/sff-offshore-oil-gas-decommissioning-policy/>.

Yours sincerely,



Steven Alexander  
Offshore Liaison