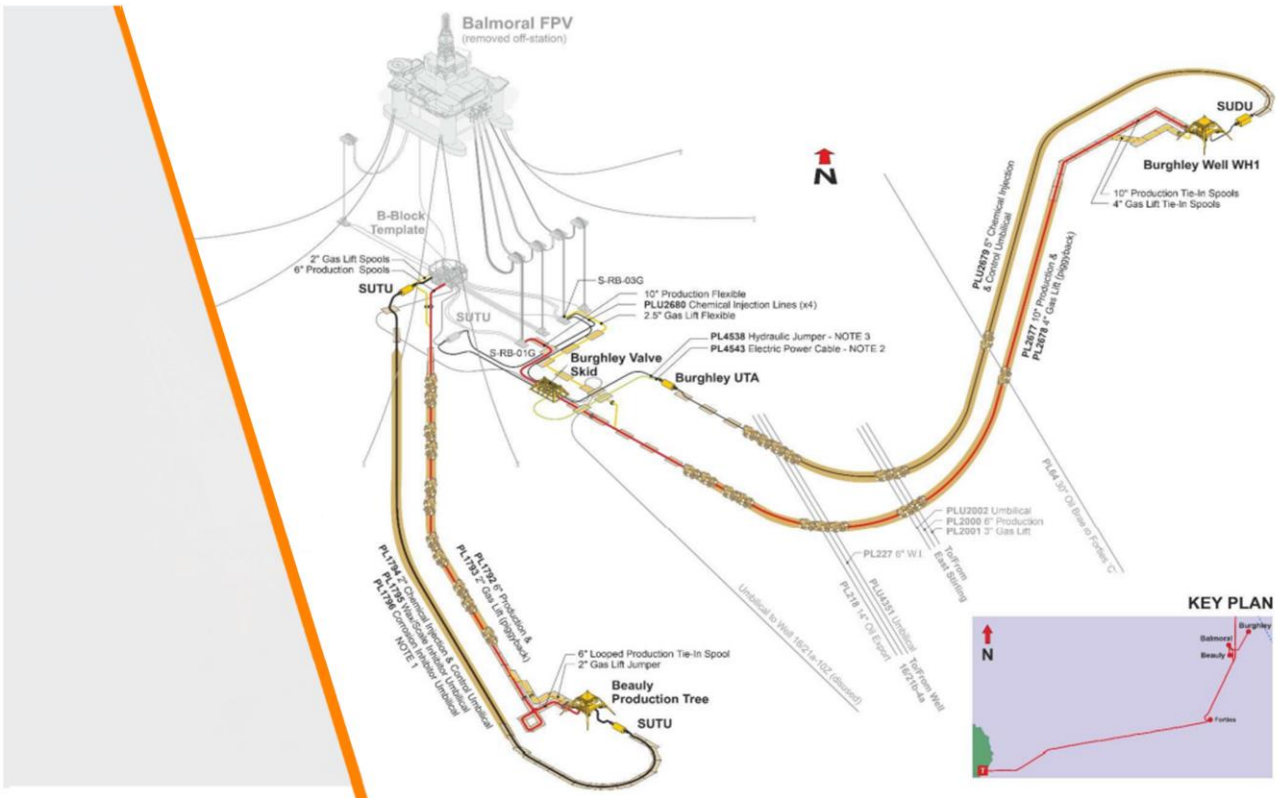

BEAULY & BURGHLEY DECOMMISSIONING PROGRAMMES

Pipelines Comparative Assessment Report

Consultation Draft

March 2023

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ABBREVIATIONS

BEIS	Department for Business, Energy & Industrial Strategy
c.	Circa (approximately)
CA	Comparative Assessment
CNS	Central North Sea
CoP	Cessation of Production
CSV	Construction Support Vessel
C&P	Contracting and Procurement
DAR	Decommissioning, Abandonment & Restoration
dia.	Diameter
DSV	Dive Support Vessel
DOC	Depth of Cover
DOL	Depth of Lowering
DP	Decommissioning Programme
EA	Environmental Appraisal
ENVID	Environmental Impact Identification
EPRD	Engineer, Prepare, Remove and Disposal
FPV	Floating Production Vessel
HIRA	Hazard Identification Risk Assessment
HSE	Health, Safety and Environmental
ICES	International Council for the Exploration of the Sea
IS	Impact Significance
km	kilometres
KP	Kilometre Point
LAT	Lowest Astronomical Tide
m	metres
MAH	Major Accident Hazard
Misc.	Miscellaneous
mm	millimetre
MSBL	Mean Seabed Level
MSFD	Marine Strategy Framework Directive
MoE	Magnitude of Effect
N/A	Not Applicable
NMPI	National marine Plan Interactive (Marine Scotland)
NORM	Naturally Occurring Radioactive Material
OBM	Oil Based Mud
OD	Outside Diameter
NSTA	North Sea Transition Authority (formerly OGA)
OGUK	Oil and Gas UK Ltd
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Oslo-Paris Convention

PL	Pipeline
PLU	Umbilical
PWA	Pipeline Works Authorisation
RAG	Red /Amber / Green
RAM	Risk Assessment Matrix
ROV	Remotely Operated Vehicle
SIMOPS	Simultaneous Operations
SUDU	Subsea Umbilical Distribution Unit
SUTU	Subsea Umbilical Termination Unit
te	Tonne
TOP	Top of Pipe
TTD	Target Trench Depth
UKCS	United Kingdom Continental Shelf
UTA	Umbilical Termination Assembly
3LPP	3 Layer Polypropylene
“	inch

1. EXECUTIVE SUMMARY

This document has been prepared to support the Decommissioning Programmes (DPs) for the Beauly and Burghley Fields pipeline and umbilical systems.

- Oil was first discovered at the Beauly field in 1998 and was brought onstream in February 2001 as a single subsea horizontal well development tied back to the Balmoral Floating Production Vessel (FPV).
- Oil was first discovered at the Burghley field in 2005 and was brought onstream in October 2010 as a single subsea horizontal well development tied back to the Balmoral FPV.
- Both fields are now in the decommissioning phase, with Cessation of Production (CoP) declared on 28th November 2020 when the Balmoral FPV ceased production and Premier Oil commenced preparation for removal of the FPV. The FPV departed location in July 2021.

The Beauly and Burghley Fields are located in Block 16/21c, approximately 220km to the Northeast of Aberdeen in a water depth of around 143 meters LAT.

Each field comprises of a single well which used to tie back to the Balmoral FPV.

- The Beauly well is approximately 5.3km from Balmoral and is connected by a 6" Production pipeline with a piggy-backed 2" gas lift pipeline. Subsea controls and chemicals were previously provided by an umbilical from the Balmoral FPV.
- The Burghley well is approximately 10.1km from Balmoral and is connected by a 10" multiphase production pipeline with a piggy-backed 4" gas lift pipeline. Subsea controls and chemicals were previously provided by an electro-hydraulic umbilical from the Balmoral FPV.

See field location in Figure 1 and field layout in Figure 2. A more detailed description of the field infrastructure with individual field locations is provided in Section 2.1.

There is *c.*30.61km of rigid pipeline and c.15.65km of umbilicals associated with the Beauly and Burghley Fields to be comparatively assessed. The decommissioning options for the pipelines and umbilicals have been subjected to a process of Comparative Assessment (CA) to assist the Repsol Sinopec Resources UK Limited project team to determine the preferred decommissioning strategy in compliance with the Department for Business, Energy & Industrial Strategy (BEIS) Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998 [1].

The strategy for surface laid structures, jumpers and any exposed stabilisation or protection features (mattresses, grout bags etc.) is that they will be removed and returned onshore for recycling or disposal. This CA Report therefore considers the decommissioning options for the subsea pipelines and umbilicals only.

Robust evidence has been gathered in terms of determining quantities and status of the pipelines and umbilicals associated with the development area, by review of separate survey reports conducted over the operational life of the fields. A review of this evidence has determined the burial depth of the pipelines and umbilical and stability of the seabed is such that the lines currently trenched and buried are predicted to remain so.

The decommissioning options considered were:

- Total Removal, with all removed materials returned onshore for recycling and disposal:
  - By Reverse Reeling;

Total Removal by Reverse S-Lay and Total Removal by Cut and lift were pre-screened out during early pre-screening studies and was not evaluated in the CA. Section 5.1 elaborates on why these options were pre-screened out.

- Remediate In-situ, by leaving the trenched and buried and rock covered sections of the lines in-situ, whilst remediating the exposed sections by one of the following sub options:
  - Rock Cover in-situ;
  - Trench and Bury in-situ;
  - Cut and Remove with all removed materials returned onshore for recycle and disposal.

Each of the decommissioning options are described in more detail in Section 3.2

The option to Leave In-situ and Monitor the pipelines and umbilicals without any remediation activity was also pre-screened out during early pre-screening studies and was not evaluated in the CA. Section 5.1 elaborates on why this option was pre-screened out.

All decommissioning options and their sub options listed above, including one option for total removal of all pipelines and umbilicals have been carried through to the conclusion of the CA process.

Two separate pipelines/ umbilicals groups were considered during the CA process these are listed, together with the recommended/ preferred decommissioning option for each group in Table 1.

Table 1: Summary of Preferred Decommissioning Option by Pipeline Group

Group ID[1]	Component / As-laid Condition	Agreed Groupings[2]	Burial Status[3]	Preferred Decommissioning Option[4]
A	Rigid Trunk Pipelines, Piggy-backed, Trenched and Buried	Includes: One 6" x 5.2km with one 2" x 5.2km piggy-backed to the 6" line (Beauly). One 10" x 10.105km with one 4" x 10.105km piggy-backed to the 10" line (Burghley).	The lines are trenched buried >0.6m Depth of Cover (DOC) and have supplementary rock cover, exposures are very short, located at pipeline ends only.	Remediate In-situ with exposed sections cut and removed.[5]
B	Umbilicals, Trenched and Buried	Includes: One 102mm OD umbilical x 5.275km (Beauly) One 130mm OD umbilical x 10.470km (Burghley)	The lines are trenched buried to a DOC of 0.64m (Beauly) and 0.57m (Burghley), exposures are very short, located at pipeline ends only.	Remediate In-situ with exposed sections cut and removed.[6]

Table 1 Notes:

[1] Basis for pipeline groupings is described in Section 4.1.4.

[2] Detailed listings and pipeline numbers of each pipeline/ umbilical included in specific pipelines groups are provided in Table 9.

[3] A summary of the average burial status across the pipeline group is provided. Detailed burial status of each pipeline within the group is provided in Table 9.

[4] Basis for preferred decommissioning options are clarified in Section 6.1.

[5] Although the option to "Remediate in-situ with exposed sections cut and removed" is ranked as the most preferred option in pipeline Group A, the difference in rating between all three remediate in-situ options considered is marginal and all three options will be carried through to a Contracting and Procurement (C&P) phase of the project to allow contractors to tender and propose the overall preferred option. If the C&P tendering phase results in another remediate in-situ option being considered more favourable than the most preferred option noted in the table, the Operator will engage with Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) before a decision is taken on overall strategy.

[6] Although the option to "Remediate in-situ with exposed sections cut and removed" is ranked as the most preferred option in pipeline Group B, the difference in rating between all four decommissioning options considered is marginal and all four options will be carried through to a Contracting and Procurement (C&P) phase of the project to allow contractors to tender and propose the overall preferred option. If the C&P tendering phase results in another remediate in-situ option being considered more favourable than the most preferred option noted in the table, the Operator will engage with Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) before a decision is taken on overall strategy.

This CA report is one of two documents submitted for consultation in support of the Beauly and Burghley Field DPs, along with the Subsea Decommissioning Environmental Appraisal (EA) [2].

The DPs supported by this CA are:

- Decommissioning Programmes – Beauly [3]
- Decommissioning Programmes – Burghley [4]

When the documents have reached issued for consultation phase, all documents will be made available online at the OPRED website, and on request from Repsol Sinopec Resources UK Limited.

2. PROJECT OVERVIEW

2.1. Field Description

The Beauly field is located in Block 16/21c, approximately 220km to the Northeast of Aberdeen in a water depth of around 143 meters. The Beauly field consists of a single well located which used to tie back to the Balmoral FPV[1].

The Beauly well is approximately 5.3km from Balmoral and is connected by a 6" Production pipeline with a piggy-backed 2" gas lift pipeline. Subsea controls and chemicals were previously provided by an umbilical from the Balmoral FPV[1].

The Burghley field is located in Block 16/22, approximately 220km to the Northeast of Aberdeen in a water depth of around 143 meters. The Burghley field consists of a single well which used to tie back to the Balmoral FPV[1].

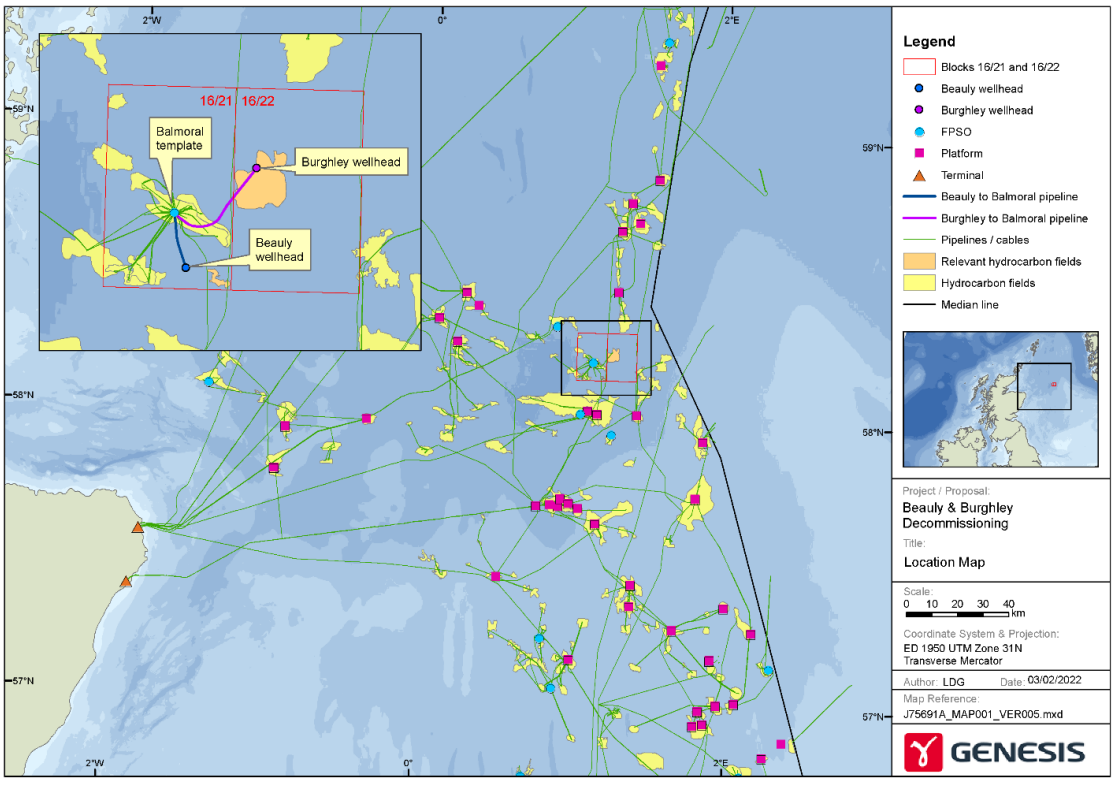
The Burghley well is approximately 10.1km from Balmoral and is connected by a 10" multiphase production pipeline with a piggy-backed 4" gas lift pipeline. Subsea controls and chemicals were previously provided by an electro-hydraulic umbilical from the Balmoral FPV[1].

Figure 1 illustrates the location of the fields whilst Figure 2 illustrates the field layout during production and distinguishes the infrastructure associated with the Beauly and Burghley Field DP scopes from other infrastructure covered by the previously approved Decommissioning Programmes for the wider Balmoral field prepared by Premier Oil.

Oil was first discovered at the Beauly field in 1998. And was brought onstream in February 2001 as a single subsea horizontal well development tied back to the Balmoral FPV. Oil was first discovered at the Burghley field in 2005. And was brought onstream in October 2010 as a single subsea horizontal well development tied back to the Balmoral FPV.

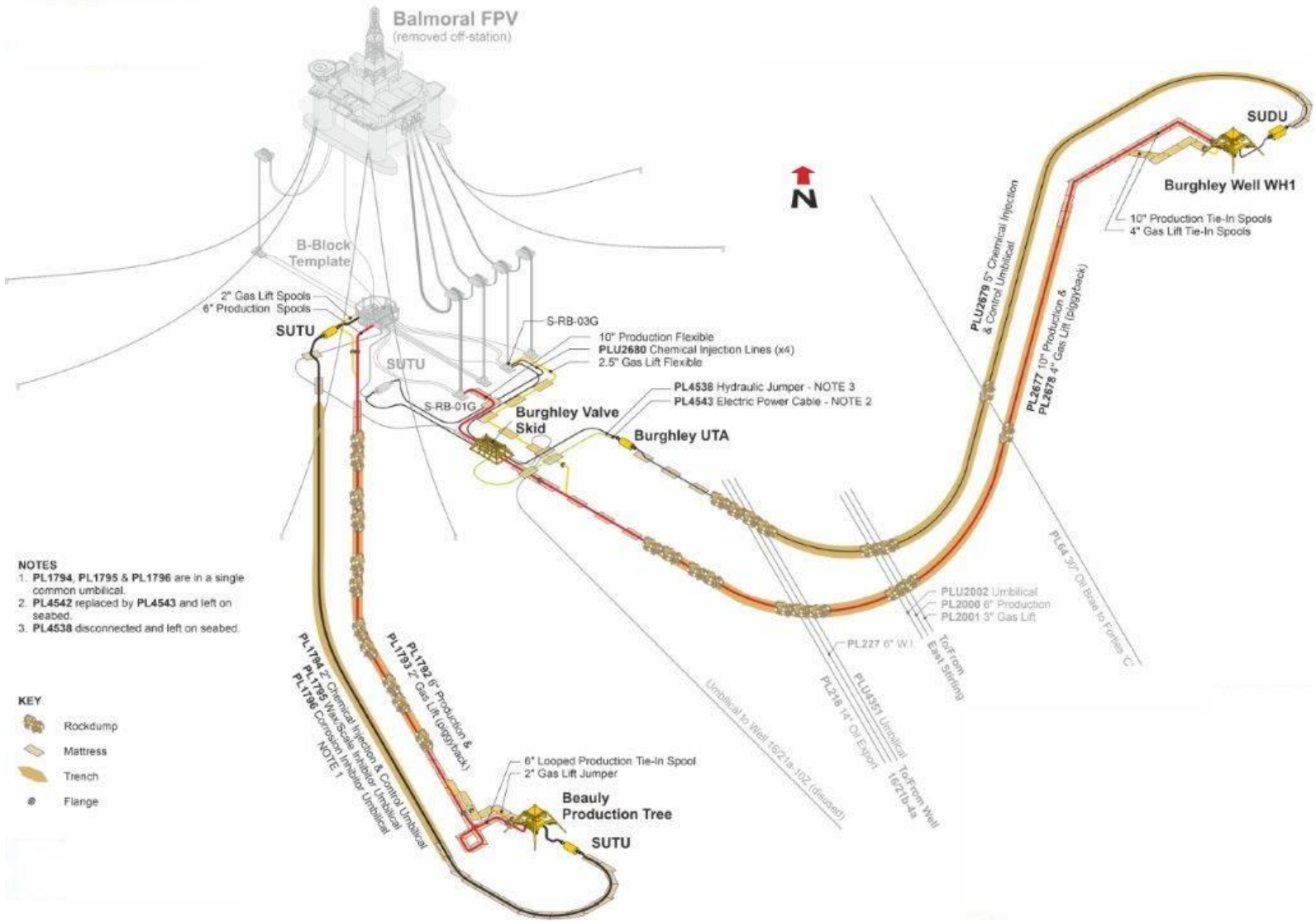
Both fields ceased production and declared CoP on 28th November 2020 when the Balmoral FPV ceased production and Premier Oil commenced preparation for removal of the FPV. The FPV departed location in July 2021.

Figure 1: Field Location



[1] COP for Beauly and Burghley has already been achieved and the lines have been flushed and isolated. The Balmoral FPV has already been moved offstation and the risers, now laid down on the seabed, the riser bases and Balmoral template are outside the scope of the Beauly and Burghley Field DPs.

Figure 2: Field Layout



2.2. Environment and Social Overview

A detailed description of the environmental and social baseline at the Beauly & Burghley fields is provided in the Subsea Environmental Appraisal (EA) Report [2], whilst a brief overview is presented in Section 4.1 of the DPs submissions [3 and 4].

In summary, In August 2017, Repsol Sinopec Resources UK Limited commissioned a pre-decommissioning environmental survey of the Beauly and Burghley Fields.

The seabed across the survey area was interpreted from SSS data as comprising mud and sandy mud. Drill cuttings were observed in grab samples at four stations in the Burghley wellhead area. The sediment type in the vicinity of Beauly and Burghley fields using Marine Strategy framework Directive (MSFD) predominant habitat classification data (EMODnet, 2018). Seabed sediments within blocks 16/21 and 16/22 comprise offshore circalittoral mud.

The fauna observed across the survey area are described as sparse, with the most frequently occurring species being sea pens (*Virgularia mirabilis*, *Pennatula phosphorea*), sea urchins (*Gracilechinus acutus*), starfish (*Asterias rubens*), shrimp (Caridea), hermit crabs (Paguridae) and hagfish (*Myxine glutinosa*). Gadoid fish (including *Pollachius virens*, *Molva molva*, *Trisopterus esmarkii*), flatfish (Pleuronectiformes), polychaete worms (Serpulidae, *Ditrupa arietina*), starfish (*Astropecten irregularis*), Norway lobsters (*Nephrops norvegicus*), and euphasiids (Euphausiacea), were observed infrequently.

Burrows were common across both survey areas, including mounds with conspicuous burrows forming a prominent feature of the sediments. The fauna responsible for creating the burrows were not identified, however the presence of sea pens and burrows means that the environmentally sensitive habitat 'sea pens and burrowing megafauna communities' may occur within the survey area.

At stations where drill cuttings and other anthropogenic debris were present, species observed included polychaete worms (Serpulidae, cf. *Ditrupa arietina*), hydroids (Hydrozoa), sea anemones (*Urticina sp*.), starfish (*Asterias rubens*), squat lobsters (Galatheidae) and sea squirts (Ascidiacea)

Macrofaunal analysis of samples collected during the Beauly survey showed that the dominant taxa were annelids (46 %) arthropods (25 %) and molluscs (19 %). These taxa also dominate in terms of individual animals. The top ten most abundant taxa include the molluscs *Adontorhina similis* and *Parathyasira equalis*, and polychaete worms *Levinsenia gracilis*, *Abyssoninoe hibernica*, *Eclysippe vanelli*, *Galathowenia oculata* and *Paramphinome jeffreysii.*

The results of macrofaunal analysis of samples collected during the Burghley survey were similar to the Beauly area with the dominant taxa comprising 50 % annelids, 25 % arthropods, and 15 % molluscs and that these groups also dominate in terms of individual animals. The most abundant taxa were polychaete worms *P. jeffreysii*, *L. gracilis*, *G. oculata* and *Heteromastus filiformis*.

Low variation in species diversity and evenness was demonstrated throughout the Beauly and Burghley survey areas.

Plankton, benthic and fish species in the area are typical of the CNS. Of the fish species identified in the area, cod, Norway pout, whiting, blue whiting and anglerfish have been assessed by Scottish Natural Heritage and Joint Nature Conservation Committee as Priority Marine Features in Scotland.

The Beauly and Burghley fields occur within ICES rectangle 45F1. Data provided by the Scottish Government indicate that seine nets and trawl gear are both used in this rectangle (Marine Scotland, 2021). Species targeted in the area include herring, mackerel, haddock, whiting, anglerfish, cod, saithe and *Nephrops*.

Using data provided by the Scottish Government (Marine Scotland, 2021), fishing effort (vessel days), value and quantity data have been plotted for UK vessels ≥ 10 m in length. The data suggest that this ICES rectangle encompasses an area that is relatively important to the UK fishing industry such that fishing activity in the area can be considered moderate.

Shipping densities in the North Sea are categorised by the North Sea Transition Authority (NSTA) to be either: negligible; very low; low; moderate; high; or very high. The shipping activity in blocks 16/21 and 16/22 is considered very low, whilst it is low in adjacent blocks to the south and moderate to the north.

The Beauly and Burghley fields are situated in a well-developed area of the North Sea, with seven assets operated by others between 13km to 31km from the Beauly and Burghley infrastructure

There are approximately 11 wrecks situated within 20 km of the Beauly and Burghley fields, three of which are situated within blocks 16/21 and 16/22. There are wrecks situated approximately 2 km east of the Beauly wellhead and approximately 3 km northwest of the Burghley wellhead.

There are no offshore windfarm developments in the vicinity of the Beauly and Burghley fields (Crown Estate, 2021) The closest telecommunications line is located approximately 70 km to the northeast (NMPI, 2019). There are no military exercise areas in the vicinity of the Beauly and Burghley fields (NMPI, 2019).

2.3. Inclusions, Exclusions and Boundaries for CA

2.3.1 Inclusions

Pipelines and Umbilicals

Two production pipelines, two gas lift pipelines and two umbilicals, one of each associated with each well are evaluated by the CA.

The pipelines and umbilicals (and their respective pipeline number, dimensions and specific boundaries) that have been evaluated in this CA are presented in Table 2 and Table 9.

For efficiency both fields have been evaluated together in one CA workshop and have therefore been listed and grouped together in this CA report and during the preparation of the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5].

Since this CA report supports two separate DPs; Beauly [3] and Burghley [4] Table 9 provides detail of the relevant DP applicable to each pipeline.

Table 2: Pipelines and Umbilicals Included in the CA Evaluation

Pipeline Number	Diameter and (Wall Thickness) (mm)	Length[1] (km)	Description	Original Product Conveyed	Description of Component Parts	From – To End Points	Burial Status	Pipeline Status	Current Content
BEAULY FIELD PIPELINES AND UMBILICALS									
PL1792	168.3 (7.9)	5.200	6" Main Production Pipeline	Oil	Carbon steel/ plastics/ misc. coatings (3LPP) & aluminium alloy	From the 6" Production header at the Beauly wellhead to the main pipeline termination at Balmoral template	Trenched and buried to an average depth of burial of 1.37m, with rock dump on 4.3Km of length, across 36 locations	Out of use	Filtered seawater
PL1793	60.3 (4.00)	5.200	2" Gas Lift Pipeline (piggy-backed to PL1792)	Lift Gas	Carbon steel/ plastics/ misc. coatings (3LPP) & aluminium alloy	From the Gas Lift pipeline termination at Balmoral template to the Gas Lift pipeline termination at Beauly wellhead		Out of use	Filtered seawater
PL1794[2]/ PL1795/ PL1796 [3]	102 (N/A)	5.275[3]	Control/Spare Chemical Umbilical/ Wax Inhibitor, Scale Inhibitor Umbilical/ Corrosion Inhibitor Umbilical	Hydraulic Fluid / Chemicals	Stainless steel/ plastics & misc. coatings	From the SUTU at Balmoral to the SUTU at Beauly wellhead	Trenched and buried to an average depth of burial of 0.64m	Out of use	Aqualink 300[2]/ Filtered seawater
BURGHLEY FIELD PIPELINES AND UMBILICALS									
PL2677	273.1 (15.9)	10.105	10" Main Production Pipeline	Oil	Carbon steel/ stainless steel/ plastics/ misc. coatings & aluminium alloy	From the 10" Production header at the Burghley wellhead to the Glamis riser base	Trenched and buried to an average depth of burial of 1.31m, with rock dump on to protect crossings and upheaval buckling	Out of use	Filtered seawater
PL2678	114.3 (7.9)	10.105	4" Gas Lift Pipeline (piggy-backed to PL2677)	Lift Gas	Carbon steel/ stainless steel/ plastics/ misc. coatings & aluminium alloy	From the Gas Lift pipeline termination at riser base S-RB-03G at Balmoral to the 4" Gas Lift header at the Burghley wellhead		Out of use	Filtered seawater
PLU2679[2]	130.3 (N/A)	10.470	Control / Chemical injection umbilical	Hydraulic Fluid / Chemicals	Stainless / plastics/ misc. coatings & copper	From the UTA at Balmoral to the SUDU at Burghley wellhead	Trenched and buried to an average depth of burial of 0.57m, with rock dump on to protect crossings	Out of use	Aqualink 300[2]/ Filtered seawater

[1] All pipeline lengths quoted in Pipeline Works Authorisation (PWA) documents include jumper spool lengths. However, since jumper spools are to be recovered and returned onshore and are excluded from this CA, all pipeline lengths quoted in Table 2 exclude jumper spool lengths.

[2] Control umbilical cores have not been flushed and contain the remaining hydraulic fluid Aqualink 300, a biodegradable water glycol hydraulic control fluid.

[3] Although the umbilical cores have been allocated separate pipeline numbers in the PWA notification, all cores associated with the three PL numbers are within a single common umbilical.

2.3.2 Exclusions

Pipe Spools and Jumpers

There are 10 short and exposed pipe tie-in spools or flexible jumper tie-ins at each end of each the main pipelines and there is a further two redundant lines on the seabed ranging in length from 13m to 300m long. The total combined length of all spools is approximately 558m with a total combined weight of approximately 79te.

There are also 21 short and exposed umbilical jumpers at each end of each of the main umbilicals ranging in length from 25m to 101m long. The total combined length of all umbilical jumpers is approximately 1,201m with a total combined weight of approximately 4.12te.

Table 3 and Table 4 provides a description of each spool and jumper, whilst

Table 5 summarises the two redundant lines currently on the seabed.

In compliance with BEIS Guidance [1], exposed small diameter pipelines, including flexible flowlines and umbilicals are expected to be entirely removed. Therefore, the base case is that all exposed pipeline spools, flexible jumpers umbilical jumpers and redundant spools will be fully removed and returned onshore for recycle and were therefore excluded from the formal CA.

Subsea Structures

A wellhead protection structure (WHPS) is located over each wellhead, and these will be fully removed as part of the wells P&A scope and will be returned onshore for reuse/recycling or disposal. Both WHPS are a gravity based structures and are already partially decommissioned:

- The Beauly WHPS weighs 32.9te and with dimensions 5.6m x 5.6m x 4.12m(h)
- The Burghley WHPS weighs 51.51te and with dimensions 9.2m x 9.2m x 6.2m (h)

Since these structures are to be fully removed, they have been excluded from the CA.

There is one further subsea structure associated with the Beauly and Burghley Fields and it is the Burghley Valve Skid (BVS) which is 9.2m x 7.7m x 4.1m high and weighs 48.15te. In compliance with BEIS Guidance [1], the BVS is not a candidate for derogation and therefore, the base case is that it will also be fully removed and returned onshore for recycle and has therefore been excluded from the CA.

Stabilisation / Protection Features

There are approximately 290 (1,868te) prefabricated mattresses, 736 (18te) grout bags and 34,582te of rock cover in the Beauly and Burghley Fields.

The mattresses and grout bags are located at the ends of pipelines in the Balmoral 500m exclusions zone and at the field end well tie-ins. There are also mattresses and grout bags located at pipeline crossings along the pipeline routes. The mattresses and grout bags offer protection to the exposed sections on pipeline and pipe spools at each end and offer separation and protection at the pipeline crossings.

The Beauly pipelines (PL1792 and PL1793) are trenched and buried to an average burial depth of 1.37m with exposed areas only reported at the trench transitions to the seabed surface tie-ins at either end of the pipelines. Rock dump has been installed over approx. 4.3km of the pipeline route, at 33 locations along the length originally to provide upheaval buckling mitigation during operation. Rock was also installed in three additional locations, KP0.720 to KP0.875, KP1.240 to KP1.365 and KP1.405 and KP1.640.

There is no rock cover associated with the Beauly Umbilical (PL1794/ PL1795/ PL1796).

The Burghley pipelines (PL2677 and PL2678) are trenched and buried to an average burial depth of 1.31m with exposed areas only reported at the trench transitions to the seabed surface tie-ins at each end of the pipelines. The pipeline is also rock dumped close to the end flange just inside the 500m zone at the Balmoral Manifold Template. The pipeline is exposed between this rock dump and the end flange for approximately 20m. Rock dump is installed to provide protection to three crossings along the pipelines route and originally to provide upheaval buckling mitigation during operation.

The Burghley Umbilical (PLU2679) is also rock dumped, to protect the crossings listed in Table 6 however, additional rock (212te) has been placed on a specific location at KP1.2 to KP1.29.

The locations, quantities and weights of stabilisation features are summarised by field in Table 6.

From a review of inspection reports, all exposed mattresses and grout bags, are expected to be recoverable. Subject to the outcome of the CA for pipelines that are rock covered, rock berms may be left undisturbed. Mattresses and grout bags that are already fully buried or are rock covered will be decommissioned in-situ.

Since these proposals are aligned with the expectations identified in the BEIS Guidance [1], mattresses are excluded from this CA. If, during execution of the project, full recovery of all exposed mattresses is not achievable, the operator will engage with OPRED to agree alternative options.

A further breakdown of materials type and itemised description of the components noted as excluded in the subsections above are provided in the Material and Waste Inventories Report [6].

Table 3: Beauly Pipe spools and jumpers, excluded from the CA evaluation

Reference	Diameter and (Wall Thickness) (mm)	Length (m)	Description	Original Product Conveyed	Description of Component Parts	From – To End Points	Burial Status	Pipeline Status	Current Content
Tie-ins associated with PL1792	168.3 (15.9)	13.3	Well tie-in spool	Oil	Carbon Steel/ Glass flake/Epoxy/ Aluminium anode	From the tie-in at the well 16/21c to the Looped pipeline tie-in spool	Surface laid	Out of use	Filtered seawater
	168.3 (15.9)	20.4	Looped pipeline tie-in spool	Oil		From the well tie-in spool flange to the Production pipeline inlet flange (PL1792)	Surface laid	Out of use	Filtered seawater
	165 (31.7)	30.0	Flexible jumper	Oil	Stainless steel carcass/ Rubber liner/ Textile reinforcement/ Carbon steel reinforcement / Elastomeric cover	From the production pipeline outlet flange (PL1792) to the Balmoral Manifold Template	Surface laid	Out of use	Filtered seawater
Tie-ins associated with PL1793	110 (26.97)	45	Flexible jumper	Gas		From the Balmoral Manifold Template to the Gas Lift pipeline inlet flange (PL1793)	Surface laid	Out of use	Filtered seawater
	110 (26.97)	30	Well tie-in spool	Gas	Carbon Steel/ Glass flake/Epoxy	From the Gas Lift pipeline outlet flange (PL1793) to the tie-in at Well 16/21c	Surface laid	Out of use	Filtered seawater
PIPE SPOOLS TOTAL		**138.7**							
Jumpers associated with Beauly main umbilical	Varies	111[1]	Hydraulic control jumpers (2-off) and chemical jumper (1-off)	Hydraulic Fluid / Chemicals	Stainless steel/ plastics & misc. coatings	From the Balmoral Manifold Template to the SUTU at Balmoral	Surface laid	Out of use	Aqualink 300[2]/ Filtered seawater
	102 (N/A)	10	Hydraulic/Chemical Control Jumper			From the SUTU at Beauly Well to the tie-in at the well 16/21c	Surface laid	Out of use	Aqualink 300[2]/ Filtered seawater
UMBILICAL JUMPERS TOTAL		**121**							
BEAULY TOTAL		**259.7**							

[1] Combined length of jumpers within this bundle (3 off, each varies between 25m and 59m long)

[2] Control umbilical cores have not been flushed and contain the remaining hydraulic fluid Aqualink 300, a biodegradable water glycol hydraulic control fluid.

Table 4: Burghley Pipe spools and jumpers, excluded from the CA evaluation

Reference	Diameter and (Wall Thickness) (mm)	Length (m)	Description	Original Product Conveyed	Description of Component Parts	From – To End Points	Burial Status	Pipeline Status	Current Content
Tie-ins associated with PL2677	168.3 (14.3)	45	Well tie-in spool	Oil	Carbon Steel/ Glass flake/Epoxy/ Aluminium anode	From the tie-in at the well WH1 to the Production pipeline inlet flange (PL2677)	Surface laid	Out of use	Filtered seawater
	168.3 (15.9)	300	10" Flexible jumper	Oil	Stainless steel carcass/ Rubber liner/ Textile reinforcement/ Carbon steel reinforcement / Elastomeric cover	From the Production pipeline outlet flange (PL2677) to the Spool flange	Surface laid	Out of use	Filtered seawater
	165 (31.7)	30	6" Flexible jumper	Oil		From the Burghley Valve Skid (BVS) to the Balmoral Glamis Riser Base	Surface laid	Out of use	Filtered seawater
Tie-ins associated with PL2678	126.5 (31.5)	350	2.5" Flexible jumper	Gas		From the Riser Base at Balmoral to the Gas Lift pipeline inlet flange (PL2678)	Surface laid	Out of use	Filtered seawater
	110 (26.97)	44.5	Well tie-in Spool	Gas	Carbon Steel/ Glass flake/Epoxy	Gas Lift pipeline outlet flange (PL2678) to tie-in at Well WH1	Surface laid	Out of use	Filtered seawater
PIPE SPOOLS TOTAL		**419.5**							
PLU2679	130.3 (N/A)	352[1]	SSIV Control Jumper (4 off)	Hydraulic Fluid	Stainless steel/ plastics & misc. coatings	From the SUTU at Balmoral to the Balmoral Riser Base (S-RB-03G)	Surface laid	Out of use	Aqualink 300[3]
PLU2680	130.3 (N/A)	101	4 x Chemical Injection Jumper (bundle)	Chemicals		From the SUTU at Balmoral to the Balmoral Riser Base (S-RB-03G)	Surface laid	Out of use	Filtered seawater
PL4542[4]	30 (N/A)	57.6	Electric Power Cable (Disconnected)	N/A	Copper/ plastics & misc. coatings	Disconnected and located adjacent to PL4543	Surface laid	Out of use	N/A
PL4543	30 (N/A)	57.6	Electric Cable	N/A	Copper/ plastics & misc. coatings	From the Burghley Valve Skid (BVS) to the Burghley UTA	Surface laid	Out of use	N/A
Misc. Jumpers	Varies	451[2]	Jumper Bundles (8 off)	Hydraulic Fluid / Chemicals	Stainless steel/ plastics & misc. coatings	From the SUTU at Balmoral /BVS to the BVS/Burghley UTA/Balmoral Riser Base	Surface laid	Out of use	Aqualink 300[3]/ Filtered seawater
UMBILICAL JUMPERS TOTAL		1,080							
BURGHLEY TOTAL		1,499.5							

[1] Combined length of jumpers within this bundle (4 off, each 88m long).
[2] Combined length (8 off, each varies between 43m and 85m long – these jumpers are not allocated pipeline numbers in the PWA.
[3] Control umbilical cores have not been flushed and contain the remaining hydraulic fluid Aqualink 300, a biodegradable water glycol hydraulic control fluid.
[4] Previously unnumbered cable / jumper disconnected and left in place on seabed - PL4543 replaced PL4542 in 2017.

Table 5: Redundant and Disconnected Lines

Reference	Diameter and (Wall Thickness) (mm)	Length (m)	Description	Original Product Conveyed	Description of Component Parts	From – To End Points	Burial Status	Pipeline Status	Current Content
PL4538[1]	30 (N/A)	55	Hydraulic Jumper - Disconnected and still on seabed	Hydraulic Fluid	Stainless steel/ plastics & misc. coatings	Located adjacent to PL4539	Surface laid	Out of use	Filtered seawater
PL4542[2]	30 (N/A)	57.6	Power Cable - Disconnected and still on seabed	N/A	Copper/ plastics & misc. coatings	Located adjacent to PL4543	Surface laid	Out of use	N/A

[1] Previously unnumbered jumper disconnected and left in place on seabed and replaced by PL4539 in 2018 (listed in Table 4). (PL4539 was subsequently returned to shore in 2021, such that liability for this pipeline has been removed).
[2] Previously unnumbered jumper disconnected and left in place on seabed and replaced by PL4543 in 2017 (listed in Table 4).

Table 6: Stabilisation / Protection Features Summary by Field

Location	Number Matresses	Weight Mattresses (te)	Number Grout bags	Weight Grout bags (te)	Rockdump (te)
BEAULY					
Balmoral 500m Zone	78	306.7	-	-	-
Beauly Wellhead Approaches	59	236.1	486	12	-
Crossings: - Umbilical 16/21a-10z at Balmoral - PL64 30" Brae to Forties Charlie	15	59.1	-	-	-
Rock dump along pipelines route	-	-	-	-	9,767
BEAULY TOTAL	**152**	**601.9**	**486**	**12**	**9,767**

Location	Number Matresses	Weight Mattresses (te)	Number Grout bags	Weight Grout bags (te)	Rockdump (te)
BURGHLEY					
Balmoral 500m Zone	25	128	50	1.25	-
Crossings within the Balmoral 500m Zone	27	299	50	1.25	5,951
South East Stirling Crossing	23	289	50	1.25	6,425
Brae Forties Crossing	31	385	50	1.25	11,325
Burghley Approaches	32	165	50	1.25	-
Rock dump along pipelines route	-	-	-	-	1,114
BURGHLEY TOTAL	**138**	**1,266**	**250**	**6**	**24,815**

2.3.3 Boundaries

In summary the boundaries of the CA are as follows:

Beauly:

- Both 6" Production pipeline (PL1792) and 2" Gas Lift pipeline (PL1793) between the Beauly Well 16/21c (excluding the well) and the Balmoral Manifold Template (excluding the template);
- The 102mm dia. Umbilical (PL1794/ PL1795/ PL1796), between the SUTU at the Balmoral Manifold Template and the SUTU at the Beauly Well 16/21c.

Burghley:

- Both 10" Production pipeline (PL2677) and 4" Gas Lift pipeline (PL2678) between the Burghley Well WH1(excluding the well) and the Balmoral Glamis Riser base (excluding the riser base);
- The 130mm dia. Umbilical (PLU2679) between the Balmoral UTA and the SUDU at the Burghley Well WH1;

Note: The boundaries of the DP include all pipe tie-ins spools and umbilical jumpers. The boundaries of the CA are slightly different in that they exclude the pipe tie-ins spools and umbilical jumpers. See Sections 2.3.2.

The pipelines, umbilicals included in the CA and their respective boundaries are summarised in Table 2 .

3. DECOMMISSIONING OPTIONS

3.1. Regulatory Context

The decommissioning of offshore oil and gas installations and pipelines on the UKCS is controlled through the Petroleum Act 1998, as amended by the Energy Act 2008.

The UK's international obligations on decommissioning are governed principally by the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention). Agreement on the regime to be applied to the decommissioning of offshore installations in the Convention area was reached at a meeting of the OSPAR Commission in July 1998 (OSPAR Decision 98/3). BEIS Guidance [1] align with OSPAR Decision 98/3.

Pipelines do not fall within the remit of OSPAR Decision 98/3, but OPRED requires that operators apply the OSPAR framework when assessing pipeline decommissioning options.

Because of the widely different circumstances of each case, OPRED does not predict with any certainty what decommissioning strategy may be approved in respect of any class of pipeline. Each pipeline must therefore be considered on its merits and in the light of a CA of the feasible options, considering the safety, environmental, technical, societal and cost impacts of the options. Cost may only be a determining factor when other criteria emerge as equal.

3.2. Options Considered

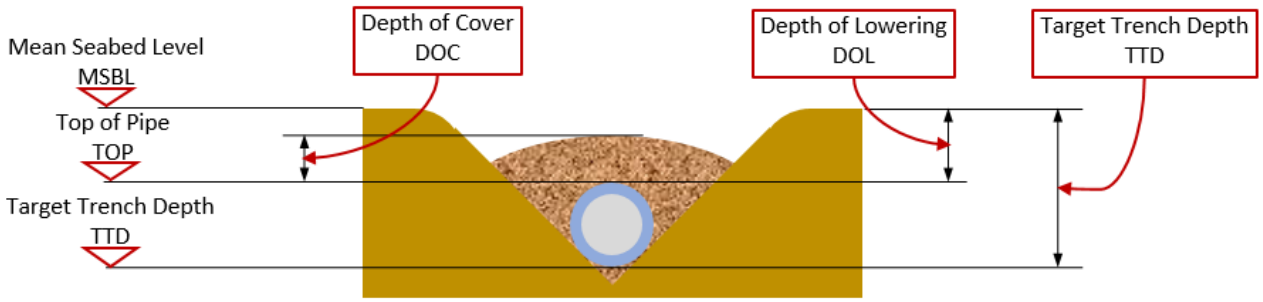
An overview of the decommissioning options considered for each of the pipelines and umbilicals included in the CA evaluation process is presented below, it should be noted that:

- For the purposes of the descriptions below, the term "pipeline" may refer to a rigid pipeline or an umbilical;
- The term "Exposed section" is where no adequate DOC* or DOL* to the pipeline exists e.g.;
  - PL1792 – Beauly 6" Main Production Pipeline (168.3 OD) is currently laid in a trench with adequate DOC of 1.37m (average) with additional 4.3km rock cover along the route. From previous inspection surveys exposures are reported only at the pipeline ends, where it transitions from full burial to tie-in on the seabed surface. PL1792 is therefore adequately buried for most of its length with only short exposures of 133m at the Balmoral tie-in location and 45m at the Beauly wellhead tie-in location.

  *DOC and DOL is explained in Figure 3.

  Table 9 provides details of the burial status of each pipeline evaluated by the CA process.
- Where Total Removal is considered remediation of the open trench or seabed after de burial has not been considered as a requirement however discussion with stakeholders may be required on the condition of the open trench where a Total Removal option is recommended by the CA.

Figure 3: Typical Trenched Pipeline Cross- section



3.2.1 Option 1a): Total Removal by Reverse Reeling

In this option, the pipeline(s) would be fully recovered from the seabed by reverse reeling and returned to shore for recycling or disposal. Note:

The approximate sequence of operations would be as follows:

1. If deep buried - Excavate pipeline(s) from seabed using a mass flow excavator deployed from a Construction Support Vessel (CSV) crane;
2. Remotely Operated Vehicle (ROV) to attach recovery clamp to end of pipeline and connect to reel lay vessel winch wire;
3. Recover pipeline to reel lay vessel and wind on to main or auxiliary reels;
4. Repeat #2 and #3 for remaining pipelines;
5. Transit to shore and offload recovered pipeline(s).

The capacity of currently available reel lay vessels range from 2000te to 5600te. Multiple trips to shore will be required due to the quantity of material to be recovered.

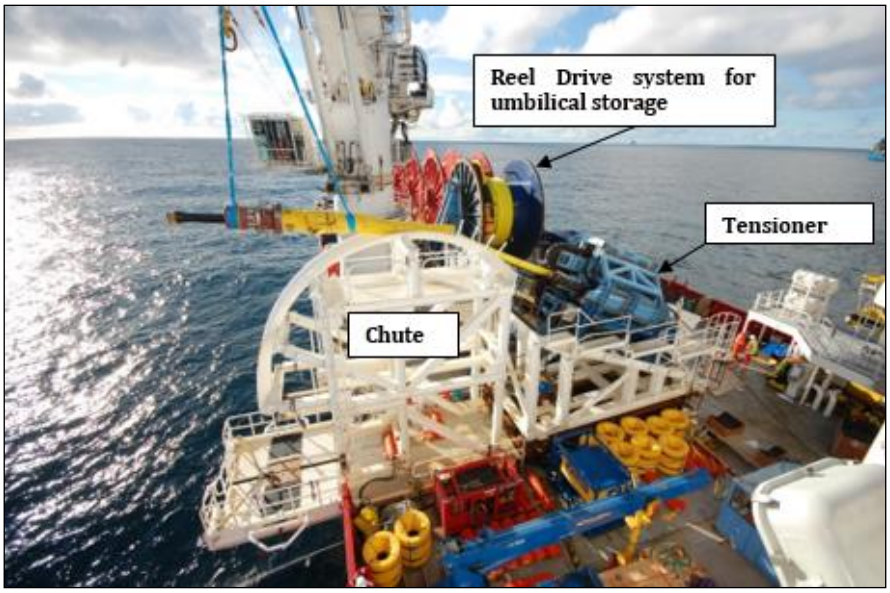
This option is not suitable for concrete coated pipelines installed by "S" lay as the pipelines have not been designed to be reeled on to a vessel, the pipe integrity would potentially fail during reeling operations also pipelines with concrete coating cannot be reeled onto the reel without the coating cracking and falling off the pipeline.

An image of a Typical Reel Lay Vessel is provided in Figure 4.

Figure 4: Typical Reel Lay Vessel

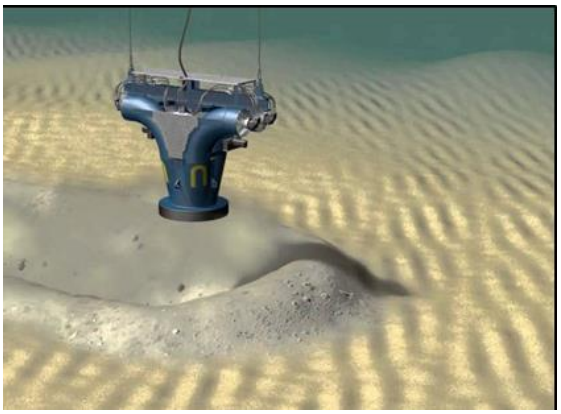
For the smaller diameter pipelines and umbilicals, recovery could also be achieved by using a CSV/ Dive Support Vessel (DSV) with a reel drive system on the deck. Depending on the size of the vessel deck, multiple reels can be used, as shown in Figure 5.

Figure 5: Reel Drive System on a Vessel (umbilical Installation shown)



All pipelines evaluated in the CA are buried and it is expected that these would require de-burial adopting mass flow excavation techniques before recovering, see Figure 6.

Figure 6: Mass Flow Excavation Technique



Both umbilicals evaluated in the CA are also buried, however it may be possible to remove these umbilicals without prior excavation of the soil above the umbilicals. This would be done by pulling the umbilical free from the soil as it is reeled onto the vessel. This would have to be reviewed to determine the top tension required to pull the umbilical out of the seabed and the integrity of the umbilical on a case by case basis, before proceeding with the execution of this removal method.

3.2.2 Option 1b): Total Removal by Reverse S-Lay

In this option, the pipeline(s) would be fully recovered from the seabed by reverse S-lay and returned to shore for recycling or disposal. A pipelay barge (Figure 7) would likely be used for the recovery of the rigid pipelines.

The pipeline would have to have its integrity assessed to resist forces induced during reverse S-Lay, the pipeline should be recovered open ended particularly as it would have been installed empty to reduce tension on the lay system and only flooded post installation. Any damage caused during recovery would need to be appropriately assessed (both from a safety perspective and technically). A particular technical challenge being for the pipeline tensioners ability to maintain appropriate tension during recovery should varying pipeline overall diameters be experienced. Similarly, the presence of any marine growth would have to be appropriately dealt with.

The approximate sequence of operations would be as follows:

1. If Buried - Excavate pipeline(s) from seabed using a mass flow excavator deployed from a CSV crane:

2. ROV to attach recovery clamp to end of pipeline and connect to S-lay vessel winch wire;
3. Recover pipeline to S-lay vessel, secure in tensioner and cut into sections on deck (usually two pipe joints *c.*24m);
4. Repeat #2 and #3 for remaining pipelines;
5. Offload to pipe carriers for transit to shore and offload recovered pipeline(s).

The pipeline would need to be emptied of fluids prior to recovery to reduce the top tension on the vessel during recovery. The pipelines were installed dry and then flooded once on the seabed.

Figure 7: Typical Pipelay Barge

3.2.3 Option 1c): Total Removal by Cut and Lift

In this option, the pipelines would be fully recovered from the seabed and returned to shore for recycling or disposal. The approximate sequence of operations would be as follows:

1. If deep buried - Excavate pipeline(s) from seabed using a mass flow excavator deployed from a CSV crane:
2. ROV to assist with the deployment of cutting tools (typically hydraulic shears - Figure 8) to cut the pipeline into 24m sections;
3. ROV to attach rigging to the cut sections to allow recovery to surface via the CSV/DSV crane (Figure 9);
4. Repeat #2 and #3 for remaining pipelines;
5. Transit to shore and offload recovered pipeline(s).

Depending on the quantity of material to be recovered it may be more cost efficient to transfer cut sections to a cargo barge with tugs or alternatively pipe haul vessels which would make multiple trips to and from shore.

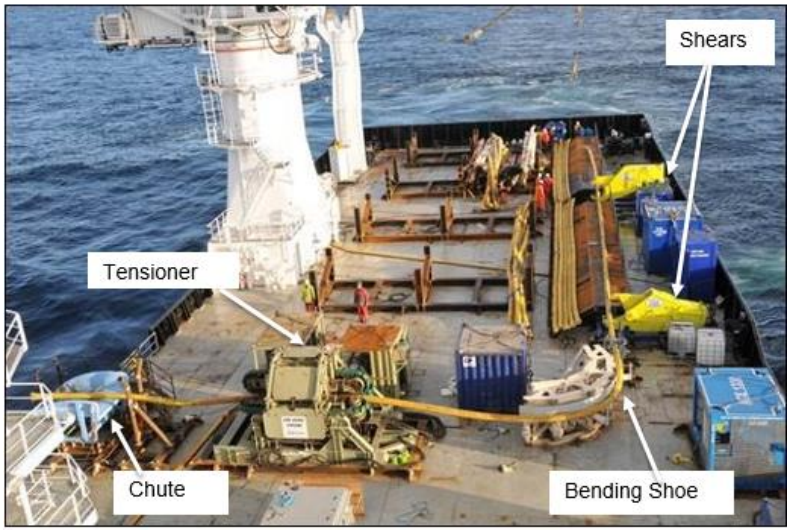
Figure 8: Example of Hydraulic Shears

Figure 9: Pipeline Cut into Sections for Recovery

This method has been used extensively in the UKCS and in decommissioning. It is also suitable for all the pipeline types, concrete coated lines and small diameter pipelines/flowlines.

An option to "Lift and Cut" i.e. firstly recover the pipeline end to the vessel and then cut for recovery may reduce vessel time with short length infield umbilicals and flexibles rather than cutting them into sections on the seabed. Figure 10 shows a typical layout for recovery.

Figure 10: Lift and Cut Methods on a CSV



3.2.4 Option 2a): Remediate In-Situ - Exposed Sections Rock Covered

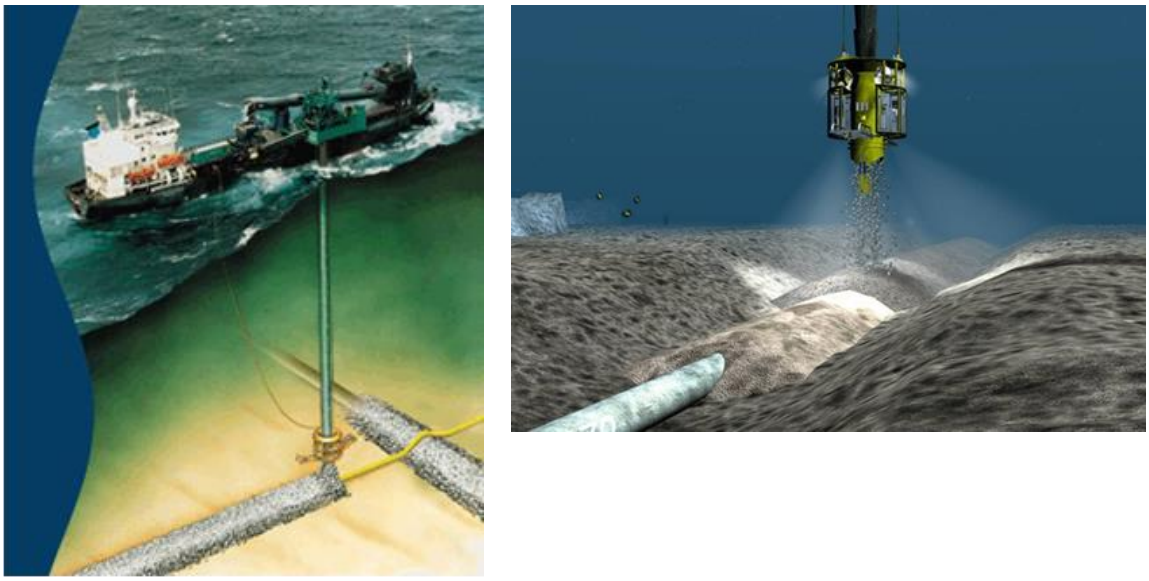
For this option, trenched and buried or rock covered lines would be decommissioned in-situ with rock added to exposed sections to achieve a rock cover profile consistent with being overtrawlable. Where the pipeline is already trenched and buried, the pipeline ends, trench transitions and exposed sections of pipeline identified in the pipeline survey would be covered with rock deployed from a rock dumping vessel, see Note: Based on review of historical inspection records reviewed during development of the Pipelines Status and Historical Review Report [7] and the fact the lines will be no longer in use, the potential for new pipeline exposures to occur in future is very unlikely.

Figure 11. The amount of rock cover would be in line with industry practise and would be agreed with all consultees during the works authorisation process.

Future inspections of the pipelines left in-situ would be required to confirm that no future exposures develop.

Note: Based on review of historical inspection records reviewed during development of the Pipelines Status and Historical Review Report [7] and the fact the lines will be no longer in use, the potential for new pipeline exposures to occur in future is very unlikely.

Figure 11: Typical Rock Dumping Activity



3.2.5 Option 2b): Remediate In-Situ - Exposed Sections Trenched and Buried

For this option, trenched and buried or rock covered lines would be decommissioned in-situ with the exposed sections trenched and buried, using a trenching / jetting unit (Figure 12 or Figure 13) deployed from an CSV / DSV crane. Where the pipeline is already trenched and buried, the pipeline ends, trench transitions and exposed sections of the pipeline identified in the pipeline survey would be trenched and buried. The trenching strategy would be in line with industry practise and would be agreed with all consultees during the works authorisation process.

Future inspections of the pipelines left in-situ would be required to confirm that no future exposures develop.

Note: Based on review of historical inspection records reviewed during development of the Pipelines Status and Historical Review Report [7] and the fact the lines will be no longer in use, the potential for new pipeline exposures to occur in future is very unlikely.

It should be noted that the export pipeline is already in a trench, which would make additional burial difficult as the berms created by trenching, are normally used as the burial material may have dispersed.

Figure 12: Example Jetting/Trenching Unit

Figure 13: Deep Ocean AMP500 Plough

3.2.6 Option 2c): Remediate In-Situ - Exposed Sections Cut and Removed

In this option, the trenched and buried sections of pipeline would remain in place. The pipeline ends, trench transitions and exposed sections of pipeline identified in the pipeline survey would be cut and removed to full trench depth. The approximate sequence of operations would be as follows:

1. Excavate pipeline(s) local to exposed sections to full trench depth using a mass flow excavator deployed from a CSV / DSV crane;
2. ROV to assist with the deployment of cutting tools (typically hydraulic shears) to cut the pipeline into 24m sections;
3. ROV to attach rigging to the cut sections to allow recovery to surface via the CSV/DSV crane;
4. Return cut sections to shore.

Future inspections of the pipelines left in-situ would be required to confirm that no future exposures develop.

Note: Based on review of historical inspection records reviewed during development of the Pipelines Status and Historical Review Report [7] and the fact the lines will be no longer in use, the potential for new pipeline exposures to occur in future is very unlikely.

3.2.7 Option 3: Leave In-Situ and Monitor

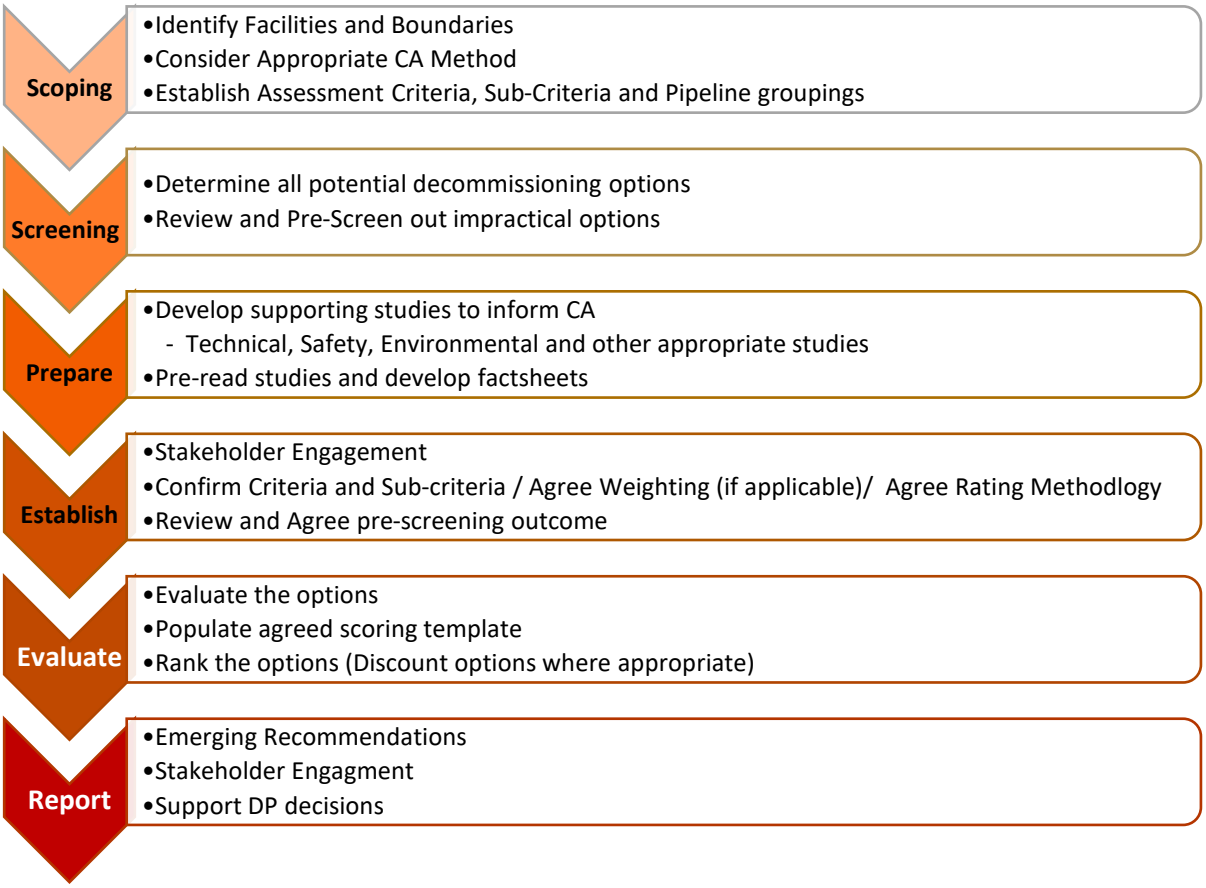
BEIS Guidance [1] identifies certain pipelines that may be candidates for in-situ decommissioning. This Leave In-situ option would mean that no remedial action would be required to the pipelines, but that only periodic monitoring over a period, with the specifics of monitoring agreed with OPRED.

However, only large diameter trunk lines which are not trenched and buried have been identified in the Guidance [1] as potential candidates for decommissioning in-situ, subject to the outcome of a CA evaluation, there are no such pipelines associated with the Beauly or Burghley fields,

4. OVERVIEW OF THE CA PROCESS

The Beauly and Burghley Fields Pipelines Decommissioning CA has followed the recommended process to be adopted for CA as laid out in 2015 Oil and Gas UK Ltd (OGUK) "Guidelines in CA in Decommissioning Programmes – 2015" [8]. Figure 14 , taken from OGUK Guidelines [8], describes the process that was followed.

Figure 14: OGUK CA Process



4.1. Scoping

4.1.1 Facilities and Boundaries

To ensure robust evidence was available to support and inform the CA evaluation of all decommissioning options, significant preparation by data gathering, reviewing drawings, inspection reports, survey reports and operating history has been completed. In addition, technical studies have been completed to accurately determine the quantity, specification, physical layout, status and predicted behaviour of the facilities to be decommissioned.

Three documents were produced that are relevant to and support and inform the CA, they are:

- Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5]
- Material and Waste Inventories Report [6]
- Pipelines Status and Historical Review Report. [7]

The results from these studies are summarised in the tables and narrative provided throughout this CA report. However, these referenced documents are available upon request.

4.1.2 Evaluation Method

It was agreed that Evaluation Method A, as described in the OGUK Guidelines [8] should be adopted i.e. Qualitative Assessment using Red/Amber/Green (RAG) to rate the performance of each decommissioning option against a pre-determined set of sub-criteria.

Under this Evaluation Method A, colour coding represents the relative preference of the options with respect to the criteria and sub-criteria, see Table 7.

Table 7: Evaluation Method A – Comparative Impact

Performance	Comparative Impact
Most Preferred	Lower Impact
	Moderate Impact
Least Preferred	Higher Impact
No Preference	No significant impact across options[1]

Notes for Table 7:

[1] BEIS Guidance [1] Annex A identifies that "The most preferred option should be selected by focusing on the matters where the impacts of the options are significantly different"; therefore, where there is no significant difference between the options the sub-criterion across the options should be colour coded grey.

4.1.3 Assessment Criteria

The five main criteria adopted for the evaluation aligns with BEIS Guidance [1] and the sub-criteria adopted aligns. Table 8 highlights the slight difference in the 14 sub-criteria adopted compared to that provided in the BEIS Guidance [1].

Table 8: Main Criteria and Sub-criteria adopted in the CA evaluation

Main Criteria	Sub-Criteria		Aligned with BEIS Guidance [1] on sub-criteria?
Technical	Risk of major project failure		Yes
	Technical complexity & track record		No- Additional sub-criteria
Safety	Risk During Project Execution Phase	To project personnel	Yes
		To those on land	Yes
		To other users of the sea	Yes
	From end points	Residual risk to other users of the sea	No- but guideline states take account for future use of area
Environment	Impact of Decommissioning Operations Offshore (includes emissions to air, discharges to sea and underwater noise)		Environmental covers all sub-criteria identified in the BEIS Guidance [1] but combines some and splits out others to make more appropriate to this specific project
	Seabed Disturbance- Short Term (includes disturbance to the cuttings pile)		
	Change of Habitat - Long Term		
	Waste Processing (i.e. processing of returned materials and use of landfill)		
Societal	Impact on commercial fisheries		Yes
	Socio-economic impact on communities and amenities		Yes - Communities and amenities combined in one sub-criterion
Economic	Cost of Decommissioning/ Removal activities		BEIS Guidance [1] do not elaborate on economic sub-criteria, but highlight that long-term cost should be a consideration
	Cost for long term monitoring / potential future remediation activities		

4.1.4 Pipeline Groupings

On completion of the subsea studies, listed in Section 4.1.1, where the quantity, specification, physical layout, current status and predicted behaviour of the facilities to be decommissioned was determined, an evaluation of similarities between individual pipelines was completed to determine appropriate pipeline groupings.

Table 9 identifies the agreed pipeline groupings and details of each pipeline within each group and Figure 15 provides the field layout identifying the individual pipeline groups.

Table 9: Pipeline and Umbilicals Grouping for CA

Group ID	Component type / as-laid condition	Agreed groupings[1]	Boundary	Length[2] (km)	Weight (te)	Burial Status[3]	Exposed Length (m)[4]	Relevant DP[5]
A	Rigid Pipelines Piggy-backed Fully Trenched and Buried Predominantly Rock covered	PL1792 – Beauly 6" Main Production Pipeline (168.3 OD)	Entire Length	5.200	176.8	Trenched and buried with average 1.37m DOC, with additional 4.3km rock cover along the route	178 (3.4%)	Beauly
		PL1793 – Beauly 2" Gas Lift Pipeline, piggy-backed to PL1792 (60.3 OD)		5.200	33.2		178 (3.4%)	
		PL2677 – Burghley 10" Main Production Pipeline (273.1 OD)	Entire Length	10.105	1271.1	Trenched and buried with average 1.31m DOC, with additional 1.12km rock cover at pipeline crossings along the route	99 (< 1%)	Burghley
		PL2678 – Beauly 4" Gas Lift Pipeline, piggy-backed to PL2677 (114.3 OD)		10.105	231.7		99 (<1%)	
B	Umbilicals Trenched and Buried	Beauly PL1794/ PL1795/ PL1796 –Control / Chemical injection umbilical (102 OD)	Entire Length	5.275	88	Trenched and buried with average 0.64m DOC, no additional rock cover present	123 (2.3%)	Beauly
		Burghley PLU2679 –Control / Chemical injection umbilical (130 OD)		10.470	234.2	Trenched and buried with average 0.57m DOC, with additional rock cover present at seven crossings and separate 0.3km along the route	512 (4.9%)	Burghley

Notes for Table 9:

1. Agreed grouping pipeline ODs exclude anti-corrosion and insulation coating thicknesses.

2. Pipeline lengths quoted exclude jumpers and tie-in spools.

3. Average burial depths are calculated including exposed lengths, concrete mattresses / blocks and rock cover.

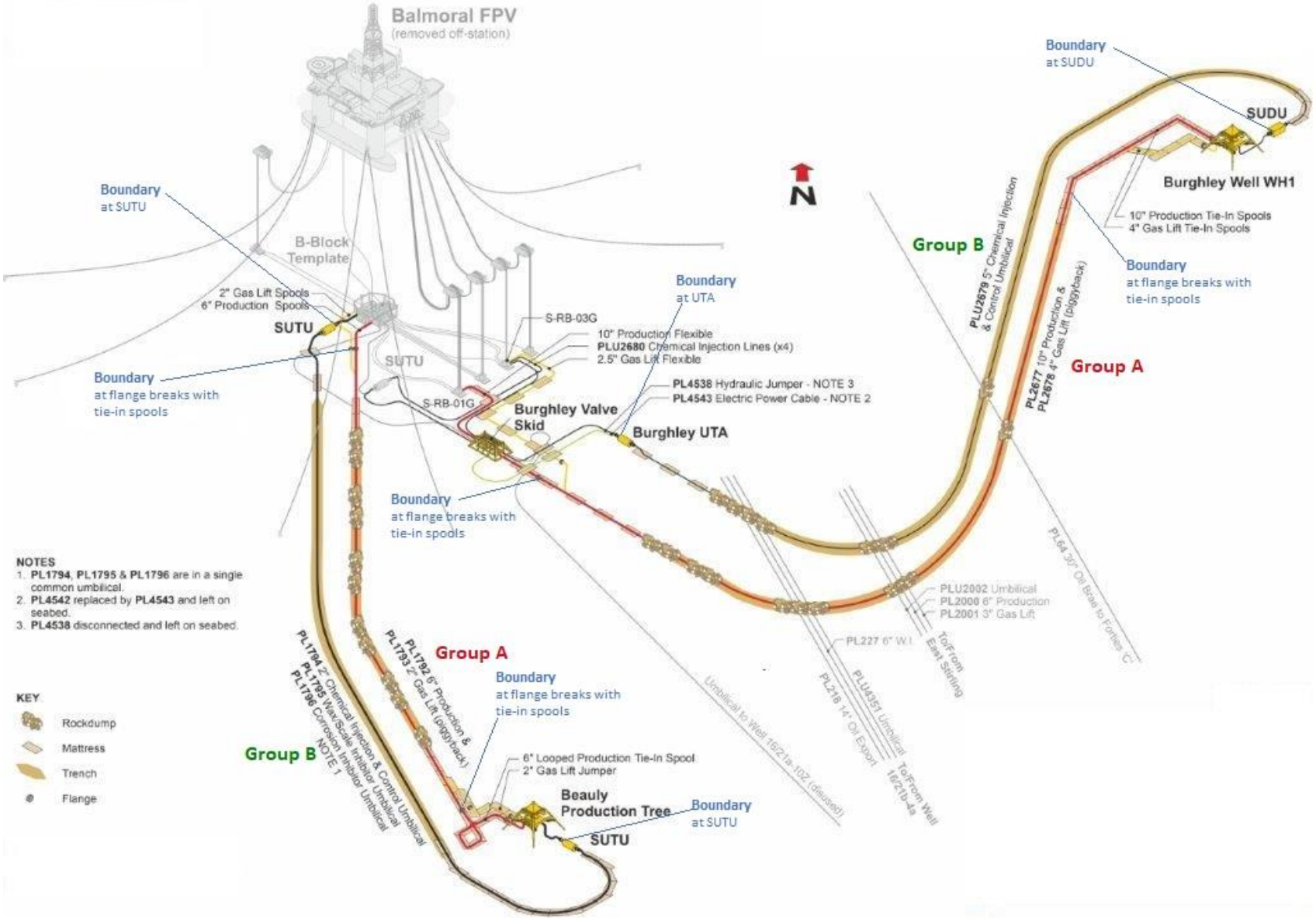
4 Exposed lengths are total lengths where the pipelines / umbilicals have no cover (at the pipeline ends only) and includes lengths covered with concrete mattresses.

Where the exposed length quoted is the summation of the pipeline exposed ends. i.e.:

- PL1792/PL1793 – Total exposure length per pipeline is 178m consisting of 133m at Balmoral and 45m at Beauly Well;
- PL2677/PL2678 – Total exposure length per pipeline is 99m consisting of 20m at Balmoral and 79m at Burghley Well;
- PL1794/PL1795/ 1796 – Total exposure length is 123m consisting of 97m at Balmoral and 26m at Beauly Well;
- PL1792/PL1793 – Total exposure length per pipeline is 512m consisting of 272m at Balmoral and 240m at Burghley Well

5 This report covers all pipelines for both Beauly and Burghley fields. This report supports two separate Decommissioning Programmes a) Beauly and b) Burghley. This column highlights the applicable Decommissioning Programme for each pipeline within each pipeline group.

Figure 15: Field Layout indicating Pipeline Groups



4.2. Screening

BEIS Guidance [1] Annexe A, and the OGUK Guidelines [8] provides guidance expectations for option screening:

Where decommissioning of a pipeline in-situ is being considered, a CA of the options is required. A two-stage process with an early option screening process to narrow options is permissible.

Stage 1: Option Screening

- Identify a comprehensive list of potential decommissioning options;
- Identify the criteria against which each option will be considered;
- Complete an evidence-based evaluation to reduce the number of reasonable/technically feasible options to a short-list;
- Expert review of evaluation results to assure the outcome and choice of options to be carried forward to a more detailed CA.

Stage 2: Detailed CA process

- Adopting shortlisted options from Stage 1, undertake a detailed CA of each option;
- Assessments must be evidenced based, using existing data where possible or gathering additional or latest information as appropriate;
- Decisions must be transparent, and regulators and stakeholders must understand the rationale underpinning the assessment and decision-making process.

To fulfil the requirements of Stage 1 Option screening, these options were taken offline and were studied in detail to define the methods, activities, equipment and vessels needed to support each option. The results of this study are reported in the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] which is available upon request.

Similar assessment criteria as described in Section 4.1.3 were applied during the option screening study. The OGUK Guidelines [8] Evaluation "Type A" approach as described in 4.1.2 was also adopted, where each of the pipeline and umbilical decommissioning options were qualitatively assessed using the RAG evaluation method shown below.

4.3. Preparation

In addition to the Technical studies described in Section 4.1.1, safety and environmental studies were conducted in support of the CA.

4.3.1 Safety Risk Assessment / Environmental Impact Identification

Before the CA evaluation workshop was convened a Hazard Identification and Risk Assessment (HIRA) and an Environmental (Impacts) Identification (ENVID) workshop was convened to inform the CA.

The objectives of the HIRA and the ENVID workshop were to:

- Determine if any of the proposed decommissioning options give rise to safety, health or environmental consequences that would result in any of the options not being taken forward to the CA i.e. to identify if there are any safety, health or environmental 'showstoppers' associated with any option;
- To risk rank (HIRA) or impact rank (ENVID) the activities associated with the decommissioning options within each grouping such that the results can be used to support assessment of the safety, environmental and societal criteria in the CA; and
- To confirm that the safety, environmental and societal sub-criteria to be considered in the CA are the most applicable.

The activities associated with each decommissioning option under consideration for each pipeline group were assessed separately which enabled the specific safety and environmental related risks of each option to be identified.

The HIRA and ENVID processes involved structured approaches, in line with general industry practice. The methodology adopted and the results from both workshops are summarised in Appendix A. The Beauly & Burghley ENVID and HIRA Workshop Report (to support the CA) [9] provides more detail and is available upon request. The ENVID methodology is presented in Appendix A of the Environmental Appraisal [2].

HIRA:

To enable a comparative evaluation of the risks across each decommissioning option under consideration, a Repsol Sinopec Resources UK, Risk Assessment Matrix (RAM) was adopted and used to rate each decommissioning option against an agreed set of guide words.

The HIRA nodes were selected to align with the safety sub-criteria that were to be considered in the CA and included:

1. Risk to project personnel;
2. Risk to other users of the sea[2];
3. Risk to those on land;
4. Risk of High Consequence/ MAH Event(s).

These risk criteria align with the safety sub-criteria to be considered in the CA evaluation as discussed in Section 4.1.3 and in Table 8.

Summary tables were prepared following the HIRA to inform the CA Evaluation Workshop. These summary tables are provided in Appendix A, for reference.

ENVID:

The ENVID nodes considered were as follows:

1. Emissions to air;
2. Resource use (offshore and onshore);
3. Disturbance to the seabed (short term and long term);
4. Discharges to sea;
5. Underwater noise;
6. Physical presence: short term (e.g. presence of vessels during execution) and long
7. term (e.g. infrastructure decommissioned *in situ*);
8. Onshore dismantling yard activities;
9. Waste generation;
10. Unplanned discharges to sea (e.g. loss of vessel inventory).

Note the results of the assessment under the different ENVID nodes were combined such that the final number of environmental sub-criteria will be less than the number of nodes considered in the ENVID[3] .

Summary data sheets were prepared following the ENVID to inform the CA Evaluation Workshop, these data sheets as presented in the CA workshop are provided in Appendix B, for reference.

4.4. Establish

4.4.1 Stakeholder Engagement

A Stakeholder Management Plan [11] has been prepared which identifies stakeholders, communication methods and indicative timings of engagement.

Consulting with stakeholders is an important part of the decommissioning impact assessment process as it allows any concerns or issues which stakeholders may have, to be communicated and addressed.

[2] Includes risk to other users of the sea during execution of the scope and also residual risk to other users of the sea post decommissioning, where equipment is left on or in the seabed.

[3] Typically number of environmental sub-criteria in the CA is expected to be 4 or 5 and will be finalised after the ENVID workshop.

As part of the informal stakeholder engagement process Repsol Sinopec Resources UK Limited issued a Scoping Report [10] to a number of stakeholders. The Scoping Report provided an overview of the Beauly and Burghley fields and the pipeline tie-back routes to the Balmoral FPV location, the proposed decommissioning options that were considered in the CA process , and an overview of the impacts to be assessed in the EA [2].

Stakeholders were invited to comment on the Scoping Report [10] with respect to any concerns they may have. Comments received on the Scoping Report have been considered in this, and subsequent updates to this CA report, and will be addressed in the consultation draft of the EA.

4.4.2 Agreed Criteria, Sub-Criteria and Weightings

Agreed main and sub-criteria are as described in Section 4.1.3.

As described in Section 4.1.2, a qualitative RAG approach to rating performance of each decommissioning option and across each sub-criterion was adopted, therefore, no numerical scoring was available during the evaluation. The application of arithmetic weightings across the criteria to be evaluated was therefore not possible. i.e. all sub-criteria evaluated were given equal weighting.

Therefore, the more sub-criteria evaluated against a specific main criterion results in that specific main criterion having greater influence on the outcome than other main criteria.

To review the impact where all the main criteria had equal weighting, the individual sub-criteria ratings were viewed during the workshop and an average weighting against the specific main criterion was agreed. The average ratings across all five main criteria, were then viewed and an equal weighting rating and ranking was agreed for each pipeline group.

The result of this analysis by main criteria is summarised against each pipeline group in Section 6.1. See also the “Narrative Summary - CA Workshop Output Sheet” for each pipeline group in the workbook provided in Appendix E, for reference.

4.4.3 Review and Agree Pre-screening Outcome

The Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment. [5] was published to the wider project team for review ahead of the CA Evaluation Workshop. The updates from the review cycle of this study [5] was presented as the introduction at the CA Evaluation Workshop described under Section 4.5.

Technical fact sheets were prepared to summarise the results of both the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment report [5] the Material and Waste Inventories report [6] and the Pipelines Status and Historical Review report [7]. The technical fact sheets are provided in Appendix C for reference.

4.5. Evaluate

The CA Evaluation Workshop was convened on 15th March 2022. Details of participants is provided in Table 10.

Table 10: CA Workshop Participants

Repsol Sinopec Resources UK Limited	
Malcolm MacLeod	Project Manager
Ciara McGarry	Environmental Engineer
Alasdair Knox	HSE Lead (Decommissioning)
Stephen Etherson	Senior Subsea Engineer
Genesis	
Stuart Odell	Project Manager
Tim Hollis	Decommissioning, Abandonment & Restoration (DAR) Focal Point
John Wilson	Senior Consultant Decommissioning (Workshop Chair/ Facilitator)
Martha O'Sullivan	Lead Consultant Environmental Engineer
Allan Brown	Senior Consultant – Technical Safety & Risk
Neil Torrance	Senior Consultant – Subsea

Workshop considerations are explained in Section 5.0, the outcome of the workshop is reported in Section 6.1.

4.6. Report

This document reports the emerging recommendations of the CA Workshop, and these are summarised in Section 6.1.

The outcome and recommendations of the CA are reflected in the draft Decommissioning Programmes [3 and 4] to be issued for public consultation.

5. CA WORKSHOP CONSIDERATIONS

5.1. Results of Options Pre-screening

The Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] describes the pre-screening process and provides the basis for the short-listed options to be taken forward in the CA workshop.

Table 11 below, identifies for each pipeline group:

- the options considered initially;
- the options pre-screened out by the study; and
- the options that were carried forward to the CA workshop.

Detailed descriptions of all methods evaluated are described in more detail in the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] and are summarised in Section 3.2 above. Presentation slides provided an overview of each decommissioning option at the CA workshop.

The reasoning for decommissioning options being discounted at pre-screening stage is also provided in the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] and only summarised here:

1a) - Total Removal by Reverse Reeling

In line with OSPAR and BEIS clean seabed policy, at least one total removal option must be considered in the CA Workshop evaluation.

Based on the assessment of the other total removal options conducted during the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5], Option 1a) for both pipelines groups A and B is estimated to be:

- Less than half the total vessel days duration compared to that required to execute of Option 1b) - Total removal by reverse S-Lay and;
- One fifteenth of the total vessel days duration compared to that required to execute of Option 1c) - Total Removal by: Cut and Lift.

These comparative vessel durations would influence the outcome of the evaluation during CA workshop i.e.:

- The longer duration of offshore work for options 1b) and 1c), could drive a longer decommissioning offshore campaigns, which increases the chance of schedule slippages;
- The longer duration of offshore work for options 1b) and 1c), could increase the risk of a poorer safety performance due to vessels being on station for much longer and also more recovery activity being required;
- The longer vessel time for options 1b) and 1c) could also result in higher campaign cost.

Therefore Option 1a) was recommended to be carried forward for evaluation in the CA workshop for both pipeline groups A & B.

The activities involved in Total Removal by Reverse Reeling is summarised in

1b) - Total Removal by Reverse S-Lay

Option 1b) has been pre-screened out in Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] for both pipeline groups A and B and was not considered for evaluation during the CA workshop.

The basis of the decision to pre-screen out this option is detailed in the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] and is summarised below:

- Vessel days duration are more than double that of Option 1a);

- Both an S-lay vessel and cargo barge + tug vessel would be stationed together (SIMOPS) during the recovery of the lines, which is not required for Option 1a), which requires one Reel Lay vessel only (i.e. no SIMOPS), therefore there is potential for greater safety risk compared to Option 1a);
- A greater number of vessels and for longer duration onstation will result in a greater project cost, approximately three times that of Option 1a).

1c) - Total Removal by Cut and Lift

Option 1c) has been pre-screened out in the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] for both pipeline groups A and B and was not considered for evaluation during the CA workshop.

The basis of the decision to pre-screen out is detailed in the Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] and is summarised below:

- Vessel days duration are almost 15 times that of Option 1a);
- Both an ROV Support Vessel and cargo barge + tug vessel will be stationed together (SIMOPS) during the recovery of the lines, which is not required for Option 1a) which requires one Reel Lay vessel only (i.e. no SIMOPS), therefore there is potential for greater safety risk compared to Option 1a);
- A greater number of vessel and for longer duration onstation will result in a greater project cost, almost eight times that of Option 1a).
- Total removal by cut and lift techniques would involve multiple seabed to vessel deck lifts which would have an increase in safety risk to deck personnel due to additional deck handling when the vessel is on station and increase in safety risk to onshore personnel when pipe is back loaded in port;
- Cut and Lift compared with other total removal options would require significantly longer duration of offshore work and vessel days, which could drive a longer decommissioning offshore campaign, which increases the chance of schedule slippages.

Remediate In-situ Options

The Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment Report [5] recommended that all three remediate in-situ options 2a) 2b and 2c) should be carried forward for evaluation in the CA workshop.

Both pipeline groups have only small lengths of exposure and only at each pipeline end, meaning the options to remediate these exposures is similar for all remediate in-situ options in terms of vessel durations and estimated cost.

For all three remediate in-situ options, the trenched and buried sections of pipeline would remain in place. The pipeline ends and trench transitions would be remediated to ensure no future hazard or environmental impact.

Future periodic inspections of the pipelines left in-situ would be required under all three remediate in-situ options to confirm that no future pipeline exposures develop. Based on review of historical inspection records reviewed during development of the Pipeline Status and Historical Review Reports [7] and the fact the lines will be no longer in use, the potential for new pipeline exposures to occur in future is extremely unlikely.

2a) - Remediate In-situ: Exposed Sections Rock Covered

In this option, the trenched and buried sections of pipeline would remain in place. The exposed pipeline ends and the pipelines within the trench transitions would be covered with rock;

- The amount of rock cover would be in line with industry practise, would be specified and installed to be over trawlable and would be agreed with all consultees during the works authorisation process;
- The introduction of a small amount of rock cover either end of the existing rock berms would be a consideration during evaluation of the environmental criteria compared to options 2b) and 2c)

2b) - Remediate In-situ: Exposed Sections Trenched and Buried

In this option, the trenched and buried sections of pipeline would remain in place. The exposed pipeline ends and the pipelines within the trench transitions would be trenched and buried to a DOC greater than 0.6m.

- The trenching strategy would be in line with industry practise and would be agreed with all consultees during the works authorisation process;
- The small lengths of exposure at each pipeline end is shorter than the seabed disturbance anticipated during ploughing and has been a consideration during the evaluation of the environmental criteria compared to options 2a) and 2c).

2c) - Remediate In-Situ: Exposed Sections Cut and Removed

In this option, the trenched and buried sections of pipeline would remain in place. The exposed pipeline ends and the pipelines within the trench transitions would be cut and removed to full trench depth.

3) -Leave In-situ and Monitor

BEIS Guidance [1] identifies that certain pipelines that may be candidates for in-situ decommissioning, this is clarified as large diameter trunk lines which are not trenched and buried, subject to the outcome of a CA evaluation. Therefore a leave in-situ and monitor option was considered to be is not applicable to the smaller diameter intra-field or in field pipelines and umbilicals covered by Groups A and B,

Table 11: Option Pre-Screening Study Recommendations

Group ID	Component Type/ As Laid Condition	1. Total Removal by:			2. Remediate In-Situ with Exposed Sections:			3. Leave In-situ and Monitor
		a) Reverse Reeling	b) Reverse S-Lay	c) Cut and Lift	a) Rock Covered	b) Trench and Buried	c) Cut and Removed	
A	Rigid Pipelines Piggy-backed Fully Trenched and Buried Predominantly Rock covered	✓	✗ Screened Out	✗ Screened Out	✓	✓	✓	✗ Not Applicable
B	Umbilicals Trenched and Buried	✓	✗ Screened Out	✗ Screened Out	✓	✓	✓	✗ Not Applicable

✓ denotes this decommissioning option was carried through to the CA workshop for evaluation

✗ denotes this decommissioning option was not evaluated in the CA workshop

5.2. Evaluation Workshop Tools

5.2.1 Qualitative Assessment - Rating Guide Table

A project specific guide table for each sub-criterion to be comparatively assessed qualitatively was prepared and published to ensure workshop participants were aligned in the application of RAG rating against each sub-criterion. This guide table is provided in Appendix D, for reference.

5.2.2 Evaluation / Rating Workbook

A project specific evaluation/ rating workbook was prepared in M.S Excel format which reflected the criteria and sub-criteria to be assessed against the specific decommissioning options for the project and for each group being evaluated.

This workbook was populated at the workshop with the agreed ratings and relevant narrative explaining the reasoning behind the rating of each sub-criterion against each decommissioning option.

The evaluation/ rating workbook is provided in Appendix E, for reference and elaborates on the basis to the recommended decommissioning options recorded in Section 6.1.

5.2.3 Decommissioning Fact Sheets

Decommissioning fact sheets have been prepared and are included in Appendices A, B and C. These present a summary of the results of the supporting studies and were used to inform the workshop participants throughout the workshop.

Note: The authors of the factsheets also participated in the evaluation workshop and were, when required, able to expand and clarify the facts.

5.3. Mechanics of Rating the Options

The evaluation / rating workbook described in Section 5.2.2 was live on screen and was populated during the workshop.

Each pipeline group was assessed in turn, by:

a) Taking each sub-criterion in turn and assessing and rating across each decommissioning option. This ensured a true comparison of the options for each sub-criterion, which would not be the case if each decommissioning option had been assessed in isolation and for all criteria first;

b) When appropriate, comments have been added in the cell being rated to record the reasoning for the rating. These comments have been used to develop the summary narrative in Section 6.1;

c) Steps a) and b) were repeated for each sub-criterion in turn until all sub-criteria had been assessed for all decommissioning options;

d) Summating the ratings was not completed until each criterion has been assessed and rated individually. This avoided the possibility of summation results influencing ratings across subsequent criteria;

e) Once all criteria had been completed, a summary page was collated and viewed to determine the overall ranking for each decommissioning option:

   i. The decommissioning option with the greatest number of sub-criteria rated as RED (Higher Impact), was agreed to be the least preferred option;

   ii. The decommissioning option with the least number of sub-criteria rated as RED (Higher Impact) and the greatest number of sub-criteria rated GREEN (Low Impact), was agreed to be the most preferred option;

   iii. Other options were then ranked in order, based on relative numbers of RED (Higher Impact) and AMBER (Moderate Impact) that the sub-criteria have attracted.

The results by individual sub-criteria were then viewed and an overall rating and ranking for each pipeline group was agreed. See the "Visual Summary" (Heatmap) page for each pipeline group in the workbook provided in Appendix E, for reference.

5.3.1 Sensitivity Analysis

Ratings equally weighted across main criteria

As described in Section 4.1.2, a qualitative RAG approach to rating performance of each decommissioning option and across each sub-criterion was adopted, therefore, no numerical scoring was applied during the evaluation such that all sub-criteria evaluated were given equal weighting.

Therefore, the more sub-criteria evaluated against a specific main criterion results in that specific main criterion having greater influence on the outcome than other main criteria.

To review the impact if all main criteria had an application of equal weighting, the individual sub-criteria ratings were viewed during the workshop and an average weighting against the specific main criterion was agreed. The average ratings across all five main criteria, were then viewed and an equally weighted rating and ranking was agreed for each pipeline group.

The result of this analysis by main criteria is summarised against each pipeline group in Section 6.1. See also the "Narrative Summary - CA Workshop Output Sheet" for each pipeline group in the workbook provided in Appendix E, for reference.

A further two Sensitivity Analyses were identified as required during the CA workshop but were conducted offline to review potential impact on the recommended / preferred decommissioning options for each pipelines group.

Sensitivity Analysis 1 - by Specific Sub-Criteria

During the workshop, as participants carried out the original RAG evaluation described in Section 5.2 and 5.3, if participants considered a decision on a specific rating to be marginal between one rating and another, this would be noted in the individual worksheets and a decision was taken to carry out a sensitivity analysis offline, by applying the agreed alternative rating for that specific sub-criteria and decommissioning option. The reasoning behind the requirement for the sensitivity analysis was also noted in the worksheets.

The basis and results of Sensitivity Analysis 1 for each pipeline group are summarised in Sections 6.1.3 and 6.1.4 and are described in detail in the relevant Sensitivity Analysis 1 Worksheet for each pipeline group in Appendix E.

Sensitivity Analysis 2 – Where economic criteria is not considered

Taking account of BEIS Guidance [1], where it states, "it is unlikely that costs alone will be accepted as the deciding factor in arriving at the most preferred option unless all other matters show no significant difference". Sensitivity Analysis 2 has removed the Economic Criteria and evaluated the outcome on the remaining sub-criteria.

To demonstrate that the rating results from the evaluation of the cost of the decommissioning options has not had an undue influence on the ranking of the decommissioning options, the economic risk sub-criteria is discounted under this sensitivity analysis for each pipeline group. i.e.:

- Cost for Decommissioning/ Removal Activities, and
- Cost for Long Term Monitoring / Remediation Activities

The basis and results of Sensitivity Analysis 2 for each pipeline group are summarised in Sections 6.1.3 and 6.1.4 and are described in detail in the relevant Sensitivity Analysis 2 Worksheet for each pipeline group in Appendix E.

6. COMPARATIVE ASSESSMENT EVALUATION

6.1. Results, Conclusions and Recommendations

This section provides a summary of the ranking reached for each decommissioning option under consideration and for each pipeline group. Options ranked 1st being the most preferred option and options ranked 2nd, 3rd and 4th (where applicable), being poorer performing options compared to the most preferred option.

During the CA Evaluation Workshop, the allocated ratings were recorded on a pre-prepared MS Excel evaluation workbook and narrative was added to explain and justify each rating. A full set of the evaluation worksheets is provided in Appendix E and a summary of the results for each group is shown in Table 12.

In summary the conclusion and recommendation from the evaluation is that as the pipelines and umbilicals are already trenched and buried to an adequate DOC for most of their route and will remain so, the most preferred decommissioning option for all the lines (both groups) is Option 2c) Remediate in-situ with exposed sections cut and removed[4].

The overall rankings for each pipeline group were determined from a summation of the ratings applied to the individual sub-criteria. Since no numerical scoring was adopted during the evaluation, the application of weightings across the criteria to be evaluated could not be applied. i.e. all 14 sub-criteria were given equal weighting by default. Therefore, the more sub-criteria evaluated against a specific main criterion results in that specific main criterion having greater influence on the outcome than other main criteria.

i.e. In this CA evaluation, Safety and Environmental have four sub-criteria each, whereas Technical, Societal and Economic each have only two sub-criteria each, see Table 8 in Section 4.1.3 for individual sub-criteria. Therefore, the ratings allocated to Safety and Environmental will have had a greater influence on the outcome overall than the other main criteria.

To review the impact if all main criteria had an application of equal weighting, the individual sub-criteria ratings were reviewed during the workshop and an average weighting against the specific main criterion was agreed. The average ratings across all five main criteria, were then viewed and an equal weighting rating and ranking was agreed for each pipeline group.

The result of this analysis by main criteria is summarised in Table 13 below. See also the "Narrative Summary - CA Workshop Output Sheet" for each pipeline group in the workbook provided in Appendix E, for reference.

In summary, the conclusions of the original evaluation where all 14 sub-criteria ratings were summated (Table 12) were not impacted when the evaluation using average ratings by main criteria only (Table 13) was completed i.e.:

- The most preferred option remains the same as the original evaluation;
- The least preferred options and recommendations to discount the least preferred option for Group A remains the same.

Section 6.1.1 (Group A) and Section 6.1.2 (Group B) elaborate on the key influencing factors in the ratings applied and hence the rankings within each group.

[4] Group A – Rigid pipelines were rated similarly for all three remediate in-situ options and it is proposed that these will be carried through to a C&P phase of the project to allow the EPRD contractors to tender and propose the overall preferred option. If the C&P tendering phase results in a remediate in-situ option other than the most preferred option noted above, the Operator will engage with OPRED before a decision is taken on overall strategy. Based on the ratings allocated to Option 1a) Total removal by reverse reeling compared to the remediate in-situ options, Option 1a) will be discounted for Group A and not considered further.

Group B – Umbilicals were rated similarly for all four decommissioning options and all four options, including Option 1a) Total removal by reverse reeling. It is proposed that these will be carried through to a C&P phase of the project to allow EPRD contractors to tender and propose the overall preferred option. If the C&P tendering phase results in a decommissioning option other than the most preferred option noted above, the Operator will engage with OPRED before a decision is taken on overall strategy.

Sensitivity Analysis

Two separate sensitivity analysis were completed for each pipelines group and the results, conclusions and recommendations from these are reported in Section 6.1.3 for Group A and 6.1.4 for Group B.

Sensitivity Analysis 1 – By specific criteria

The basis of this sensitivity analysis is clarified in Section 5.3.1.

The results of this sensitivity analysis are also reported in detail in the relevant Sensitivity Analysis 1 – by Specific Sub-Criteria Worksheet for each pipeline group in Appendix E.

Sensitivity Analysis 2 – Where economic criteria is not considered

The basis of this sensitivity analysis are clarified in Section 5.3.1.

The results of this sensitivity analysis is also reported in detail in the relevant Sensitivity Analysis 2 – Where economic criteria is not considered, for each pipeline group in Appendix E.

Table 12: Summary of CA Ranking and Rating by Sub-Criteria

The overall ratings count is based on the individual 14 sub-criteria described Section 4.1.3.

Decommissioning Options		1. Total Removal by:	2. Remediate In-situ with:		
Sub Options		a)	a)	b)	c)
		Reverse Reeling	Exposed Sections Rock Covered	Exposed Sections Trenched and Buried	Exposed Sections Cut and Removed
GROUP A Rigid Pipelines, Piggy-backed, Trenched and Buried	OVERALL RATING	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	OVERALL RANKING	4th	2nd =	2nd =	1st
	Rating Count	Higher Impact (Red) = 1	Higher Impact (Red) = 0	Higher Impact (Red) = 0	Higher Impact (Red) = 0
		Moderate Impact (Amber) = 4	Moderate Impact (Amber) = 4	Moderate Impact (Amber) = 4	Moderate Impact (Amber) = 2
		Lower Impact (Green) = 4	Lower Impact (Green) = 5	Lower Impact (Green) = 5	Lower Impact (Green) = 7
		Not significantly different = 5	Not significantly different = 5	Not significantly different = 5	Not significantly different = 5
	RANKING OBSERVATIONS	Ratings across options 2a), 2b) and 2c) are not significantly different with options 2a) and 2b) which are ranked 2nd= attracting only two more Moderate Impact (Amber) ratings than option2c) which is ranked 1st with only one sub-criterion rated Moderate Impact (Amber) for each option. Option 1a) is ranked 4th and is significantly different in terms of Higher Impact (Red) and Moderate Impact (Amber) ratings attracted compared to option 2c)			
	COMMENTS AND RECOMMENDATIONS	Based on these evaluation results Options 2a), 2b) and 2c) are ranked 1st and 2nd= and all three options should be carried forward to C&P tendering for the execution phase. It is recommended that Option 2c) is deemed the most preferred option but it is proposed that Options 2a), 2b) and 2c) will all be carried forward to C&P tendering for the execution phase and if this results in a potential change in preferred option from Option 2c), the operator will engage with OPRED to discuss this potential change. Option 1a) is ranked 4th and has been rated sufficiently worse than the other three decommissioning option to be discounted as an option to be carried forward. It was noted at the workshop that the decommissioning of rigid pipelines that were already trenched and buried was consistent with the approved decommissioning options elsewhere in the Balmoral field (i.e. in the same area). It is concluded that the performance of Option 1a) in this evaluation compared to the other options justifies the decision to discount it from further consideration.			
GROUP B Umbilicals, Trenched and Buried	OVERALL RATING	Lower Impact	Moderate Impact	Moderate Impact	Lower Impact
	OVERALL RANKING	1st =	3rd =	3rd =	1st =
	Rating Count	Higher Impact (Red) = 0	Higher Impact (Red) = 0	Higher Impact (Red) = 0	Higher Impact (Red) = 0
		Moderate Impact (Amber) = 1	Moderate Impact (Amber) = 3	Moderate Impact (Amber) = 3	Moderate Impact (Amber) = 1
		Lower Impact (Green) = 3	Lower Impact (Green) = 1	Lower Impact (Green) = 1	Lower Impact (Green) = 3
		Not significantly different = 10	Not significantly different = 10	Not significantly different = 10	Not significantly different = 10
	RANKING OBSERVATIONS	Ratings across all four options are not significantly different with options 2a) and 2b) attracting only two more Moderate Impact (Amber) ratings than options 1a) and 2c) which are both 1st= with only one sub-criterion rated Moderate Impact (Amber) for each option. The fact that 10 of the 14 sub-criterion evaluated are rated as not significantly different suggest that there is not much difference overall in any of the options. All options attract a Moderate Impact (Amber) rating for seabed disturbance except Option 2c) and all Options attract a Moderate Impact (Amber) rating for Cost of long term monitoring except for Option 1a). The other two key differences attracting a Moderate Impact (Amber) rating are: - Option 2a); Change of habitat long term - due to the fact that new rock berms are introduced to the seabed with this option, and: - Option 2b): Technical complexity - due to the fact that the Burghley umbilical at the Balmoral end will require particular attention when trenching and burying due to the configuration where it exits directly from a rock berm without any transition.			
	COMMENTS AND RECOMMENDATIONS	Based on these evaluation results Options 1a) and 2c) are ranked 1st = and both should be carried forward to C&P tendering for the execution phase. It was noted at the workshop that total removal of the flexible lines was consistent with the approved decommissioning options elsewhere in the Balmoral field (i.e. in the same area). However the results of this evaluation are very close across all four options and taking account of the results of Sensitivity A analysis (See Sensitivity A heatmap) with very slightly different ratings Option 1a) could go from ranked 1st= to be ranked 4th out of 4 options. Since OPRED prefer a single preferred option to be identified in the CA Report and the Decommissioning Programme (DP), it is recommended that option 2c) is adopted as the single most preferred option as option 1a) becomes the least preferred option if the sensitivities discussed at the evaluation workshop are realised (Sensitivity A). It is recommended that Option 2c) is deemed the most preferred option but it is proposed that all four decommissioning options will be carried forward to C&P tendering for the execution phase and if this results in a potential change in preferred option from Option 2c), the operator will engage with OPRED to discuss this potential change.			

Denotes Option should be discounted and not considered further. Denotes Option has been ranked 1st.

Table 13: Summary of CA Ranking and Average Rating by Main Criteria

The overall ratings count is based on the five main criteria evaluated, to provide a sense check of impact of equally weighted results across main criteria.

Decommissioning Options		1. Total Removal by:	2. Remediate In-situ with:		
Sub Options		a)	a)	b)	c)
		Reverse Reeling	Exposed Sections Rock Covered	Exposed Sections Trenched and Buried	Exposed Sections Cut and Removed
GROUP A Rigid Pipelines, Piggy-backed, Trenched and Buried	OVERALL RATING	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	OVERALL RANKING	4th	2nd	3rd	1st
	Rating Count	Higher Impact (Red) = 1	Higher Impact (Red) = 0	Higher Impact (Red) = 0	Higher Impact (Red) = 0
		Moderate Impact (Amber) = 3	Moderate Impact (Amber) = 3	Moderate Impact (Amber) = 4	Moderate Impact (Amber) = 2
		Lower Impact (Green) = 1	Lower Impact (Green) = 2	Lower Impact (Green) = 1	Lower Impact (Green) = 8
		Not significantly different = 0	Not significantly different = 0	Not significantly different = 0	Not significantly different = 5
	RANKING OBSERVATIONS	The rankings are based on the average rating by main criteria only achieved for each decommissioning option. The application of this average rating across the five main criteria means that each main criteria has equal influence on the outcome of the evaluation. This differs from the ratings applied in Table 12 where each (of the 14) individual sub-criteria is counted and influences the outcome more where main criteria for specific criteria that has a greater number of sub-criteria (e.g. Safety and Environmental). The application of these average ratings by main criteria only does not alter the rankings of Options 1a), 2a) and 2c) which remain the same as the rankings in Table 12 , it does change the ranking of Option 2b) from previously ranked 2nd= to become ranked 3rd.			
	COMMENTS AND RECOMMENDATIONS	As this average ratings to main criteria only has not changed the ranking significantly, the comments and recommendations described in the Table 12 remain justified.			
GROUP B Umbilicals, Trenched and Buried	OVERALL RATING	Lower Impact	Moderate Impact	Moderate Impact	Lower Impact
	OVERALL RANKING	1st =	3rd	4th	1st =
	Rating Count	Higher Impact (Red) = 0	Higher Impact (Red) = 0	Higher Impact (Red) = 0	Higher Impact (Red) = 0
		Moderate Impact (Amber) = 1	Moderate Impact (Amber) = 2	Moderate Impact (Amber) = 3	Moderate Impact (Amber) = 1
		Lower Impact (Green) = 2	Lower Impact (Green) = 1	Lower Impact (Green) = 0	Lower Impact (Green) = 2
		Not significantly different = 2	Not significantly different = 2	Not significantly different = 2	Not significantly different = 2
	RANKING OBSERVATIONS	The rankings are based on the average rating by main criteria only achieved for each decommissioning option. The application of this average rating across the five main criteria means that each main criteria has equal influence on the outcome of the evaluation. This differs from the ratings applied in Table 12 where each (of the 14) individual sub-criteria is counted and influences the outcome more where main criteria for specific criteria that has a greater number of sub-criteria (e.g. Safety and Environmental). The application of these average ratings by main criteria only does not alter the rankings of Options 1a), 2a) and 2c) which remain the same as the rankings in Table 12 , it does change the ranking of Option 2b) from previously ranked 2nd= to become ranked 3rd.			
	COMMENTS AND RECOMMENDATIONS	As this average ratings to main criteria only has not changed the ranking significantly, the comments and recommendations described in the Table 12 remain justified.			

Denotes Option should be discounted and not considered further. Denotes Option has been ranked 1st.

6.1.1 Group A – Rigid Pipelines, Piggy-backed, Trenched and Buried

This group consists of four rigid pipelines, piggy-backed together in groups of two and in separate trenches

- One combination of 6" Production line with 2" gas lift line piggy-backed each 5.2km long (Beauly).
- One combination 10" Production line with 4" gas lift line piggy-backed each 10.105km long (Burghley)

The pipelines are fully trenched buried to significantly greater than 0.6m DOC along their entire route with exposures at the trench transitions only, at each end of the pipelines where the lines are tied in on the seabed surface. This group of pipelines have also been substantially rock covered to mitigate upheaval buckling during operation and as protection for crossings. See Table 9 in Section 4.1.4 for details of individual pipelines.

Based on the review of the historical inspection data available, all lines are expected to remain fully trenched and buried over time.

The outcome of the CA Evaluation Workshop ratings count, ranking and recommendation for each decommissioning option is presented in Table 12 above.

Key influencing factors in the ratings applied and hence the ranking this group:

Option 2c) Remediate in-situ with exposed sections cut and removed is ranked as 1st therefore recommended as the most preferred decommissioning option.

It is rated predominantly Low Impact (Green) or not significantly different from other decommissioning options across most of the individual sub-criteria, with only two of the 14 sub-criteria rated as Moderate Impact (Amber), these are:

- Societal - Impact on Commercial Fisheries:
  - Although recognised that the existing rock berms are left in place and although these are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain their stability and therefore the seabed remains accessible to fishing gear, the moderate impact rating is based on the fact that this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).
- Economic Risk - Cost for long term monitoring / Remediation activities:
  - Moderate rating is based on the fact that the existing rock berms will incur an ongoing liability of being monitored for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion. It was also noted that the Beauly pipelines lines are also buried >1m below seabed, so if rock that was applied to mitigate upheaval buckling of the Beauly lines during operation was subsequently disturbed, remediation of this rock berm less likely to be required as the pipelines would not be exposed even in this scenario.

Options 2a) Remediate in-situ with exposed sections rock covered and Option 2b) Remediate in-situ with exposed sections trenched and buried are ranked 2nd equal and are rated predominantly Low Impact (Green) or not significantly different from other decommissioning options across most of the individual sub-criteria, with only four of the 14 sub-criteria rated as Moderate Impact (Amber), these are:

- Societal - Impact on Commercial Fisheries:
  - For the same reason for the rating of Option 2c) above.
- Economic Risk - Cost for long term monitoring / Remediation activities:
  - For the same reason for the rating of Option 2c) above.
- Environmental - Seabed Disturbance Short Term:
  - This option is recognised to result in short term localised disturbance during the application of rock cover (Option 2a)) and trenching and burying (Option 2b)) at the exposures at the pipeline ends. The footprint of this short term disturbance is considered significantly smaller than the footprint of disturbance associated with Option 1a) but more impact than Option 2c).

The remaining moderate impact rating applicable to options 2a) and 2b) are different for each decommissioning option:

- Option 2a) - Remediate in-situ with exposed sections rock covered is rated Moderate Impact (Amber) for Environmental - Change of Habitat - Long Term:
  - Due to the addition of new rock materials meaning that the introduction of a different habitat type to the area. This will potentially impact on existing ecosystem, by allowing other species to settle in the area. Area impacted is small but is considered a Moderate Impact in terms of change of habitat.
- Option 2b) - Remediate in-situ with exposed sections trenched and buried is rated Moderate Impact (Amber) for Technical Feasibility - Technical Complexity & Track Record:
  - Due to the configuration at the Balmoral end of the Burghley pipelines, where the lines are surface laid below the existing rock cover and therefore have no transition from below the surface will make trenching of the Burghley lines at the Balmoral end more difficult and jet trenching equipment will need to be adopted as these pipelines lines exit directly from a rock berm on seabed surface.

Based on these evaluation results Options 2a), 2b) are ranked 2nd= and are rated only marginally worse than Option 2c) the most preferred option and therefore it is recommended that Options 2a) and 2b) should be carried forward with Option 2c) to C&P tendering for the execution phase and that subsequent dialogue would be held with OPRED in the case where a change to the declared most preferred option, Option 2c) occurs.

It is recommended that Option 2c) is deemed the most preferred option, but it is proposed that Options 2a), 2b) and 2c) will all be carried forward to C&P tendering for the execution phase and if this results in a potential change in the preferred option from Option 2c), the operator will engage with OPRED to discuss this potential change.

It was also noted at the workshop that the decommissioning in-situ of rigid pipelines that were already trenched and buried was consistent with the approved decommissioning options elsewhere in the Balmoral field (i.e. in the same area).

Option 1a) Total removal by reverse reeling is ranked 4th and has been rated with one Higher Impact (Red) for:

- Environmental - Seabed Disturbance Short Term:
  - Short term seabed disturbance is considered to be Higher Impact due to the debuiral technique for the pipelines using mass flow excavation which may require multiple passes along the combined 15.3km for both Beauly and Burghley pipelines routes and will cause significant short term disturbance along the pipeline routes. Existing rock berms will be scattered over wide area compared to the remediate in-situ decommissioning options evaluated where the existing rock berms remain undisturbed.

Option 1a) has also been rated with four Moderate Impact (Amber) ratings, these are:

- Technical Feasibility - Risk of Major Project Failure:
  - The significant depth of sediment cover, plus rock cover above most of Beauly pipeline may require multiple passes of mass flow excavation before the pipelines are exposed for removal, leading to potentially an uncertain extension to the overall campaign duration.
  - The pipelines have been in operation a long time and since they are fully trenched and buried, the ability to inspect has been limited. Therefore condition of the pipelines to withstand the tension and bending stresses applied during recovery and reeling is uncertain. Although theoretical analysis will improve confidence of the capabilities of the pipelines to be recovered by this technique, if the lines were to break during recovery this could lead to multiple campaigns and potentially a change to recovery techniques.
- Safety – Risk To Project Personnel during recovery of the pipelines from the seabed and;
- Safety – Risk To Those on Land during offloading and management of materials onshore.

Both areas of activity are seen as higher safety risk than the remediate in-situ options as:

- c.30.6km/1,632te of line would be required to be managed on vessel deck compared to c.0.554m/21te associated with Option 2c) and no materials to be managed on deck for Options 2a) and 2b);

- Deck crew activities associated with cutting and removing the piggy-back spacer blocks and removing the anodes on the pipelines by grinding increases deck crew interaction;
- Although management of materials returned onshore will be at licenced yards, quayside/ yard crew exposure to residues to be managed when pipeline is un-reeled and cut into sections for onward transport for disposal and recycle. Potential for NORM and wax unknown, but containment processes will be adopted when required;
- Larger quantities of materials to be road transported between dismantling yard and final disposal/ recycling destination than other remediate in-situ decommissioning options.

On the basis that Option 1a) is ranked 4th and is significantly different in terms of Higher Impact (Red) and Moderate Impact (Amber) ratings as described above, it is recommended that Option 1a) is discounted and not considered further.

The output sheets providing more detail of the original evaluation are provided in Appendix E, pages 60 to 64 for Group A.

6.1.2 Group B – Umbilicals Trenched and Buried

This group comprises of two umbilicals located in their separate trenches and both being trenched and buried to and average depth of 0.64m (Beauly) and 0.57m (Burghley) DOC along their entire route with exposures at the trench transitions only, at each end of the umbilicals where they are tied in on the seabed surface.

The Beauly umbilical has no additional rock cover, the Burghley umbilical has rock cover at specific locations to protect the crossings listed in Table 6, and additional rock cover at a specific location at KP1.2 to KP1.29.

See Table 9 in Section 4.1.4 for details of individual pipelines.

Based on the review of the historical survey data available, all lines are expected to remain fully trenched and buried over time.

The outcome of the CA Evaluation Workshop ratings count, ranking and recommendation for each decommissioning option is presented in Table 12 above.

Key influencing factors in the ratings applied and hence the ranking this group:

Ratings across all four decommissioning options evaluated are not significantly different with options 2a) Remediate in-situ with exposed sections rock covered and Option 2b) Remediate in-situ with exposed sections trenched and buried attracting only two more Moderate Impact (Amber) ratings than Option 1a) Total removal by reverse reeling and Option 2c) Remediate in-situ with exposed sections cut and removed which are both 1st equal with these two options only rated Moderate Impact (Amber) for one sub-criterion for each.

The fact that 10 of the 14 sub-criterion evaluated are rated as not significantly different across all four decommissioning options suggest that there is not much difference overall in any of the options.

The key differences between the evaluation of Group B – Umbilicals to the evaluation of Group A pipelines are:

- The Group B umbilicals are not buried as deeply and have much less rock cover than applied to the Group A pipelines:
  - The Beauly umbilical has no rock cover, and the Burghley umbilical only has rock cover at umbilical / pipeline crossings, where the umbilical is surface laid for short lengths
  - Hence, the base assumption during the evaluation has been that the umbilicals can be withdrawn through the sediment cover when being recovered by reverse reeling under Option 1a) i.e. no mass flow excavation required for Group B but is required for Group A.
- Unlike the rigid pipelines in Group A which are piggy-backed and need to be separated when recovered to the vessel deck before being reeled, the umbilicals in Group B are single small diameter flexible lines, which can be reeled directly onto the vessel reels with minimal deck crew intervention;
- Similarly, the materials handling at the quayside/ dismantling yard is far simpler for Group B than for Group A and the quantity of materials being returned means much less road transport than for Group A:

- Hence the Operational Safety risk across all sub-criteria and across all four decommissioning options has been considered to be not significantly different;

- Residual risk to other users of the sea for the remediate in-situ options has also been considered not to be significantly different from Option 1a) Total removal by reverse reeling, due to the fact there is a very small amount of existing rock berm left in-situ associated the four umbilical/pipeline crossings and only at the Burghley umbilical, compared to the larger quantity of rock berm associated with the pipelines in Group A;

- The remaining sub-criteria that has been rated as Moderate Impact (Amber) is similar to the ratings for Group A, i.e.:
  - All options attract a Moderate Impact (Amber) rating for seabed disturbance except Option 2c) and
  - All Options attract a Moderate Impact (Amber) rating for Cost of long term monitoring except for Option 1a).
  - The other two key differences attracting a Moderate Impact (Amber) rating are:
    - Option 2a); Change of habitat long term - due to the fact that new rock berms are introduced to the seabed with this option, and:
    - Option 2b): Technical complexity - due to the fact that the Burghley umbilical at the Balmoral end will require particular attention when trenching and burying due to the configuration where it exits directly from a rock berm without any transition.

Based on these evaluation results Options 1a) and 2c) are ranked 1st equal and both should be carried forward to C&P tendering for the execution phase. It was noted at the workshop that total removal of the flexible lines was consistent with the approved decommissioning options elsewhere in the Balmoral field (i.e. in the same area).

However, the results of this evaluation are very close across all four options and taking account of the results of Sensitivity Analysis 1 (see Section 6.1.4) with very slightly different ratings Option 1a) could go from ranked 1st equal to be ranked 4th out of 4 options.

It is recommended that Option 2c) is deemed the most preferred option but it is proposed that all four decommissioning options will be carried forward to C&P tendering for the execution phase and if this results in a potential change in preferred option from Option 2c), the operator will engage with OPRED to discuss this potential change.

The output sheets providing more detail of the workshop evaluation are provided in Appendix E pages 67 to 71 for Group B.

6.1.3 Sensitivity Analysis – Group A

Sensitivity Analysis 1 – By specific sub-criteria:

There were five separate sub-criteria / decommissioning options combinations identified for specific change of ratings in Group A, see Table 14.

Table 14: Group A Sensitivity Analysis 1

Option / Sub-Criteria	Original Rating	Revised Rating	Reason for sensitivity analysis
Option 1a) Total Removal by Reverse Reeling/ Technical Complexity & Track Record	Low Impact (Green)	Moderate Impact (Amber)	To take cognisance of the additional and diverse activities associated with cutting and removing the piggy-back spacer blocks and removing the anodes on the pipelines as they are drawn onto the vessel deck and before they are reeled.
Options 2a), 2b) and 2c) Remediate In-Situ Options/ Residual (Long Term) Risk To Other Users of the Sea	Low Impact (Green)	Moderate Impact (Amber)	In consideration of the potential for the existing and new additional rock berms to become unstable leading to potential snagging hazard where pipelines are located on seabed surface below the rock berm.
Option 1a) Total Removal by Reverse Reeling/ Seabed Disturbance- Short Term	Higher Impact (Red)	Moderate Impact (Amber)	To take cognisance of relatively low area of seabed disturbance.
Options 2a), 2b) and 2c) Remediate In-Situ Options/ Seabed Disturbance- Short Term	Moderate Impact (Amber)	Low Impact (Green)	To take cognisance of relatively low area of seabed disturbance.
Options 2a), 2b) and 2c) Remediate In-Situ Options/ Cost for long term monitoring / Remediation activities	Moderate Impact (Amber)	Low Impact (Green)	To take cognisance of scenario with the Beauly rock berms not requiring maintenance if they subsequently become unstable.

Under this sensitivity analysis:

- Option 2c) remains ranked 1st and its performance against the other decommissioning options improves as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber).
- Options 2a) and 2b) swap places in the ranking with Option 2b) becoming 2nd and 2a) dropping to 3rd. Option 2b) improves as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber).
- Option 1a) remains ranked 4th as although its rating for seabed disturbance improves from Higher Impact (Red) to Moderate Impact (Amber) its Technical Complexity is rated worse being rated Moderate Impact (Amber), instead of Lower Impact (Green) and remains significantly different in terms of Moderate Impact (Amber) ratings attracted compared to option 2c).

This sensitivity analysis reinforces the decision to nominate Option 2c) as the most preferred decommissioning option in the CA report and in the DP. The fact that Options 2a) and 2b) are rated only marginally worse than Option 2c) promotes the decision that all three remediate in- situ decommissioning options should be taken forward to carried forward to C&P tendering for the execution phase. This sensitivity analysis reinforces the decision to discount Option 1a) from further consideration.

Refer to Appendix E, page 65 for more detail of this analysis for Group A.

Sensitivity Analysis 2 – Where economic criteria is not considered:

Under this sensitivity analysis where the ratings for Cost for Decommissioning/ Removal activities and Cost for long term monitoring / remediation activities have not been considered:

- The ranking across all decommissioning options remains the same as the workshop evaluation.
- This is unsurprising as:
  - The ratings applied during the workshop for Cost for Decommissioning/ Removal activities was Moderate Impact (Amber for Option 1a) and Lower Impact (Green) for all three remediate in-situ options; and
  - The ratings applied during the workshop for Cost for long term monitoring / remediation activities was Lower Impact (Green) for Option 1a) and Moderate Impact (Amber) for all three remediate in-situ options

  This in effect cancelled out the influence of the Economic criteria during the workshop evaluation.

This sensitivity analysis demonstrates across all decommissioning options that cost does not influence the conclusion on the most preferred option to be recommended in the DP, nor does it influence the subsidiary recommendations on:

- Options to be carried forward to the C&P tendering phase to enable the EPRD contractors to contribute to the assessment of the preferred option from an economic and overall campaign strategy;
- Options to be discounted and not considered further.

Refer to Appendix E, page 66 for more detail of this analysis for Group A.

6.1.4 Sensitivity Analysis – Group B

Sensitivity Analysis 1 – By specific sub-criteria:

There were eight separate sub-criteria / decommissioning options combinations identified for specific change of ratings in Group B, see Table 15.

Table 15: Group B Sensitivity Analysis 1

Option / Sub-Criteria	Original Rating	Revised Rating	Reason for sensitivity analysis
Option 1a) Total Removal by Reverse Reeling/ Risk of Major Project Failure	Not significantly different	Moderate Impact (Amber)	In consideration that even with the necessary due diligence in analysing the capabilities of the umbilicals to be withdrawn, if failure occurred during reeling it may be necessary to mobilise mass flow excavation vessel/equipment which would impact schedule.
Option 1a) Total Removal by Reverse Reeling/ Risk to Project Personnel	Not significantly different	Moderate Impact (Amber)	In consideration of the additional materials being recovered to the vessel deck compared to the other options.
Option 1a) Total Removal by Reverse Reeling/ Risk to Those on Land	Not significantly different	Moderate Impact (Amber)	In consideration of the additional materials being returned onshore to be managed at quayside and dismantling yard compared to the other options.
Option 2a) Remediate In-Situ with Exposed Sections Rock Covered/ Seabed Disturbance- Short Term	Moderate Impact (Amber)	Low Impact (Green)	To take cognisance of the fact that the footprint of disturbance in Option 2a) is significantly lower than it is in Option 1a).
Option 2b) Remediate In-Situ with Exposed Sections Rock Covered/ Seabed Disturbance- Short Term	Moderate Impact (Amber)	Low Impact (Green)	To take cognisance of the fact that the footprint of disturbance in Option 2b) is significantly lower than it is in Option 1a).
Option 1a) Total Removal by Reverse Reeling/ Waste Processing	Not significantly different	Moderate Impact (Amber)	In consideration of the quantity of plastics being returned onshore in Option 1a) to be dealt with compared to other options.
Option 2b) Remediate In-situ with exposed sections trenched and buried/ Cost for long term monitoring / Remediation activities	Moderate Impact (Amber)	Low Impact (Green)	To take cognisance of the fact that the footprint area of the rock berms left in-situ in this option are small and half of that left under option 2a) where new rock berms are added.
Option 2c) Remediate In-situ with exposed sections cut and removed/ Cost for long term monitoring / Remediation activities	Moderate Impact (Amber)	Low Impact (Green)	To take cognisance of the fact that the footprint area of the rock berms left in-situ in this option are small and half of that left under option 2a) where new rock berms are added.

Under this sensitivity analysis:

- Option 2c) remains ranked 1st and its performance against the other decommissioning options improves as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber).

- Four sub-criteria have been re-rated from Lower Impact (Green) to Moderate Impact (Amber) for Option 1a), the fact that 6 of the 14 sub-criteria have been rated as not significantly different means that Option 1a) has changed 50% of its remaining ratings to its detriment in terms of performance overall and moves its ranking from 1st = to 4th out of 4 decommissioning options evaluated.
- Option 2b improves its ranking compared to Option 2a) and moves from 3rd = to 2nd as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber).
- Options 2a) and 2b) are not rated significantly different overall from Option 2c) with only having 2 more (2a) and 1more (2b) Moderate Impact (Amber) rating than Option 2c)

This sensitivity analysis reinforces the decision to nominate Option 2c) as the most preferred decommissioning. The fact the original evaluation from the workshop ranks Option 1a) as 1st= promotes the decision that options 1a) and 2c) should be carried forward to C&P tendering for the execution phase. The fact that Options 2a) and 2b) are rated only marginally worse than Option 2c) promotes the decision that all four decommissioning options should be taken forward to carried forward to C&P tendering for the execution phase.

Refer to Appendix E, page 72 for more detail of this analysis for Group B.

Sensitivity Analysis 2 – Where economic criteria is not considered:

Under this sensitivity analysis where the ratings for Cost for Decommissioning/ Removal activities and Cost for long term monitoring / remediation activities have not been considered:

- Option 2c) remains ranked 1st and its performance against the other decommissioning options improves compared to the workshop evaluation as the cost of long term monitoring which attracted a Moderate Impact (Amber) rating in the workshop has not been considered.
- Options 2a) and 2b) remain ranked 3rd = as the cost of long term monitoring which attracted a Moderate Impact (Amber) rating in the workshop evaluation has not been considered.
- Option 1a)'s ranking drops from 1st = to 2nd as the benefit it gained from having a Lower Impact (Green) rating for Cost for long term monitoring / Remediation activities, compared to the Moderate Impact (Amber) rating applied to the Remediate in-situ options for this sub-criterion in the workshop evaluation has not been considered.

This sensitivity analysis demonstrates across all decommissioning options that cost does not influence the conclusion on the most preferred option to be recommended in the DP, nor does it influence the subsidiary recommendations on:

- Options to be carried forward to the C&P tendering phase to enable the EPRD contractors to contribute to the assessment of the preferred option from an economic and overall campaign strategy;
- Options to be discounted and not considered further.

Refer to Appendix E, page 73 for more detail of this analysis for Group B.

7. REFERENCES

Reference Number	Document Title	Document Number / Revision/Date
1	BEIS Guidance Notes – Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998 (November 2018)	Available in public domain
2	Beauly & Burghley Decommissioning Environmental Appraisal	RP-DTABAB001-HS-0018/ C01/ Oct 2022
3	Decommissioning Programmes – Beauly	RP-DTABAB001-DC-0017/ C02/ Oct 2022
4	Decommissioning Programmes - Burghley	RP-DTABAB001-DC-0016/ C02/ Oct 2022
5	Pipeline and Subsea Infrastructure Removal Methods - Pre-screening and Technical Feasibility Assessment.	RP-DTABAB001-SS-0030/ C01/ Mar. 2022
6	Material and Waste Inventories Report.	RP-DTABAB001-SS-0028/ C02/ Sep. 2022
7	Pipelines Status and Historical Review Report.	RP-DTABAB001-SS-0029/ C01/ Feb. 2022
8	Oil and Gas UK Guidelines for CA in Decommissioning Programmes, October 2015	Available in public domain
9	Beauly & Burghley ENVID and HIRA Workshop Report (to support the CA)	RP-DTABAB001-HS-0027/ C01/ Apr. 2022
10	Beauly & Burghley Decommissioning Scoping Report.	RP-DTABAB001-HS-0021/ C02/ Jun. 2022
11	Beauly & Burghley Decommissioning Stakeholder Management Plan	RP-DTABAB001-HS-0020/ C01/ Jun. 2022

APPENDIX A – HIRA RESULTS

The HIRA was held on 28 February 2022 and although a separate HIRA and ENVID Report [9] has been published, summary tables of the results of the HIRA were prepared to inform the workshop participants. These summary tables are provided herein for reference.

Risk Assessment Matrix

CONSEQUENCE				SEVERITY	LIKELIHOOD				
People / Safety	Environment	Asset / Business / Production Change (annualised)	Reputation		Very Unlikely A freak combination of factors would be required for an incident to result	Unlikely A rare combination of factors would be required for an incident to result	Possible Could happen when additional, unusual factors are present but otherwise unlikely to occur	Likely Not certain to happen under normal conditions but could happen if a predictable additional factor was present	Very Likely Almost inevitable that an incident would result.
P	E	A	R		A	B	C	D	E
Two or more fatalities	Critical Release: Release from a catastrophic pipeline failure or freeflowing hydrocarbons from the reservoir (either from a well or uncontrollable release from the topsides). Released mass ≥50 tonnes.	Extensive damage - Multiple system damage. Business value change >£10m >100k boe.	Serious international reputation impact. Revocation of Permit or corporate prosecution.	5	Medium / Alert	Medium	High	High	High / Alarm
Single Fatality or Total Permanent Disability	Major Release: ≥20 and <50 tonnes hydrocarbon or non-PLONOR chemical.	Major damage - system shutdown. Business value change <£10M >10k boe.	Major national reputation impact. Prohibition notice.	4	Low / Caution	Medium	Medium	High	High
Major Injury *Includes injuries requiring >7 consecutive days off work as per RIDDOR definition.*	Serious Release: ≥1 and <20 tonnes hydrocarbon or non-PLONOR chemical.	Moderate damage - system requires some isolation. Business value change <£1M >1k boe.	Local reputation impact. Improvement notice or enforcement notice.	3	Low	Low	Medium	Medium	High
Moderate Injury *Includes injuries requiring 3 or more consecutive days off work and recordable under RIDDOR.*	Minor Release: <1 tonne hydrocarbon or non-PLONOR chemical. >10 tonnes of a PLONOR chemical.	Minor damage - system requires partial isolation. Business value change <£500k >100 boe.	Internal reputation impact. Informal notification of opportunities for improvement or letter.	2	Very Low / Care	Low	Low	Medium	Medium
Minor Injury *Injuries requiring <3 days off work, or no time off. Not recordable or reportable under RIDDOR.*	Negligible Release: Release of 10 tonnes or less of a PLONOR chemical. None or minimal clean-up required. *PLONOR: Considered to pose little or no risk to the environment*	Slight damage - system still safe to operate. Business value change <£100K <100 boe.	Scrutiny from Internal Auditor - ICP Action	1	Very Low	Very Low	Low	Low	Medium
No injury	No release or environmental impact	No damage/ cost	No impact	0	Very Low				

HIRA Summary Tables

The scoring and colour coding of each facet of each sub-criterion and for each decommissioning option was agreed at the HIRA whilst adopting the RAM above.

PIPELINE GROUP A Rigid Pipelines, Piggy-backed, Trenched and Buried				
Hazard / Guideword	**1. Total Removal by**	**2. Remediate In-Situ with Exposed Sections**		
	a) Reverse Reeling	**a) Rock Covered**	**b) Trench & Buried**	**c) Cut & Removed**
RISK TO PROJECT PERSONNEL				
Release at deck – Residual Hydrocarbons/ NORM	1B	n/a	n/a	2B
Release at sea – Residual Hydrocarbons / NORM	1A	n/a	n/a	1A
Fire	2B	n/a	n/a	1A
Explosion	2B	n/a	n/a	1A
Impact – Lifting Operations	4B	1A	1A	4A
Impact - Rock dumping activity.	n/a	4A	n/a	n/a
Impact - Snagging subsea during reeling activity.	4B	n/a	n/a	n/a
Equipment Failure	4B	2A	2A	4B
Climatic - Adverse weather.	1B	1A	1A	1B
Occupational - congestion/ complication	3B	2A	2A	3B
Escape Evacuation and Rescue	2B	2B	2B	2B
SIMOPs – offshore	3B	3B	3B	3B
SIMOPs – onshore	4A	n/a	n/a	4A
Vessel Collision	3B	3B	3B	3B
Project interaction with adjacent live hydrocarbon system	5A	n/a	n/a	5A
RISK TO THOSE ON LAND				
Release	2A	n/a	n/a	2A
Fire	2A	n/a	n/a	2A
Explosion	2A	n/a	n/a	2A
Impact – Lifting Operations	4B	n/a	n/a	4A
Transport of material from quay	5B	n/a	n/a	5A
Climatic	2A	n/a	n/a	2A
Occupational – Cutting/ grinding/ hot work	4B	n/a	n/a	4A
Occupational – Noise and vibration	2C	n/a	n/a	2B
Occupational – Odour	1C	n/a	n/a	1C
Occupational - Congestion/ complication	2C	n/a	n/a	2B
Occupational – Security	1C	n/a	n/a	1C
Escape, Evacuation and Rescue	1B	n/a	n/a	1B
RISK TO OTHER USERS OF THE SEA (During Project Execution)				
Impact – during activity	3B	n/a	n/a	3B
Climatic – during activity	1B	1A	1A	1B
RESIDUAL RISK TO OTHER USERS OF THE SEA				
Impact – post activity	n/a	2A	2A	2A

PIPELINE GROUP B Umbilicals , Trenched and Buried				
Hazard / Guideword	**1. Total Removal by**	**2. Remediate In-Situ with Exposed Sections**		
	a) Reverse Reeling	**a) Rock Covered**	**b) Trench & Buried**	**c) Cut & Removed**
RISK TO PROJECT PERSONNEL				
Release at deck – Residual Hydrocarbons / NORM	1A	n/a	n/a	2A
Release at sea – Residual Hydrocarbons / NORM	1A	n/a	n/a	1A
Fire	1A	n/a	n/a	1A
Explosion	1A	n/a	n/a	1A
Impact – Lifting Operations	4B	1A	1A	4A
Impact - Rock dumping activity.	n/a	4A	n/a	n/a
Impact - Snagging subsea during reeling activity.	4B	n/a	n/a	n/a
Equipment Failure	4B	2A	2A	4B
Climatic - Adverse weather.	1B	1A	1A	1B
Occupational - congestion/ complication	3B	2A	2A	3B
Escape Evacuation and Rescue	2B	2B	2B	2B
SIMOPs – offshore	3B	3B	3B	3B
SIMOPs - onshore	4A	n/a	n/a	4A
Vessel Collision	3B	3B	3B	3B
Project interaction with adjacent live hydrocarbon system	5A	n/a	n/a	5A
RISK TO THOSE ON LAND				
Release	2A	n/a	n/a	2A
Fire	2A	n/a	n/a	2A
Explosion	2A	n/a	n/a	2A
Impact – Lifting Operations	4B	n/a	n/a	4A
Transport of material from quay	5B	n/a	n/a	5A
Climatic	2A	n/a	n/a	2A
Occupational – Noise and vibration	2C	n/a	n/a	2B
Occupational - Odour	1C	n/a	n/a	1C
Occupational - Congestion/ complication	2C	n/a	n/a	2B
Occupational - Security	1C	n/a	n/a	1C
Escape, Evacuation and Rescue	1B	n/a	n/a	1B
RISK TO OTHER USERS OF THE SEA (During Project Execution)				
Impact – during activity	3B	n/a	n/a	3B
Climatic – during activity	1B	1A	1A	1B
RESIDUAL RISK TO OTHER USERS OF THE SEA				
Impact – post activity	n/a	2A	2A	2A

APPENDIX B – ENVID DATA SHEETS

The ENVID was completed on 28 February 2022 and although a separate HIRA and ENVID Report [9] has been published, ENVID data sheets summarising the results of the ENVID were prepared to inform the workshop participants. These data sheets are provided herein for reference.

PIPELINE GROUP A **Rigid Pipelines, Piggy-backed, Trenched and Buried**					
CA sub-criteria	**ENVID Nodes within each sub-criterion**	**Decommissioning Options**			
		1.Total Removal by	**2. Remediate In-Situ with Exposed Sections**		
		a) Reverse Reeling	**a) Rock-Covered**	**b) Trenched and Buried**	**c) Cut & Removed**
Environmental sub-criteria					
Impact of Decommissioning Operations Offshore	**Vessel emissions**	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown the ENVID found the Magnitude of Effect (MoE) and subsequent Impact Significance (IS) of the atmospheric emissions associated with the different vessel campaigns to be the same for all options. Cognisance of this similarity should be considered in the CA such that the impact of vessel emissions could be ranked the same across all options.			
	Underwater vessel noise	MoE: Minor (2) IS: Low	MoE: Minor (2) IS: Low	MoE: Minor (2) IS: Low	MoE: Minor (2) IS: Low
		As shown, the ENVID considered the MoE and IS of underwater vessel noise to be the same across all options. For note: the MoE of underwater noise associated with cutting, rock dumping and trenching activities was considered Negligible, and the resultant IS Low for all options. Cognisance of this similarity should be considered in the CA such that underwater noise could be ranked the same across all options.			
	Discharges to sea from vessels and flowlines.	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		The ENVID considered discharges from the vessels and flowlines separately. MoE and IS for each aspect and each option was considered the same. Cognisance of this similarity should be considered in the CA such that discharges to sea could be ranked the same across all options.			
Seabed Disturbance - Short Term	**Disturbance to the seabed**	MoE: Serious (3) IS: Moderate	MoE: Minor (2) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that the MoE and IS differed between the different options. Cognisance of this difference should be considered in the CA Workshop.			
Loss of Habitat - Long Term	**Impact of physical presence of materials left on the seabed** *only on benthic species- not fishing.*	N/A	MoE: Minor (2) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that though the IS was the same (Low) for all relevant options, the MoE varied. Cognisance of this difference and the fact that this aspect is not relevant to one of the options should be considered in the CA Workshop.			
Waste Processing i.e. processing of returned materials and use of landfill	**Generation of waste/use of landfill**	MoE: Negligible (1) IS: Low	N/A	N/A	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that MoE and IS were the same for the applicable options. Cognisance of this similarity and the fact that this aspect is not relevant to one of the options should be considered in the CA Workshop.			
Societal sub-criteria					
Impact on Commercial Fisheries	**Impact of materials left on the seabed on other users**	N/A	MoE: Minor (2) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that the MoE and IS was the same for all relevant options. The CA should take of this similarity and the fact that this aspect is not relevant to some of the options.			
Socio-economic impact on communities and amenities	**Yard activities**	MoE: Minor (2) IS: Low	N/A	N/A	MoE: Minor (2) IS: Low
		As shown, the ENVID considered the MoE and IS to be the same for the relevant options. Cognisance of fact that this aspect is not relevant to some of the options should be considered in the CA.			

PIPELINE GROUP B **Umbilicals, Trenched and Buried**					
CA sub-criteria	**ENVID Nodes within each sub-criterion**	**Decommissioning Options**			
		1.Total Removal by	**2. Remediate In-Situ with Exposed Sections**		
		a) Reverse Reeling	**a) Rock-Covered**	**b) Trenched and Buried**	**c) Cut & Removed**
Environmental sub-criteria					
Impact of Decommissioning Operations Offshore	**Vessel emissions**	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown the ENVID found the Magnitude of Effect (MoE) and subsequent Impact Significance (IS) of the atmospheric emissions associated with the different vessel campaigns to be the same for all options. Cognisance of this similarity should be considered in the CA such that the impact of vessel emissions could be ranked the same across all options.			
	Underwater vessel noise	MoE: Minor (2) IS: Low	MoE: Minor (2) IS: Low	MoE: Minor (2) IS: Low	MoE: Minor (2) IS: Low
		As shown, the ENVID considered the MoE and IS of underwater vessel noise to be the same across all options. For note: the MoE of underwater noise associated with cutting, rock dumping and trenching activities was considered Negligible, and the resultant IS Low for all options. Cognisance of this similarity should be considered in the CA such that underwater noise could be ranked the same across all options.			
	Discharges to sea from vessels and umbilical cores	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		The ENVID considered discharges from the vessels and flowlines separately. MoE and IS for each aspect and each option was considered the same. Cognisance of this similarity should be considered in the CA such that discharges to sea could be ranked the same across all options.			
Seabed Disturbance - Short Term	**Disturbance to the seabed**	MoE: Minor (2) IS: Low	MoE: Minor (2) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that the MoE differed, but the IS was the same across all options. Cognisance of this difference should be considered in the CA Workshop.			
Loss of Habitat - Long Term	**Impact of physical presence of materials left on the seabed** *only on benthic species- not fishing.*	N/A	MoE: Minor (2) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that though the IS was the same (Low) for all relevant options, the MoE varied. Cognisance of this difference and the fact that this aspect is not relevant to one of the options should be considered in the CA Workshop.			
Waste Processing i.e. processing of returned materials and use of landfill	**Generation of waste/use of landfill**	MoE: Minor (2) IS: Low	N/A	N/A	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that although the MoE differed for the applicable options, the IS was the same. Cognisance of this difference in MoE and the fact that this aspect is not relevant to one of the options should be considered in the CA Workshop.			
Societal sub-criteria					
Impact on Commercial Fisheries	**Impact of materials left on the seabed on other users**	N/A	MoE: Minor (2) IS: Low	MoE: Negligible (1) IS: Low	MoE: Negligible (1) IS: Low
		As shown, the ENVID found that the MoE and IS was the same for all relevant options. The CA should take of this similarity and the fact that this aspect is not relevant to some of the options.			
Socio-economic impact on communities and amenities	**Yard activities**	MoE: Minor (2) IS: Low	N/A	N/A	MoE: Minor (2) IS: Low
		As shown, the ENVID considered the MoE and IS to be the same for the relevant options. Cognisance of fact that this aspect is not relevant to some of the options should be considered in the CA.			

APPENDIX C – TECHNICAL FACT SHEETS

Technical factsheets were prepared by the subsea engineer on completion of the engineering/ supporting studies listed in Section 4.1.1.

Group ID	Basis of Rating	Decommissioning Options			
		1. Total Removal by	2. Remediate in-situ with exposed sections:		
		a) Reverse Reeling	a) Rock-Covered	b) Trenched and Buried	c) Cut and Removed
A Rigid Pipelines, Piggy-backed, Trenched and Buried	Total vessel days	22 (200%)	13 (118%)	11 (100%)	11 (100%)
	Vessel SIMOPS days	0	0	0	0
	Mob and demob days	10	9	7	5
	Number vessel transit days	2 (154%)	1.3 (100%)	1.3 (100%)	1.3 (100%)
	Quantity of materials returned to shore (te)	1632	0	0	21
	Quantity of materials left on or in seabed (te)	0	1632	1632	1611
	Quantity of rock cover applied (te)	0	2994	0	0
	Cost estimate (£'000)*	2485 (368%)	814 (121%)	675 (100%)	675 (100%)

* Commercial figures are confidential and will be removed from the public version and % difference only will be quoted.

Group ID	Basis of Rating	Decommissioning Options			
		1. Total Removal by	2. Remediate in-situ with exposed sections:		
		a) Reverse Reeling	a) Rock-Covered	b) Trenched and Buried	c) Cut and Removed
B Umbilicals, Trenched and Buried	Total vessel days	15 (167%)	14 (156%)	9 (100%)	9 (100%)
	Vessel SIMOPS days	0	0	0	0
	Mob and demob days	5	9	5	5
	Number vessel transit days	2 (154%)	1.3 (100%)	1.3 (100%)	1.3 (100%)
	Quantity of materials returned to shore (te)	314	0	0	13
	Quantity of materials left on or in seabed (te)	0	314	314	300
	Quantity of rock cover applied (te)	0	3261	0	0
	Cost estimate (£'000)*	940 (172%)	879 (160%)	548 (100%)	548 (100%)

* Commercial figures are confidential and will be removed from the public version and % difference only will be quoted.

APPENDIX D – CA RATINGS GUIDE TABLE

Assessment Criteria			RATING		
Main Criteria	**Sub- Criteria**		**LOW IMPACT**	**MODERATE IMPACT**	**HIGHER IMPACT**
TECHNICAL FEASIBILITY	**Risk of Major Project Failure**		Normal operational procedures proposed. Scope is straightforward and understood. Offshore Execution Phase Schedule unlikely to slip beyond planned schedule plus contingencies applied.	Some specialist operational procedures required. Some minor scope uncertainties to be resolved before execution. Potential for some schedule slippage activity resulting project delay but not leading to revisit to execution methods.	Unique operational procedures proposed. Major scope uncertainties will remain at execution. Potential for unplanned and unforeseen activity resulting in significant project delay or potential revisit to execution methods.
	Technical Complexity & Track Record		Uses established technology and/or working methods designed for this field of operation. Large experienced contractor pool available.	Uses proven technology and/or working method but in a diverse field of operation. Some experienced contractors available.	Uses novel technology untested in this field of operation or untried methods to be introduced. Likely to be new to contractors.
SAFETY	**Risk During Project Execution**	**To Project Personnel**	Relatively short campaign (exposure duration) No vessel SIMOPS. No diving. Minimal materials handling or interaction with deck crew.	Longer exposure duration. Low vessel SIMOPS (2 vessels). Some diving involved, but short duration. Some materials handling on deck (No toxic or high-risk materials, no heavy loads)	Long or multiple campaigns High level vessel SIMOPs (>2 vessels). Significant diving activity anticipated. Significant materials handling on deck (involving either toxic or high-risk materials, or heavy loads)
		To Those on Land	Minimal materials returned onshore. Routine materials handling anticipated	More materials returned onshore for disposal. Some additional materials cutting and handling. No contaminated materials anticipated.	Significant volume of materials returned onshore with large cutting/ dismantling effort before disposal. Contaminated materials also to be managed.
		To Other Users of the Sea	No increased risk to other vessels than currently under normal operations.	Some additional risk to other vessels due to additional construction vessel activity and vessel transits but over short durations. Activities involved at seabed means construction vessels need little time before initiating evasive action from collision.	Increased risk to other vessels due to multiple construction vessels activity and vessel and barge transits over prolonged period. Activities involved at seabed means it is difficult for construction vessel to initiate evasive action from collision.
	Residual Risk to Other Users of the Sea		No increased risk to fishing trawlers introduced than currently present out with the current field exclusion zones.	Some additional risk to fishing vessels introduced due to infrastructure being decommissioned in-situ. However snagging risk mitigated by infrastructure expected to remain over trawlable.	Increased risk from structures / exposed sections of pipeline or protection / stabilisation features decommissioned in-situ, with no mitigation introduced to prevent snagging from over trawling.
ENVIRONMENTAL	**Impact of Decommissioning Operations Offshore** *(includes emissions to air, discharges to sea and underwater noise)*		Undetectable impact from emissions to air. No/minor permitted discharges to sea. Underwater noise generated is not expected to exceed existing background noise.	Effects of emissions to air are detectable. Potential for unplanned discharges not resulting in noticeable environmental impact. Noise generated could exceed existing background levels resulting in noticeable displacement of cetaceans.	Noticeable impact in air quality on local populations. Potential for unplanned discharges resulting in noticeable environmental impact. Underwater noise generated resulting in physical injury to cetacean species could be possible.
	Seabed Disturbance - Short Term *(includes disturbance to the cuttings piles)*		Localised disturbance to the seabed. Possible addition of small volumes of rock cover.	Localised changes to the seabed are possible e.g. addition of rock to sandy seabed area or resettlement of contaminated sediments (e.g. OBM contaminated cuttings) over a wider area.	Widespread mid-to long term (2 + years) degradation of the seabed e.g. resettlement of OBM contaminated cuttings over a much wider seabed area relatively to existing footprint.
	Change of Habitat - Long Term		No additional material added (e.g. rock dump) to support decommissioning activities. Benthic species in area are widespread. Any potential impact to the sediment and associated ecology is expected to be barely detectable.	Some additional material added (e.g. rock dump) to support decommissioning activities. Benthic species in area are widespread. Detectable impact to the sediment and associated ecology. (e.g. from plastics or wax at exposed sections).	Significant impact on a designated species. Detectable impacts to sediments and water column and associated ecologies (e.g. from plastics or wax at exposed sections).
	Waste Processing *(i.e. processing of returned materials and use of landfill)*		Minimal volumes of non-hazardous waste returned that cannot be recycled or re-used. Relatively small volumes of hazardous material.	Relatively small volumes of non-hazardous waste returned that cannot be recycled or re-used. Moderate volumes of hazardous material.	Large volumes of non- hazardous materials returned that cannot be recycled or re-used. Large volumes of hazardous material.
SOCIETAL	**Impact on Commercial Fisheries**		Option results in area becoming or continuing to be accessible to fishing gear.	Stabilisation features e.g. rock cover means that though seabed is accessible to fishing gear, this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).	Available fishing area decreases, due to self-imposed exclusion zones by fishermen due to recurring snagging hazards.
	Socio-economic impact on communities and amenities		Additional employment created and minimal disruption to local communities.	Maintaining local jobs and minimal disruption to local communities.	Significant impact on local communities e.g. noise, traffic, odour. No additional employment.
ECONOMIC RISK	**Cost for Decommissioning/ Removal activities**		Lowest cost option or within 30% of lowest cost.	Between 130% and 200% of lowest cost option.	Greater than 200% of lowest cost option.
	Cost for long term monitoring / Remediation activities		Minimal potential ongoing cost liability. Post project assessment survey only.	Potential for 2 to 3 periodic monitoring surveys to review behaviour of site post project completion. Potential for some remediation activities (e.g. re-profile unstable rock berms).	Requirement for more than three periodic monitoring surveys, and over a much more prolonged period to review behaviour of site post project completion. It is more likely that some post project remediation activities will be required.

APPENDIX E – CA EVALUATION WORKSHOP RESULTS WORKBOOK

This Appendix contains a large volume of information and has been provided with its own index for easy reference.

APPENDIX E CONTENTS

Updated Rating Workbook - B&B Group A.xlsx

Piggy backed rigid pipelines.
Fully trenched, buried to > 0.6 m DOC and predominantly rock covered

Four rigid pipelines, piggy backed together in groups of two and in separate trenches .
One combination of 6" Production line with 2" gaslift line piggybacked each 5.2km long (Beauly).
One combination 10" Production line with 4" gaslift line piggbacked each 10.105km long (Burghley)

TECHNICAL & SAFETY CRITERIA

Assessment Criteria			Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
			Sub Criteria/ / Sub Options	a)	a)	b)	c)
				REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY			Risk of Major Project Failure	The depth of cover (1.37m Beauly and 1.31m Burghley)+ rock cover above most of Beauly pipeline for upheaval buckling mitigation may require multiple passes of mass flow excavation before the pipelines are exposed for removal, potentially an uncertain extension to the overall campaign duration. The pipelines have been in operation for 21 years (Beauly) and 12 years (Burghley) and since they are fully trenched and buried, the ability to inspect has been limited. Therefore condition of the pipelines to withstand the tension and bending stresses applied during recovery and reeling is uncertain. Although theoretical analysis before mobilisation will improve confidence of the capabilities of the pipelines to be recovered by this technique, if the lines were to break during recovery this could lead to multiple campaigns and potentially a change to recovery techniques. Base case assumption is that the live 3rd party crossing associated with the Burghley pipelines and the Brae to Forties oil pipeline (PL64) will be left to be decommissioned later with the Forties lines, as currently fully rock covered at the crossing.	Total exposure is only 544m across all lines and only at pipeline ends. Additional rock to be applied under this option is c. 2,994te Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied.	Total exposure is only 544m across all lines. Scope is straightforward and understood, however it is highlighted from recent previous RSRUK experience of this type of activity and lesson learned, care and attention is required to ensure appropriate trenching equipment is adopted cognisant of seabed strata conditions and composition. Assuming this is the case, the Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied.	Total exposure is only 544m across all lines. Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied.
			RATING	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
			Technical Complexity & Track Record	No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Moderate Impact (Amber) to take cognisance of the additional and diverse activities associated with cutting and removing the piggyback spacer blocks and removing the anodes on the pipelines as they are drawn onto the vessel deck and before they are reeled (See Sensitivity B Heatmap).*	No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved.	Noted that trenching length will be slightly longer than reported pipeline exposure lengths at each end of the pipelines based on trenching equipment constraints (up to 50m transition for each trench). Trenching of the Burghley pipelines at the Balmoral end may be more difficult and jet trenching equipment will need to be adopted as these pipelines exit directly from a rock berm on seabed surface (i.e. no existing trench transitions are at these locations).	No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved
			RATING	Lower Impact	Lower Impact	Moderate Impact	Lower Impact
			TECHNICAL: OVERALL RATING BASED ON AVERAGE	**Moderate Impact**	**Lower Impact**	**Moderate Impact**	**Lower Impact**
SAFETY	Risk During Project Execution		To Project Personnel	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short campaign duration (c.22 days), single vessel, no SIMOPS. c.30.6km/1,632te of line to be managed on deck compared to c.0.554m/21te associated with Option 2c) and no materials to be managed on deck for Options 2a) and 2b) Deck crew activities associated with cutting and removing the piggyback spacer blocks and removing the anodes on the pipelines by grinding increases deck crew interaction. Anodes are fitted every 12th pipejoint, jointed pipe lengths are 12.2m therefore approximatyely every 146m, total number of andodes to be remode by grinding are approximately 70 on Beauly and 140 on Burghley.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (c.13 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity as rock dumping is mostly automated i.e. normal operation for vessel.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (c.11 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity/ interaction with equipment and associated with launching and recovery of ROV and trenching equipment only i.e. normal operation for vessel.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (c.11 days), single vessel, no SIMOPS. Some deck crew material handling (Approximately 21te) in recovery of exposed sections of pipelines, potential exposure to pipeline residues at cut ends. But relatively small diameter pipelines sections, between 10" dia and 2" diameter and risks will be mitigated. with deck crew being excluded from the back deck during lifting ops.
			RATING	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
			To Those on Land	Management of materials returned onshore will be at licenced yards. c.30.6km/1,632te of pipeline returned onshore. Quayside/ yard crew exposure to residues to be managed when pipeline is un-reeled and cut into sections for onward transport for disposal and recycle. Potential for NORM and wax unknown, but containment processes will be adopted when required. Most deconstruct work in yard is remote from personnel and carried out using appropriate equipment. Larger quantities of materials to be road transported between dismantling yard and final disposal/ recycling destination than other decommissioning options.	Nothing returned onshore. Approximately 2,994te rock cover to be supplied and transported, however not identified as a major risk as supply of rock cover is an ongoing industry practice.	Nothing returned onshore.	Management of materials returned onshore will be at licenced yards. Only *c.* 554m/ 21te of recovered pipeline returned onshore, most cutting will be done offshore. minimal quantities to be road transported between dismantling yard and final disposal/ recycling destination and is not a significant differentiator from Options 2a) and 2b).
			RATING	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
			To Other Users of the Sea	No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 22 days. Reel vessel is only onstation for 12 days. No vessel transits other than initial Mobilisation and Demobilisation. The reel vessel will be connected to the pipelines on seabed during recovery. An evacuation plan to cut and laydown the pipeline in an emergency or to avoid a collision with other vessels will be in place. Guard vessel will be in place during period when pipeline has been unburied. Exclusion zone will also be applied to the area where the construction vessels are working in for duration of the campaign. With these mitigations in place risk is considered to be Low Impact	No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 13 days. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. Risk is considered to be Low Impact.	No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 11 days. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. Risk is considered to be Low Impact.	No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 11 days. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. Risk is considered to be Low Impact.
			RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
			Residual (Long Term) Risk To Other Users of the Sea	No residual risk as this option will leave a safe seabed, scattered rock cover would remain over trawlable. Therefore risk is considered to be Low Impact for this option.	Existing rock berms that are left in place for Options 2a), 2b) and 2c) are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. It was noted that the rock berms associated with the Beauly pipelines route were installed to mitigate upheaval buckling of the pipelines during operation and that the pipelines are buried in the trench c. 1.3m below the rock berms. Therefore if the existing rock berms on the seabed surface were to become unstable, the Beauly pipelines would not become exposed or pose a snagging hazard. The rock berms associated with the Burghley pipeline route are located at four pipeline crossings and therefore the Burghley pipelines at these rock berms are not trenched and would potentially become a snagging hazard if the Burghley rock berms became unstable.		
					See clarification on existing rock berms above, additionally *c.* 2994te (*c.* 320m long in total) of new rock cover at exposed sections will also be installed to be over trawlable and consistent in specification with existing rock berms. Therefore risk is considered to be Low Impact for this option. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming a risk of Moderate Impact (Amber) taking account of the potential for the existing and new additional rock berms to become unstable leading to potential snagging hazard where pipelines are located on seabed surface below the rock berm (See Sensitivity A Heatmap).*	See clarification on existing rock berms above, additionally current exposures at pipeline ends will be trenched and buried to eliminate snagging hazard.Therefore risk is considered to be Low Impact for this option. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming a risk of Moderate Impact (Amber) taking account of the potential for the existing rock berms to become unstable leading to potential snagging hazard where pipelines are located on seabed surface below the rock berm (See Sensitivity A Heatmap).*	See clarification on existing rock berms above, additionally current exposures at pipeline ends will be cut and removed to eliminate snagging hazard.Therefore risk is considered to be Low Impact for this option. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming a risk of Moderate Impact (Amber) taking account of the potential for the existing rock berms to become unstable leading to potential snagging hazard where pipelines are located on seabed surface below the rock berm (See Sensitivity A Heatmap).*
			RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
			SAFETY: OVERALL RATING BASED ON AVERAGE	**Moderate Impact**	**Lower Impact**	**Lower Impact**	**Lower Impact**

Updated Rating Workbook - B&B Group A.xlsx

Piggy backed rigid pipelines.
Fully trenched, buried to > 0.6 m DOC and predominantly rock covered

Four rigid pipelines, piggy backed together in groups of two and in separate trenches .
One combination of 6" Production line with 2" gaslift line piggybacked each 5.2km long (Beauly).
One combination 10" Production line with 4" gaslift line piggbacked each 10.105km long (Burghley)

ENVIRONMENTAL CRITERIA

Assessment Criteria	Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options	a)	a)	b)	c)
		REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
ENVIRONMENTAL	**Impact of Decommissioning Operations Offshore** *(includes emissions to air, discharges to sea and underwater noise)*	Vessel durations and vessel types are similar for all options (22 days for option 1a)) and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned to reduce the hydrocarbon contents to as low as reasonable practicable, any discharges from the lines during recovery are not expected to have a significant impact. Sources of underwater noise will include the presence of vessels and the noise associated with reverse reeling. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Pipeline cutting techniques, if required, are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this sub criterion are similar and considered to be Lower Impact.	Vessel durations and vessel types are similar for all options (13 days for option 2a)) and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned to reduce the hydrocarbon contents to as low as reasonable practicable, dichrges from the pipelines during the application of rock cover is not anticipated however in the unlikely event any discharges are not expected to have a significant impact. Sources of underwater noise will include the presence of vessels and the noise associated with rock dumping. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Pipeline cutting is not anticipated for this option, but if it became necessary, cutting techniques are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this sub criterion are similar and considered to be Lower Impact..	Vessel durations and vessel types are similar for all options (11 days for option 2b)) and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned to reduce the hydrocarbon contents to as low as reasonable practicable, any discharges from the lines during trenching abd burial are not expected to have a significant impact. Sources of underwater noise will include the presence of vessels and the noise associated with trenching and burial. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Pipeline cutting is not anticipated for this option, but if it became necessary, cutting techniques are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this sub criterion are similar and considered to be Lower Impact.	Vessel durations and vessel types are similar for all options (11 days for option 2c)) and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned to reduce the hydrocarbon contents to as low as reasonable practicable, any discharges from the lines during recovery are not expected to have a significant impact. Sources of underwater noise will include the presence of vessels and the noise associated with cutting and removing pipelines sections. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Flowline cutting techniques are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this sub criterion are similar and considered to be Lower Impact.
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term *(includes disturbance to the cuttings piles)*	The depth of cover (1.37m Beauly and 1.31m Burghley)+ rock cover above most of Beauly pipeline for upheaval buckling mitigation may require multiple passes of mass flow excavation before the pipelines are exposed for removal. Full length of piggy backed pipelines to be deburied (c.30.6km), including dispersal of rock berm before removal (*c.* 15.3km). Existing rock berms will be scattered over wide area compared to options 2a) , 2b) and 2c where the existing rock berms remain undisturbed. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Moderate Impact (Amber) to take cognisance of relatively low area of seabed disturbance (See Sensitivity A Heatmap).*	Existing rock berms remain undisturbed in this option.. New/ additional rock berm of similar specification to existing berm to be added at exposed ends only (*c* .800m x 10m area and 2,994te of new rock berm in total). This option is recognised to result in short term localised disturbance during rock placement. The footprint of this short term disturbance is considered significantly smaller than the footprint of disturbance associated with Option 1a). *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Lower Impact (Green) to take cognisance of low area of seabed disturbance (See Sensitivity A Heatmap).*	Existing rock berms remain undisturbed in this option. This option is recognised to result in short term localised disturbance during the trenching and burying activities. It was noted that additional trench transitioning required will be greater that the length of the exposed sections of the lines. The footprint of this short term disturbance is considered significantly smaller (c 0.75km long) than the footprint of disturbance associated with Option1a). *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Lower Impact (Green) to take cognisance of low area of seabed disturbance (See Sensitivity A Heatmap).*	Existing rock berms remain undisturbed in this option. Some minor/ localised seabed disturbance in very small areas at cut locations on seabed where the exposed sections of the pipelines and at both ends within the trench transition.
	RATING	Higher Impact	Moderate Impact	Moderate Impact	Lower Impact
	Change of Habitat - Long Term	No additional material to be introduced to the seabed to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of Option 1a) on the existing habitat is not considered significant.	Additional rock cover means the introduction of a different habitat type to the area. This will potentially impact on existing ecosystem, by allowing other species to settle in the area. Area impacted is relatively small (*c* . 800m x 10m maximum)	No additional material introduced to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of Option 2b) on the existing habitat is not considered significant.	No additional material to be introduced to the seabed to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of Option 2c) on the existing habitat is not considered significant.
	RATING	Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing *(i.e. processing of returned materials and use of landfill)*	Approximately 30.6km of 10"/8"/4"/2" diameter pipeline (1,632te) returning onshore. The use of landfill is expected to be minimal as the pipelines are mostly steel which can be recycled, there is c. 230te of materials associated with hard rubber piggy back spacers, which are anticipated to be recycled or incinerated rather than being directed to landfill. Potential for NORM and wax residues is uncertain but can managed. Overall quantities associated with this option are not significant and impacts are therefore considered low.	No materials returned onshore. Impacts are therefore considered low.	No materials returned onshore. Impacts are therefore considered low.	Total quantities returned onshore only c.554m/ 21te across all pipelines made up of mostly steel. Considered not significantly different to Options 2a) and 2b) but less than option 1a). Impacts are therefore considered low.
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	ENVIRONMENTAL: OVERALL RATING BASED ON AVERAGE	**Higher Impact**	**Moderate Impact**	**Moderate Impact**	**Lower Impact**

Updated Rating Workbook - B&B Group A.xlsx

Piggy backed rigid pipelines.
Fully trenched, buried to > 0.6 m DOC and predominantly rock covered

SOCIETAL & ECONOMIC RISK CRITERIA

Four rigid pipelines, piggy backed together in groups of two and in separate trenches .
One combination of 6" Production line with 2" gaslift line piggybacked each 5.2km long (Beauly).
One combination 10" Production line with 4" gaslift line piggbacked each 10.105km long (Burghley)

Assessment Criteria	Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options	a)	a)	b)	c)
		REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
SOCIETAL	Impact on Commercial Fisheries	The lines will be fully removed and although the disturbed rock berm material will be scattered and left in place, overtrawl trials will be carried out to ensure an accessible seabed for trawlers before leaving the worksite, therefore no impact on commercial fisheries is anticipated with this option.	Existing rock berms that are left in place for Options 2a), 2b) and 2c) are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. It was noted that the rock berms associated with the Beauly pipelines route were installed to mitigate upheaval buckling of the pipelines during operation and that the pipelines are buried in the trench c. 1.3m below the rock berms. Therefore if the existing rock berms on the seabed surface were to become unstable, the Beauly pipelines would not become exposed and therefore would not impact the fishing industries accessibility to the site The rock berms associated with the Burghley pipeline route are located at four pipeline crossings and therefore the Burghley pipelines at these rock berms are not trenched and would potentially become a snagging hazard if the Burghley rock berms became unstable, however the total area occupied by the rock berms at these crossings on the Burghley pipelines route is only c. 15,000m2, therefore, a relatively small fishing area may be impacted if the berm was to eventually become dislodged following multiple trawl passes.		
			See clarification on existing rock berms above, additionally new small rock berm extensions will be installed at end of the existing berms where exposures exist (*c.* 3000m^2 area in total) the additional berms will also be installed to be over trawlable and consistent in specification with existing rock berms. Therefore, a very small fishing area may be impacted if the berm was to eventually become dislodged following multiple trawl passes. Considered to be Moderate Impact to commercial fisheries on the basis that the existing rock berm is left in place and although seabed is accessible to fishing gear, this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).	See clarification on existing rock berms above, additionally the exposed sections of pipelines at both ends of the existing rock berm are to trenched an buried to a depth greater than 0.6m. Considered to be Moderate Impact to commercial fisheries on the basis that the existing rock berm is left in place and although seabed is accessible to fishing gear, this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).	See clarification on existing rock berms above, additionally the exposed sections of pipelines at both ends of the existing rock berm are to be cut and removed. The existing rock berms will remain in place and are less than 15km long in total. Considered to be Moderate Impact to commercial fisheries on the basis that the existing rock berm is left in place and although seabed is accessible to fishing gear, this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).
	RATING	Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	Socio-economic Impact on Communities and Amenities	Although more materials are returned onshore when compared to the other options being evaluated, the quantity (c. 1,632te) is not expected to result in the creation of new jobs. In addition, impacts on communities and amenities as a result of increased road traffic, odour and noise are not expected to be significant as materials will be returned to licensed and currently operating yards and recycling/ disposal facilities. Therefore is considered to be Low Impact for this sub criterion.	No materials returned, such that no new onshore jobs anticipated. Similarly no impact on communities and amenities. Therefore is considered to be not applicable for this sub criterion.	No materials returned, such that no new onshore jobs anticipated. Similarly no impact on communities and amenities. Therefore is considered to be not applicable for this sub criterion.	Negligible quantity of materials returned (21te) such that impacts on communities and amenities as a result of increased traffic, odour and noise are not expected to be significant. In addition, no new onshore jobs anticipated. Therefore is considered to be Low Impact for this sub criterion.
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	SOCIETAL: OVERALL RATING - BASED ON AVERAGE	**Lower Impact**	**Moderate Impact**	**Moderate Impact**	**Moderate Impact**
ECONOMIC RISK	Cost for Decommissioning/ Removal activities	£2,485,000 (368%) of the lowest cost options. However since only £1.8M more than lowest cost option, considered to be Moderate impact compared to other options.	£814,000 (121% more than lowest cost options) considered to be low impact compared to lowest cost options.	£675,000 (joint lowest cost option).	£675,000 (joint lowest cost option).
	RATING	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Cost for long term monitoring / Remediation activities	Minimal potential ongoing cost liability as all pipelines removed. Post project assessment survey and over trawl trial only anticipated.	Existing lines already buried, with rock berms located at intervals along the pipelines route, will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion. Potential for some remediation activities e.g. re-profile of newly installed berms if they become unstable. Beauly lines are also buried >1m below seabed, so if rock is disturbed remediation less likely to be required.	Existing lines already buried, with rock berms located at intervals along the pipelines route, will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion.Beauly lines are also buried >1m below seabed, so if rock is disturbed remediation less likely to be required *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Low Impact (Green) to take cognisance of scenario with the Beauly rock berms not requiring maintenance if they subsequenty become unstable. (See Sensitivity A Heatmap).*	Existing lines already buried and predominantly rock covered will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion.Beauly lines are also buried >1m below seabed, so if rock is disturbed remediation less likely to be required. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Low Impact (Green) to take cognisance of scenario with the Beauly rock berms not requiring maintenance if they subsequenty become unstable. (See Sensitivity A Heatmap).*
	RATING	Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	ECONOMIC RISK: OVERALL RATING BASED ON AVERAGE	**Moderate Impact**	**Moderate Impact**	**Moderate Impact**	**Moderate Impact**

Updated Rating Workbook - B&B Group A.xlsx

Piggy backed rigid pipelines.
Fully trenched, buried to > 0.6 m DOC and predominantly rock covered

VISUAL RATING SUMMARY (HEATMAP)

Four rigid pipelines, piggy backed together in groups of two and in separate trenches .
One combination of 6" Production line with 2" gaslift line piggybacked each 5.2km long (Beauly).
One combination 10" Production line with 4" gaslift line piggbacked each 10.105km long (Burghley)

Assessment Criteria	Decommissioning Options		1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options		a)	a)	b)	c)
			REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	Risk of Major Project Failure		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Technical Complexity & Track Record		Lower Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	Risk During Project Execution	To Project Personnel	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Those on Land	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Other Users of the Sea	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Residual (Long Term) Risk To Other Users of the Sea		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ENVIRONMENTAL	Impact of Decommissioning Operations Offshore		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term		Higher Impact	Moderate Impact	Moderate Impact	Lower Impact
	Change of Habitat - Long Term		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing		Not significantly different	Not significantly different	Not significantly different	Not significantly different
SOCIETAL	Impact on Commercial Fisheries		Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	Socio-economic Impact on Communities and Amenities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ECONOMIC RISK	Cost for Decommissioning/ Removal activities		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Cost for long term monitoring / Remediation activities		Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	OVERALL RATING		**Moderate Impact**	**Lower Impact**	**Lower Impact**	**Lower Impact**
	OVERALL RANKING		**4th**	**2nd =**	**2nd=**	**1st**
	RANKING OBSERVATIONS		Ratings across options 2a), 2b) and 2c) are not significantly different with options 2a) and 2b) which are ranked 2nd= attracting only two more Moderate Impact (Amber) ratings than option2c) which is ranked 1st with only one sub-criterion rated Moderate Impact (Amber) for each option. Option 1a) is ranked 4th and is significantly different in terms of Higher Impact (Red) and Moderate Impact (Amber) ratings attracted compared to option 2c)			
	Rating Count		Red = 1 Amber = 4 Green = 4 Not significantly different = 5	Red = 0 Amber = 4 Green = 5 Not significantly different = 5	Red = 0 Amber = 4 Green = 5 Not significantly different = 5	Red = 0 Amber = 2 Green = 7 Not significantly different = 5
	COMMENTS AND RECOMMENDATIONS		Based on these evaluation results Options 2a), 2b) and 2c) are ranked 1st and 2nd= and all three options should be carried forward to C&P tendering for the execution phase. Option 1a) is ranked 4th and has been rated sufficiently worse than the other three decommissioning option to be discounted as an option to be carried forward. It was noted at the workshop that the decommissioning in-situ of rigid pipelines that were already trenched and buried was consistent with the approved decommissioning options elsewhere in the Balmoral field (i.e. in the same area). It is concluded that the performance of Option 1a) in this evaluation compared to the other options justifies the decision to discount it from further consideration.			

Updated Rating Workbook - B&B Group A.xlsx

Rigid Pipelines and Umbilicals, Trenched and Buried

Four rigid pipelines, piggy backed together in groups of two and in separate trenches .
One combination of 6" Production line with 2" gas lift line piggybacked each 5.2km long (Beauly).
One combination 10" Production line with 4" gas lift line piggybacked each 10.105km long (Burghley)

NARRATIVE SUMMARY:

Sub-criteria ratings have been averaged and thus equally weighted by main criteria.

Red / italic in the cells text below highlights the main areas of influence in a combined rating evaluation poorer than Low Impact (Green).

SUMMARY

Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
Sub Criteria/ Sub Options	a)	a)	b)	c)
	REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	The significant depth of cover + rock cover above most of Beauly pipeline may require multiple passes of mass flow excavation before the pipelines are exposed for removal, potentially an uncertain extension to the overall campaign duration. The pipelines have been in operation a relatively long time and since they are fully trenched and buried, the ability to inspect has been limited. Therefore condition of the pipelines to withstand the tension and bending stresses applied during recovery and reeling is uncertain. Although theoretical analysis will improve confidence of the capabilities of the pipelines to be recovered by this technique, if the lines were to break during recovery this could lead to multiple campaigns and potentially a change to recovery techniques. Base case assumption is that the live 3rd party crossing associated with the Burghley pipelines and Brae to Forties oil pipeline (PL64) will be left to be decommissioned later with the Forties lines, as currently fully rock covered at the crossing. No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved.	Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved.	Scope is straightforward and understood, however *care and attention is required to ensure appropriate trenching equipment is adopted cognisant of seabed strata conditions and composition.* Assuming this is the case, the Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. Noted that trenching length will be slightly longer than reported pipeline exposure lengths at each end of the pipelines based on trenching equipment constraints. Trenching of the Burghley lines at the Balmoral end may be more difficult and jet trenching equipment will need to be adopted as these pipelines lines exit directly from a rock berm on seabed surface (i.e. no existing trench transitions are at these locations).	Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved
AVERAGE RATING THIS CRITERIA	Moderate Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short campaign duration (c.22 days), single vessel, no SIMOPS. *More materials returned onshore than other options meaning more deck crew and quayside/ dismantling yard crew interaction with materials handling than other options. More deck crew materials handling associated with cutting and removing the piggyback spacer blocks and removing the anodes on the pipelines by grinding.Anodes are fitted every 12th pipe joint, jointed pipe lengths are 12.2m therefore approximatyely every 146m, total number of andodes to be remode by grinding are approximately 70 on Beauly and 140 on Burghley.* Management of materials returned onshore will be at licenced yards. Quayside/ yard crew exposure to residues to be managed when pipeline is un-reeled and cut into sections for onward transport for disposal and recycle. Potential for NORM and wax unknown, but containment processes will be adopted when required. Most deconstruct work in yard is remote from personnel and carried out using appropriate equipment. *Larger quantities of materials to be road transported between dismantling yard and final disposal/ recycling destination than other decommissioning options.* No increased risk to other users of the sea during the execution campaign than currently under normal operations. Relatively short campaign, reel vessel is only onstation for 12 days. No vessel transits other than initial Mobilisation and Demobilisation. The reel vessel will be connected to the pipelines on seabed during recovery. An evacuation plan to cut and laydown the pipeline in an emergency or to avoid a collision with other vessels will be in place. Guard vessel will be in place during period when pipeline has been unburied. Exclusion zone will also be applied to the area where the construction vessels are working in for duration of the campaign. No residual risk to other users of the sea as this option will leave a safe seabed, scattered rock cover would remain over trawlable.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (c.13 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity as rock dumping is mostly automated No risk to those on land as nothing returned onshore. Approximately 2,994te rock cover to be supplied and transported, however not identified as a major risk as supply of rock cover is an ongoing industry practice. No increased risk to other users of the sea during the execution campaign than currently under normal operations. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. No residual risk to other users of the sea as the pipelines are trenched and buried for most of their route and are predicted to remain so. The existing rock berms that are to be left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. New rock berms at exposed sections at each end of pipeline route will also be installed to be over trawlable and consistent in specification with existing rock berms.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (c.11 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity/ interaction with equipment and associated with launching and recovery of ROV and trenching equipment only i.e. normal operation for vessel. No risk to those on land as nothing returned onshore. No increased risk to other users of the sea during the execution campaign than currently under normal operations. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. No residual risk to other users of the sea as existing rock berms that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability, additionally current exposures at pipeline ends will be trenched and buried to eliminate snagging hazard.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (c.11 days), single vessel, no SIMOPS. Some deck crew material handling (Approximately 21te) in recovery of exposed sections of pipelines, potential exposure to pipeline residues at cut ends. However risks will be mitigated, with deck crew being excluded from the back deck during lifting ops. No increased risk to other users of the sea during the execution campaign than currently under normal operations. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. No residual risk to other users of the sea as existing rock berms that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability, additionally current exposures at pipeline ends will be cut and removed to eliminate snagging hazard.
AVERAGE RATING THIS CRITERIA	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
ENVIRONMENTAL	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned, any discharges from the lines during recovery are not expected to have a significant impact. Sources of underwater noise during the campaign are not considered to have a significant impact on marine mammals or fish species in the area. Pipeline cutting techniques are similar for all options and explosives will not be used. *Short term seabed disturbance is considered to be Higher Impact due to the debuiral technique for the pipelines using mass flow excavation which may require multiple passes will cause significant short term disturbance along the pipeline routes. Existing rock berms will be scattered over wide area compared to the remediate in-situ decommissioning options evaluated where the existing rock berms remain undisturbed.* No additional material to be introduced to the seabed to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact on the existing habitat is not considered significant. Approximately 30.6km of 10"/8"/4"/2" diameter pipeline (1,632te) returning onshore.The use of landfill is expected to be minimal as the pipelines are mostly steel which can be recycled, there is c. 230te of materials associated with hard rubber piggy back spacers, which are anticipated to be recycled or incinerated rather than being directed to landfill. Overall waste material quantities associated with this option are not significant and impacts are therefore considered low.	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned, no discharges from the lines are expected during the application of rock cover. Sources of underwater noise during the campaign are not considered to have a significant impact on marine mammals or fish species in the area. Pipeline cutting is not anticipated for this option, but if it became necessary, cutting techniques are similar for all options and explosives will not be used. Existing rock berms remain undisturbed in this option.. *This option is recognised to result in short term localised disturbance during placement of the new rock berms at the exposures at the pipeline ends. The footprint of this short term disturbance is considered significantly smaller than the footprint of disturbance associated with Option 1a) and is considered to be a Moderate Impact for seabed disturbance.* *The addition of new rock materials means the introduction of a different habitat type to the area. This will potentially impact on existing ecosystem, by allowing other species to settle in the area. Area impacted is relatively small but is considered a Moderate Impact in terms of change of habitat.* No materials returned onshore therefore no waste processing impact.	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned, any discharges from the lines during trenching and burial are not expected to have a significant impact. Sources of underwater noise during the campaign are not considered to have a significant impact on marine mammals or fish species in the area.Pipeline cutting is not anticipated for this option, but if it became necessary, cutting techniques are similar for all options and explosives will not be used. Existing rock berms remain undisturbed in this option.. *This option is recognised to result in short term localised disturbance during the trenching and burying activities at the exposures at the pipeline ends. The footprint of this short term disturbance is considered significantly smaller than the footprint of disturbance associated with Option 1a) and is considered to be a Moderate Impact for seabed disturbance.* No new material is introduced to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact on the existing habitat is not considered significant. No materials returned onshore therefore no waste processing impact.	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. As the lines have been flushed and cleaned, any discharges from the lines during recovery of the short exposed sections are not expected to have a significant impact. Sources of underwater noise during the campaign are not considered to have a significant impact on marine mammals or fish species in the area. Pipeline cutting techniques are similar for all options and explosives will not be used. This option is recognised to result in only minor/ localised seabed disturbance in very small areas at cut locations on seabed where the exposed sections of the pipelines and at both ends within the trench transition and is considered to be Lower Impact for seabed disturbance. No new material is introduced to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact on the existing habitat is not considered significant. Total quantities of waste materials returned onshore very small and made up of mostly steel and is therefore considered to be of Low Impact for waste processing.
AVERAGE RATING THIS CRITERIA	Higher Impact	Moderate Impact	Moderate Impact	Lower Impact
SOCIETAL	The pipelines will be fully removed and although the disturbed rock berm material will be scattered and left in place, over trawl trials will be carried out to ensure an accessible seabed for trawlers before leaving the worksite, therefore no impact on commercial fisheries is anticipated. Although more materials are returned onshore when compared to the other decommissioning options being evaluated, the quantity being returned is not expected to result in the creation of new jobs. In addition, impacts on communities and amenities as a result of increased road traffic, odour and noise are not expected to be significant as materials will be returned to licensed and currently operating yards and recycling/ disposal facilities.	*Although existing rock berms that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability the evaluation, it is considered to be Moderate Impact to commercial fisheries on the basis that the existing rock berm is left in place and although seabed is accessible to fishing gear, this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).* *Additionally new rock berms at exposed sections at each end of pipeline route will also be installed to be over trawlable and consistent in specification with existing rock berms.* No impact either beneficial or detrimental to communities and amenities as no materials returned, such that no new onshore jobs anticipated and no onshore disruption anticipated.	*Although existing rock berms that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability the evaluation, it is considered to be Moderate Impact to commercial fisheries on the basis that the existing rock berm is left in place and although seabed is accessible to fishing gear, this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).* Additionally the exposed sections of pipelines at both ends of the existing rock berm are to trenched an buried to a depth greater than 0.6m. No impact either beneficial or detrimental to communities and amenities as no materials returned, such that no new onshore jobs anticipated and no onshore disruption anticipated.	*Although existing rock berms that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability the evaluation, it is considered to be Moderate Impact to commercial fisheries on the basis that the existing rock berm is left in place and although seabed is accessible to fishing gear, this could change over time (e.g. potential for the rock berms to become dislodged following multiple trawl passes).* Additionally the exposed sections of pipelines at both ends of the existing rock berm are to be cut and removed. No impact either beneficial or detrimental to communities and amenities as only a very small quantity of materials is returned, such that no new onshore jobs anticipated and no onshore disruption anticipated.
AVERAGE RATING THIS CRITERIA	Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
ECONOMIC RISK	*Comparative execution cost estimated to be £2.485,000 (368%) of the lowest cost options. However since only £1.8M more than lowest cost option, considered to be Moderate impact compared to other options.* Minimal potential ongoing cost liability as all pipelines removed. Post project assessment survey and over trawl trial only anticipated and considered to be Low Impact.	Comparative execution cost estimated to be £814,000 (121% more than lowest cost options) considered to be low impact compared to lowest cost options and considered to be Low Impact. *Existing lines already buried, with rock berms located at intervals along the pipelines route, will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion and considered to be Moderate Impact.*	Comparative execution cost estimated to be £675,000 (joint lowest cost option) and considered to be Low Impact. *Existing lines already buried, with rock berms located at intervals along the pipelines route, will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion and considered to be Moderate Impact.*	Comparative execution cost estimated to be £675,000 (joint lowest cost option) and considered to be Low Impact. *Existing lines already buried, with rock berms located at intervals along the pipelines route, will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion and considered to be Moderate Impact.*
AVERAGE RATING THIS CRITERIA	Moderate Impact	Moderate Impact	Moderate Impact	Moderate Impact

OVERALL RATING	Moderate Impact	Moderate Impact	Moderate Impact	Lower Impact
OVERALL RANKING	**4th**	**2nd**	**3rd**	**1st**
RANKING OBSERVATIONS	Ranking is based on the average rating by main criteria only achieved for each decommissioning option. The application of this average rating across the five main criteria means that each main criteria has equal influence on the outcome of the evaluation. This differs from the Visual rating Summary (heatmap) where each individual sub-criteria is counted and infuences the outcome more where main criteria for specific criteria that has a greater number of sub-crieria (e.g Safety and Environmental). The application of these average ratings by main criteria does not alter the rankings of Options 1a), 2a) and 2c) which remain the same as the ranking in the Visual Ratings Summary (Heatmap) it does change the ranking of Option 2b) from previously ranked 2nd= to become ranked 3rd.			
Rating Count	Red = 1 Amber = 3 Green = 1 Not significantly different = 0	Red = 0 Amber = 3 Green = 2 Not significantly different = 0	Red = 0 Amber = 4 Green = 1 Not significantly different = 5	Red = 0 Amber = 2 Green = 8 Not significantly different = 0
COMMENTS AND RECOMMENDATIONS	As this average ratings to main criteria has not changed the ranking significantly the comments and recommendations described in the Visual Ratings Summary (Heatmap) remain justified.			

Updated Rating Workbook - B&B Group A.xlsx

Piggy backed rigid pipelines.
Fully trenched, buried to > 0.6 m DOC and predominantly rock covered

SENSITIVITY 1 ANALYSIS - BY SPECIFIC CRITERIA

Four rigid pipelines, piggy backed together in groups of two and in separate trenches .
One combination of 6" Production line with 2" gaslift line piggybacked each 5.2km long (Beauly).
One combination 10" Production line with 4" gaslift line piggbacked each 10.105km long (Burghley)

Assessment Criteria	Decommissioning Options		1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options		a)	a)	b)	c)
			REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	Risk of Major Project Failure		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Technical Complexity & Track Record		Moderate Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	Risk During Project Execution	To Project Personnel	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Those on Land	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Other Users of the Sea	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Residual (Long Term) Risk To Other Users of the Sea		Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
ENVIRONMENTAL	Impact of Decommissioning Operations Offshore		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Change of Habitat - Long Term		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing		Not significantly different	Not significantly different	Not significantly different	Not significantly different
SOCIETAL	Impact on Commercial Fisheries		Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	Socio-economic Impact on Communities and Amenities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ECONOMIC RISK	Cost for Decommissioning/ Removal activities		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Cost for long term monitoring / Remediation activities		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	OVERALL RATING		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	OVERALL RANKING		4th	3rd	2nd	1st
	RANKING OBSERVATIONS		Under this sensitivity analysis: - Option 2c) remains ranked 1st and its performance against the other decommissioning options improves as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber). - Options 2a) and 2b) swap places in the ranking with Option 2b) becoming 2nd and 2a) droping to 3rd. Option 2b) improves as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber). - Option 1a) remains ranked 4th as although its rating for seabed disturbance improves from Higher Impact (Red) to Moderate Impact (Amber) its Technical Complexity is rated worse being rated Moderate Impact Amber , instead of Lower Impact (Green) and remains significantly different in terms of Moderate Impact (Amber) ratings attracted compared to option 2c).		
	Rating Count		Red = 0 Amber = 6 Green = 4 Not significantly different = 4	Red = 0 Amber = 4 Green = 6 Not significantly different = 4	Red = 0 Amber = 3 Green = 7 Not significantly different = 4	Red = 0 Amber = 2 Green = 8 Not significantly different = 4
	COMMENTS AND RECOMMENDATIONS		This sensitivity analysis reinforces the decision to nominate Option 2c) as the most preferred decommissioning option in the CA report and in the DP. The fact that Options 2a) and 2b) are rated only marginally worse than Option 2c) promotes the decision that all 3 remediate in- situ decommissioning options should be taken forward to carried forward to C&P tendering for the execution phase. This sensitivity analysis reinforces the decision to discount Option 1a) from further consideration.			

Sensitivity: Changed from Lower Impact (Green) to Moderate Impact (Amber) to take cognisance of the additional and diverse activities associated with cutting and removing the piggyback spacer blocks and removing the anodes on the pipelines as they are drawn onto the vessel deck and before they are reeled

Sensitivity: Changed from Lower Impact (Green) to Moderate Impact (Amber) taking account of the potential for the existing and new additional rock berms to become unstable leading to potential snagging hazard where pipelines are located on seabed surface below the rock berm

Sensitivity: Changed from Higher Impact (Red) to Moderate Impact (Amber) to take cognisance of relatively low area of seabed disturbance

Sensitivity: Changed from Moderate Impact (Amber) to Lower Impact (Green) to take cognisance of relatively low area of seabed disturbance

Sensitivity: Changed from Moderate Impact (Amber) to Lower Impact (Green) to take cognisance of scenario with the Beauly rock berms not requiring maintenance if they subsequenty become unstable.

Updated Rating Workbook - B&B Group A.xlsx

Piggy backed rigid pipelines.
Fully trenched, buried to > 0.6 m DOC and predominantly rock covered

Four rigid pipelines, piggy backed together in groups of two and in separate trenches .
One combination of 6" Production line with 2" gaslift line piggybacked each 5.2km long (Beauly).
One combination 10" Production line with 4" gaslift line piggbacked each 10.105km long (Burghley)

SENSITIVITY ANALYSIS 2 - WHERE ECONOMIC CRITERIA IS NOT CONSIDERED

Assessment Criteria	Decommissioning Options		1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options		a)	a)	b)	c)
			REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	Risk of Major Project Failure		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Technical Complexity & Track Record		Lower Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	Risk During Project Execution	To Project Personnel	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Those on Land	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Other Users of the Sea	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Residual (Long Term) Risk To Other Users of the Sea		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ENVIRONMENTAL	Impact of Decommissioning Operations Offshore		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term		Higher Impact	Moderate Impact	Moderate Impact	Lower Impact
	Change of Habitat - Long Term		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing		Not significantly different	Not significantly different	Not significantly different	Not significantly different
SOCIETAL	Impact on Commercial Fisheries		Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	Socio-economic Impact on Communities and Amenities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
OVERALL RATING			Moderate Impact	Lower Impact	Lower Impact	Lower Impact
OVERALL RANKING			4th	2nd =	2nd=	1st
RANKING OBSERVATIONS	Under this sensitivity analysis where the ratings for Cost for Decommissioning/ Removal activities and Cost for long term monitoring / remediation activities have not been considered : - The rankings across all decommissioning options remains the same as the workshop evaluation. - This is unsurprising as: - The ratings applied during the workshop for Cost for Decommissioning/ Removal activities was Moderate Impact (Amber for Option 1a) and Lower Impact (Green) for all three remediate in-situ options; and - The ratings applied during the workshop for Cost for long term monitoring / remediation activities was Lower Impact (Green) for Option 1a) and Moderate Impact (Amber) for all three remediate in-situ options This in effect cancelled out the influence of the Economic criteria on the evaluation.					
Rating Count			Red = 1 Amber = 3 Green = 3 Not significantly different = 5	Red = 0 Amber = 3 Green = 4 Not significantly different = 5	Red = 0 Amber = 3 Green = 4 Not significantly different = 5	Red = 0 Amber = 1 Green = 6 Not significantly different = 5
COMMENTS AND RECOMMENDATIONS	There is no change to the rankings compared to the workshop evaluation (see VRS heatmap worksheet). Therefore the comments and recommendations described in the Visual Ratings Summary (Heatmap) remain justified.					

Updated Rating Workbook - B&B Group B.xlsx

Umbilicals Fully trenched, buried to > 0.6 m DOC

Two umbilicals, each in a separate trench consisting of:
- One 102mm OD Control / CI umbilical x 5.27km long (Beauly)
- One 130mm OD Control / CI umbilical x 10.382km long (Burghley)

TECHNICAL & SAFETY CRITERIA

Assessment Criteria			Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
			Sub Criteria/ / Sub Options	a)	a)	b)	c)
				REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY			Risk of Major Project Failure	Potentially the umbilicals could be withdrawn through the sediment cover, eliminating the requirement for mass flow excavation, as the cover is between 0.64m and 0.57m above the umbilicals, theoretical analysis will be required to confirm breaking strain of umbilicals versus sediment composition/ condition to confirm the feasibility before this withdrawal strategy was adopted. It was noted that the Beauly umbilical has a breaking load of 37.6te which indicates that a withdrawal strategy was feasible. Even if mass flow excavation beforehand was deemed necessary the scope is considered normal operational procedures and the scope is straightforward and understood. Offshore Execution Phase Schedule unlikely to slip beyond planned schedule plus contingencies applied. Therefore risk is considered to be Low Impact for this option. Noted that Base case assumptions are that: - Removal strategy is to withdraw the umbilicals through their covering without the need for mass flow excavation and: - The live 3rd party crossing associated with Burghley umbilical and the Brae to Forties oil pipeline (PL64) will be left to be decommissioned later with the Forties lines, as currently fully rock covered at the crossing. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming a risk of Moderate Impact (Amber) in consideration that even with the necessary due diligence in analysing the capabilities of the umbilicals to be withdrawn, if failure occurred during reeling it may be necessary to mobilise mass flow excavation vessel/equipment which would impact schedule.*	Total exposure is only 735m across all lines and only at umbilical ends. Additional rock to be applied under this option is *c* . 3,1261te Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. Therefore risk is considered to be Low Impact for this option.	Total exposure is only 735m across all lines and only at umbilical ends. Scope is straightforward and understood, however it is highlighted from recent previous RSRUK experience of this type of activity and lesson learned, care and attention is required to ensure appropriate trenching equipment is adopted cognisant of seabed strata conditions and composition. Assuming this is the case, the Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. Therefore risk is considered to be Low Impact for this option.	Total exposure is only 735m across all lines and only at umbilical ends. Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. Therefore risk is considered to be Low Impact for this option.
			RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
			Technical Complexity & Track Record	No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved.	No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved	Noted that trenching length will be slightly longer than reported pipeline exposure lengths at each end of the umbilicals based on trenching equipment constraints (up to 50m transition for each trench). Trenching of the Burghley umbilical at the Balmoral end may be more difficult and jet trenching equipment will need to be adopted as this umbilical exits directly from a rock berm on seabed surface (i.e. no existing trench transitions are at this location).	No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved
			RATING	Lower Impact	Lower Impact	Moderate Impact	Lower Impact
			TECHNICAL: OVERALL RATING BASED ON AVERAGE	**Lower Impact**	**Lower Impact**	**Moderate Impact**	**Lower Impact**
SAFETY	Risk During Project Execution	To Project Personnel		No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (*c* .15 days), single vessel, no SIMOPS. *c* .15.8km/314te of line to be managed on deck compared to *c* .0.735m/13te associated with Option 2c) and no materials to be managed on deck for Options 2a) and 2b). All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores. the SUTU/ SUDU fitted to the ends of the umbilicals contain hydraulic fluid in the cores and the base case assumption is that the umbilicals can be reeled without first cutting and removing the SUTU/SUDU which therefore contains the water based hydraulic fluid in the cores during reeling and transportation back onshore. Although more materials are recovered to deck than other options the procedures ensure minimal deck crew interaction during recovery risk is therefore considered to be Low Impact for this option. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming a risk of Moderate Impact (Amber) in consideration of the additional materials being recovered compared to the other options.*	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (c.14 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity as rock dumping is mostly automated i.e. normal operation for vessel. Therefore risk is considered to be Low Impact for this option.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (*c* .9 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity/ interaction with equipment and associated with launching and recovery of ROV and trenching equipment only i.e. normal operation for vessel. Therefore risk is considered to be Low Impact for this option.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (*c* .9 days), single vessel, no SIMOPS. Some deck crew material handling (c. 735m/ 13te) in recovery of exposed sections of umbilicals, potential exposure to umbilical residues at cut ends. But water based hydraulic fluids only and risks can be mitigated by bunding or containment by capping ends. Therefore risk is considered to be Low Impact for this option.
			RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
		To Those on Land		Management of materials returned onshore will be at licenced yards. c.15.8km/314te of umbilical returned onshore, quayside/ yard crew exposure to residues to be managed when umbilicals are un-reeled and cut into sections for onward disposal and recycle. Only water based hydraulic fluid is expected in the cores and no blocked cores containing other chemicals, but containment / bunding will be adopted if required to mitigate risk. Most deconstruct work in yard is remote from personnel and carried out using appropriate equipment. Therefore risk is considered to be Low Impact for this option. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming a risk of Moderate Impact (Amber) in consideration of the additional road transport of materials to final disposal/ recycle sites compared to the other decommissioning options.*	Nothing returned onshore. *c* . 3,261te rock cover to be supplied and transported, however not identified as a major risk as supply of rock cover is an ongoing industry practice Therefore risk is considered to be Low Impact for this option	Nothing returned onshore. Therefore risk is not applicable for this option	Management of materials returned onshore will be at licenced yards. Only *c.* 735m/ 13te of recovered umbilical returned onshore, most cutting will be done offshore. minimal quantities to be road transported between dismantling yard and final disposal/ recycling destination and is not a significant differentiator from Options 2a) and 2b). Therefore risk is considered to be Low Impact for this option
			RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
		To Other Users of the Sea		No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 15 days. Reel vessel is only onstation for 5 days. No vessel transits other than initial Mobilisation and Demobilisation. The reel vessel will be connected to the umbilical on seabed during recovery. An evacuation plan to cut and laydown the umbilical in an emergency or to avoid a collision with other vessels will be in place. Guard vessel will be in place during period when pipeline has been unburied. Exclusion zone will also be applied to the area where the construction vessels are working in for duration of the campaign. With these mitigations in place risk is considered to be Low Impact	No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 14 days. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. Risk is considered to be Low Impact.	No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 9 days. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. Risk is considered to be Low Impact.	No increased risk to other vessels than currently under normal operations. Relatively short campaign duration of 9 days. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. Risk is considered to be Low Impact.
			RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
		Residual (Long Term) Risk To Other Users of the Sea		No residual risk as this option will leave a safe seabed, Beauly umbilical has no rock berm, scattered rock cover from Burghley umbilical (at pipeline crossings) would remain over trawlable. Therefore risk is considered to be Low Impact for this option.	The umbilicals are trenched and buried for most of their route and are redicted to remain so. The Beauly umbilical has no rock berm, the Burghley umbilical has individual and relatively small rock berms along its route and only where it crosses over existing pipelines (4 locations). These rock berms will be left in place for Options 2a), 2b) and 2c) and are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability.		
					See clarification on existing rock berms above, additional rock cover (*c.* 3,361te and c. 775m long in total) will be installed over the existing at exposed sections of umbilical at each end of both Beauly and Burghley umbilicals. The rock berms will be installed to be over trawlable and consistent in specification with existing rock berms. Therefore risk is considered to be Low Impact for this option.	See clarification on existing rock berms above, additionally current exposures at pipeline ends will be trenched and buried to eliminate snagging hazard. Therefore risk is considered to be Low Impact for this option.	See clarification on existing rock berms above, additionally current exposures at pipeline ends will be cut and removed to eliminate snagging hazard. Therefore risk is considered to be Low Impact for this option.
			RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
			SAFETY: OVERALL RATING BASED ON AVERAGE	**Not Significantly Different**	**Not Significantly Different**	**Not Significantly Different**	**Not Significantly Different**

Updated Rating Workbook - B&B Group B.xlsx

Umbilicals Fully trenched, buried to > 0.6 m DOC

Two umbilicals, each in a separate trench consisting of:
- One 102mm OD Control / CI umbilical x 5.27km long (Beauly)
- One 130mm OD Control / CI umbilical x 10.382km long (Burghley)

ENVIRONMENTAL CRITERIA

Assessment Criteria	Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options	a)	a)	b)	c)
		REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
ENVIRONMENTAL	**Impact of Decommissioning Operations Offshore** *(includes emissions to air, discharges to sea and underwater noise)*	Vessel durations and vessel types are similar for all options (15 days for option 1a)) and all vessels will be MARPOL compliant. All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores. the SUTU/ SUDU fitted to the ends of the umbilicals contain hydraulic fluid in the cores and the base case assumption is that the umbilicals can be reeled without first cutting and removing the SUTU/SUDU which therefore contains the water based hydraulic fluid in the cores during reeling and transportation back onshore, any discharges (planned or accidental) from the lines during recovery are therefore not expected to have a significant impact. Sources of underwater noise will include the presence of vessels and the noise associated with reverse reeling. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Umbilical cutting techniques when required,are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this subcriterion are similar and considered to be Lower Impact.	Vessel durations and vessel types are similar for all options (13 days for option 2a)) and all vessels will be MARPOL compliant. All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores, under this option any discharges from the lines during the application of rock cover is not expected to have a significant impact The SUTUs at each end of the umbilical will remain in place and will contain the water base hydraulic fluid in the cores during the application of rock. Sources of underwater noise will include the presence of vessels and the noise associated with the application of rock cover. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Umbilical cutting techniques when required,are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this subcriterion are similar and considered to be Lower Impact..	Vessel durations and vessel types are similar for all options (11 days for option 2b)) and all vessels will be MARPOL compliant. All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores, under this option any discharges from the lines during the trenching and burial is not expected to have a significant impact The SUTUs at each end of the umbilical will remain in place and will contain the water base hydraulic fluid in the cores during trenching and burial. Sources of underwater noise will include the presence of vessels and the noise associated with trenching and buria. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Umbilical cutting techniques when required,are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this subcriterion are similar and considered to be Lower Impact..	Vessel durations and vessel types are similar for all options (11 days for option 2c)) and all vessels will be MARPOL compliant. All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores, under this option any discharges from the lines will be limited to the water base hydrauilic fluid in the cores which is anticipated to result in small quantities released at the umbilical cut points and from the cores in the sections of umbilical that are recovered to the surface, these discharges are not expected to have a significant impact. Sources of underwater noise will include the presence of vessels and the noise associated with cutting and lifting the exposed sections of umbilical. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Umbilical cutting techniques when required,are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under this subcriterion are similar and considered to be Lower Impact.
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term *(includes disturbance to the cuttings piles)*	Base case assumption is that the umbilicals could be withdrawn through the sediment cover, eliminating the requirement for mass flow excavation, as the cover is between 0.64m and 0.57m above the umbilicals, However, full length of umbilicals to be withdrawn through the sediment is *c.* 15.3km and although existing rock berms associated with the Burghley umbilical crossings will be displaced before withdrawal this will be in four small locations only and has therefore been evaluated as Moderate Impact (Amber)	Existing rock berms remain undisturbed. New/ additional rock berm of similar specification to existing berms is to be added at exposed ends only (*c* . 3,361te and c. 775m long in total). This option is recognised to result in short term localised disturbance during rock placement. It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Lower Impact (Green) to take cognisance of the fact that the footprint of disturbance is significantly lower than Option 1a)	Existing rock berms remain undisturbed. This option is recognised to result in short term localised disturbance during the trenching and burying activities with additional trench transitioning (Jet trenching of the Burghley umbilical will be required at the Balmoral end as it exits directly from a rock berm on seabed surface i.e. no existing trench transitions are at this location). It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Lower Impact (Green) to take cognisance of the fact that the footprint of disturbance is significantly lower than Option 1a)	Some minor/ localised seabed disturbance in very small areas at cut locations on seabed where the exposed sections of the umbilicals and at both ends within the trench transition.
	RATING	Moderate Impact	Moderate Impact	Moderate Impact	Lower Impact
	Change of Habitat - Long Term	No additional material to be introduced to the seabed to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of Option 1a) on the existing habitat is not considered significant.	Additional rock cover means the introduction of a different habitat type to the area. This will potentially impact on existing ecosystem, by allowing other species to settle in the area. Area impacted is relatively small (c. 775m x 4m maximum)	No additional material introduced to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of Option 2b) on the existing habitat is not considered significant.	No additional material to be introduced to the seabed to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of Option 2c) on the existing habitat is not considered significant.
	RATING	Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing *(i.e. processing of returned materials and use of landfill)*	*c* .15.3km of umbilical (*c* . 314te total , 245te steel, 25te copper and 44te plastics) This is mostly steel which can be recycled. It is anticipated that the c. 44te of plastics may be incinerated rather than being directed to landfill. Overall quantities associated with this option are not significant and impacts are therefore considered low. It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming a risk of Moderate Impact (Amber) in consideration of the amount of plastics being returned onshore to be dealt with compared to other options	No materials returned onshore. Impacts are therefore considered low.	No materials returned onshore. Impacts are therefore considered low.	Total quantities returned onshore only c.735m of umbilical (c. 13te total, 10te steel, 1te copper and 2te plastics). Considered not significantly different to Options 2a) and 2b) but less than option 1a). Impacts are therefore considered low.
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	ENVIRONMENTAL: OVERALL RATING BASED ON AVERAGE	**Moderate Impact**	**Moderate Impact**	**Moderate Impact**	**Lower Impact**

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Umbilicals Fully trenched, buried to > 0.6 m DOC

Two umbilicals, each in a separate trench consisting of:
- One 102mm OD Control / CI umbilical x 5.27km long (Beauly)
- One 130mm OD Control / CI umbilical x 10.382km long (Burghley)

SOCIETAL & ECONOMIC RISK CRITERIA

Assessment Criteria	Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options	a)	a)	b)	c)
		REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
SOCIETAL	Impact on Commercial Fisheries	The lines will be fully removed and although the disturbed rock berm will be left in place, over trawl trials will be carried out to ensure an accessible seabed for trawlers before leaving the worksite, therefore no impact on commercial fisheries is anticipated with this option.	The Beauly umbilical has no rock berms, the Burghley umbilical has individual and relatively small rock berms along its route and only where it crosses over existing pipelines (4 locations). These rock berms will be left in place for Options 2a), 2b) and 2c) and are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. The umbilical at the four pipeline crossings are not trenched and would potentially become a snagging hazard if the rock berms at these locations became unstable, however the total area occupied by these rock berms is only c. 3,000m^2, therefore, a relatively small fishing area may be impacted if the berm was to eventually become dislodged following multiple trawl passes. Also from previous experience from stakeholder engagement with fishing industry representatives, the is no concern regarding snagging on small diameter umbilicals are the fishing equipment is able to break these lines. See clarification on existing rock berms above, additionally new small rock berm extensions will be installed at end of the existing berms where exposures exist (c.3,100m^2 area in total) the additional berms will be installed to be over trawlable and consistent in specification with existing rock berms. Therefore, a relatively small fishing area may be impacted if the berm was to eventually become dislodged following multiple trawl passes. This option is considered to be Lower Impact to commercial fisheries on the basis that the area occupied by existing rock berms is a very small fishing area and the fact that it will not hinder commercial fishing in the area.	See clarification on existing rock berms above, additionally the exposed sections at both ends of the umbilical are to trenched an buried to a depth greater than 0.6m. This option is considered to be Lower Impact to commercial fisheries on the basis that the area occupied by existing rock berms is a very small fishing area and the fact that it will not hinder commercial fishing in the area.	See clarification on existing rock berms above, additionally the exposed sections at both ends of the umbilical are to be cut and removed. This option is considered to be Lower Impact to commercial fisheries on the basis that the area occupied by existing rock berms is a very small fishing area and the fact that it will not hinder commercial fishing in the area.
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Socio-economic Impact on Communities and Amenities	Although more materials are returned onshore when compared to the other options being evaluated, the quantity (*c* . 314te) is not expected to result in the creation of new jobs. In addition, impacts on communities and amenities as a result of increased road traffic, odour and noise are not expected to be significant as materials will be returned to licensed and currently operating yards and recycling/ disposal facilities. Therefore is considered to be Low Impact for this sub criterion.	No materials returned, such that no new onshore jobs anticipated. Similarly no impact on communities and amenities. Therefore is considered to be not applicable for this sub criterion.	No materials returned, such that no new onshore jobs anticipated. Similarly no impact on communities and amenities. Therefore is considered to be not applicable for this sub criterion.	Negligible quantity of materials returned (13te) such that impacts on communities and amenities as a result of increased traffic, odour and noise are not expected to be significant. In addition, no new onshore jobs anticipated. Therefore is considered to be Low Impact for this sub criterion.
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	SOCIETAL: OVERALL RATING - BASED ON AVERAGE	**Not Significantly Different**	**Not Significantly Different**	**Not Significantly Different**	**Not Significantly Different**
ECONOMIC RISK	Cost for Decommissioning/ Removal activities	£940,000 (172%) of the lowest cost options. However since only £392,000 more than lowest cost option, considered to be low impact and not significantly different from other options.	£879,000 (169%) of lowest cost options. However since only £331,000 more than lowest cost option, considered to be low impact and not significantly different from other options.	£548,000 (joint lowest cost option)	£548,000 (joint lowest cost option)
	RATING	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Cost for long term monitoring / Remediation activities	Minimal potential ongoing cost liability as umbilicals are removed. Post project assessment survey and over trawl trial only anticipated.	Umbilicals are trenched and buried for most of their route and are anticipated to remain so. Only Burghley umbilical has rock berms that will need monitored and repaired if they become unstable. Additional rock berms at each end of the umbilicals is added under this option effectively doubling the footprint occupied by rock berms. The umbilical routes will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion. Opportunities to carry out monitoring with Group A and other Balmoral assets decommissioned in-situ.	Umbilicals are trenched and buried for most of their route and are anticipated to remain so. Only Burghley umbilical has rock berms that will need monitored and repaired if they become unstable. The umbilical routes will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion. Opportunities to carry out monitoring with Group A and other Balmoral assets decommissioned in-situ. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Lower Impact (Green) to take cognisance of the fact that the footprint area of the rock berms left in-situ in this option are half of that left under option 2a) where new rock berms are added.*	Umbilicals are trenched and buried for most of their route and are anticipated to remain so. Only Burghley umbilical has rock berms that will need monitored and repaired if they become unstable. The umbilical routes will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion. Opportunities to carry out monitoring with Group A and other Balmoral assets decommissioned in-situ. *It was agreed during the workshop evaluation to carry out a sensitivity analysis assuming Lower Impact (Green) to take cognisance of the fact that the footprint area of the rock berms left in-situ in this option are half of that left under option 2a) where new rock berms are added.*
	RATING	Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	ECONOMIC RISK: OVERALL RATING BASED ON AVERAGE	**Lower Impact**	**Moderate Impact**	**Moderate Impact**	**Moderate Impact**

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VISUAL RATING SUMMARY (HEATMAP)

Assessment Criteria	Decommissioning Options		1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options		a)	a)	b)	c)
			REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	Risk of Major Project Failure		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Technical Complexity & Track Record		Lower Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	Risk During Project Execution	To Project Personnel	Not significantly different	Not significantly different	Not significantly different	Not significantly different
		To Those on Land	Not significantly different	Not significantly different	Not significantly different	Not significantly different
		To Other Users of the Sea	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Residual (Long Term) Risk To Other Users of the Sea		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ENVIRONMENTAL	Impact of Decommissioning Operations Offshore		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term		Moderate Impact	Moderate Impact	Moderate Impact	Lower Impact
	Change of Habitat - Long Term		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing		Not significantly different	Not significantly different	Not significantly different	Not significantly different
SOCIETAL	Impact on Commercial Fisheries		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Socio-economic Impact on Communities and Amenities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ECONOMIC RISK	Cost for Decommissioning/ Removal activities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Cost for long term monitoring / Remediation activities		Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
	OVERALL RATING		Lower Impact	Moderate Impact	Moderate Impact	Lower Impact
	OVERALL RANKING		1st =	3rd =	3rd =	1st =
	RANKING OBSERVATIONS		Ratings across all four options are not significantly different with options 2a) and 2b) attracting only two more Moderate Impact (Amber) ratings than options 1a) and 2c) which are both 1st= with only one sub-criterion rated Moderate Impact (Amber) for each option. The fact that 10 of the 14 sub-criterion evaluated are rated as not significantly different suggest that there is not much difference overall in any of the options. All options attract a Moderate Impact (Amber) rating for seabed disturbance except Option 2c) and all Options attract a Moderate Impact (Amber) rating for Cost of long term monitoring except for Option 1a). The other two key differences attracting a Moderate Impact (Amber) rating are: - Option 2a); Change of habitat long term - due to the fact that new rock berms are introduced to the seabed with this option, and: - Option 2b): Technical complexity - due to the fact that the Burghley umbilical at the Balmoral end will require particular attention when trenching and burying due to the configuration where it exits directly from a rock berm without any transition.		
	Rating Count		Red = 0 Amber = 1 Green = 3 Not significantly different = 10	Red = 0 Amber = 3 Green = 1 Not significantly different = 10	Red = 0 Amber = 3 Green = 1 Not significantly different = 10	Red = 0 Amber = 1 Green = 3 Not significantly different = 10
	COMMENTS AND RECOMMENDATIONS		Based on these evaluation results Options 1a) and 2c) are ranked 1st = and both should be carried forward to C&P tendering for the execution phase. It was noted at the workshop that total removal of the flexible lines was consistent with the approved decommissioning options elsewhere in the Balmoral field (i.e. in the same area). However the results of this evaluation are very close across all four options and taking account of the results of Sensitivity A analysis (See Sensitivity A heatmap) with very slightly different ratings Option 1a) could go from ranked 1st= to be ranked 4th out of 4 options. Since OPRED prefer a single preferred option to be identified in the CA Report and the Decommissioning Programme (DP), it is recommended that option 2c) is adopted as the single most preferred option as option 1a) becomes the least preferred option if the sensitivities discussed at the evaluation workshop are realised (Sensitivity A). The CA Report and DP will recommend that Option 2c) as the most preferred option, but will qualify that all four decommissioning options will be carried forward to C&P tendering for the execution phase and if this results in a potential change in preferred option from Option 2c) RSRUK will engage with OPRED to discuss this potential change.		

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Two umbilicals, each in a separate trench consisting of:
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NARRATIVE SUMMARY:

Sub-criteria ratings have been averaged and thus equally weighted by main criteria.

Red / italic in the cells text below highlights the main areas of influence in a combined rating evaluation poorer than Low Impact (Green).

SUMMARY

Decommissioning Options	1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
Sub Criteria/ Sub Options	a)	a)	b)	c)
	REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	Potentially the umbilicals could be withdrawn through the sediment cover, eliminating the requirement for mass flow excavation, as the cover is between 0.64m and 0.57m above the umbilicals, this is the base case recovery technique evaluated in the workshop. Even if mass flow excavation beforehand was deemed necessary the scope is considered normal operational procedures and the scope is straightforward and understood. Offshore Execution Phase Schedule unlikely to slip beyond planned schedule plus contingencies applied. Therefore risk is considered to be Low Impact for this option. Noted that Base case assumption is that the live 3rd party crossing associated with Burghley umbilical and the Brae to Forties oil pipeline (PL64) will be left to be decommissioned later with the Forties lines, as currently fully rock covered at the crossing. No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved.	Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved.	Scope is straightforward and understood, however *care and attention is required to ensure appropriate trenching equipment is adopted cognisant of seabed strata conditions and composition.* Assuming this is the case, the Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. *Noted that trenching length will be slightly longer than reported pipeline exposure lengths at each end of the umbilicals based on trenching equipment constraints (up to 50m transition for each trench).* *Trenching of the Burghley umbilical at the Balmoral end may be more difficult and jet trenching equipment will need to be adopted as this umbilical exits directly from a rock berm on seabed surface (i.e. no existing trench transitions are at this location).*	Scope is straightforward and understood with no specific uncertainties identified. Offshore Execution Phase Schedule is unlikely to slip beyond planned schedule plus contingencies applied. No new technology or working practices to be introduced. Options have good industry track record in the North Sea and can be executed by contractors with significant previous experience of all activities involved.
AVERAGE RATING THIS CRITERIA	Lower Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (*c*.15 days), single vessel, no SIMOPS. All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores. the SUTU/ SUDU fitted to the ends of the umbilicals contain hydraulic fluid in the cores and the base case assumption is that the umbilicals can be reeled without first cutting and removing the SUTU/SUDU which therefore contains the water based hydraulic fluid in the cores during reeling and transportation back onshore. Although more materials (*c* .314te) are recovered and returned onshore than other options, the procedures ensure minimal deck crew/ yard crew interaction and materials handling risk on the vessel deck and at the quayside. Minimal quantities to be road transported between dismantling yard and final disposal/ recycling destination and is not a significant differentiator and is therefore considered to be Low Impact for this option. No increased risk to other users of the sea during the execution campaign than currently under normal operations. Relatively short campaign, reel vessel is only onstation for 5 days. No vessel transits other than initial Mobilisation and Demobilisation. The reel vessel will be connected to the pipelines on seabed during recovery. An evacuation plan to cut and laydown the pipeline in an emergency or to avoid a collision with other vessels will be in place. Guard vessel will be in place during period when pipeline has been unburied. Exclusion zone will also be applied to the area where the construction vessels are working in for duration of the campaign. No residual risk to other users of the sea as this option will leave a safe seabed, scattered rock cover would remain over trawlable. Therefore overall safety risk is considered to be Lower Impact for this option.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (*c* .14 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity as rock dumping is mostly automated i.e. normal operation for vessel. No risk to those on land as nothing returned onshore. No increased risk to other users of the sea during the execution campaign than currently under normal operations. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. No residual risk to other users of the sea as the umbilicals are trenched and buried for most of their route and are predicted to remain so, the existing rock berms associated with the Burghley umbilical only at four pipeline crossings and that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. New rock berms at exposed sections at each end of umbilical routes will also be installed to be over trawlable and consistent in specification with existing rock berms. Therefore overall safety risk is considered to be Lower Impact for this option.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (*c*. 9 days), single vessel, no SIMOPS. No materials returned to deck. Minimal deck crew activity/ interaction with equipment and associated with launching and recovery of ROV and trenching equipment only i.e. normal operation for vessel. No risk to those on land as nothing returned onshore. No increased risk to other users of the sea during the execution campaign than currently under normal operations. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. No residual risk to other users of the sea as the umbilicals are trenched and buried for most of their route and are predicted to remain so, the existing rock berms associated with the Burghley umbilical only at four pipeline crossings and that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability, additionally current exposures at umbilcal ends will be trenched and buried to eliminate snagging hazard. Therefore overall safety risk is considered to be Lower Impact for this option.	No planned helicopter transfers to and from the vessel. No diver intervention anticipated. Relatively short duration (*c*. 9 days), single vessel, no SIMOPS. Some deck crew material handling (*c* .13te) in recovery of exposed sections of umbilicals, potential exposure to umbilical residues at cut ends. But water based hydraulic fluids only and risks can be mitigated by bunding or containment by capping ends. Very small quantity of umbilical returned onshore, most cutting will be done offshore, minimal quantities to be road transported between dismantling yard and final disposal/ recycling destination and is not a significant differentiator and is therefore considered to be Low Impact for this option. No increased risk to other users of the sea during the execution campaign than currently under normal operations. No vessel transits other than initial Mobilisation and Demobilisation. Activity is largely within 500m zone at each end of pipeline, at exposure locations only. No residual risk to other users of the sea as the umbilicals are trenched and buried for most of their route and are predicted to remain so, the existing rock berms associated with the Burghley umbilical only at four pipeline crossings and that are left in place are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability, additionally current exposures at umbilcal ends will be trenched and buried to eliminate snagging hazard. Therefore overall safety risk is considered to be Lower Impact for this option.
AVERAGE RATING THIS CRITERIA	Not Significantly Different	Not Significantly Different	Not Significantly Different	Not Significantly Different
ENVIRONMENTAL	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. As the chemical cores have been flushed and cleaned with only water based hydraulic fluid remaining in the cores. the SUTU/ SUDU fitted to the ends of the umbilicals contain the water based hydraulic fluid in the cores and the base case assumption is that the umbilicals can be reeled without first cutting and removing the SUTU/SUDU which therefore contains the water based hydraulic fluid in the cores during reeling and transportation back onshore, any discharges (planned or accidental) from the lines during recovery are therefore not expected to have a significant impact. Sources of underwater noise during the campaign are not considered to have a significant impact on marine mammals or fish species in the area. Umbilical cutting techniques when required,are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under the Impact of Decommissioning Operations Offshore subcriterion are similar and considered to be Lower Impact.. *Potentially the umbilicals could be withdrawn through the sediment cover, eliminating the requirement for mass flow excavation, as the cover is between 0.64m and 0.57m above the umbilicals, this is the base case recovery technique evaluated in the workshop. However, full length of umbilicals to be withdrawn through the sediment is c.15.3km.and has therefore been evaluated as Moderate Impact (Amber) for seabed disturbance short term.* No additional material to be introduced to the seabed to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of this option on the existing habitat is not considered significant. Approximately 314te of wast materials is returned onshore this is mostly steel which can be recycled. It is anticipated that the c. 44te of plastics may be incinerated rather than being directed to landfill. Overall quantities associated with this option are not significant and impacts are therefore considered lower impact for waste processing.	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores, under this option any discharges from the lines during the application of rock cover is not expected to have a significant impact The SUTUs at each end of the umbilical will remain in place and will contain the water base hydraulic fluid in the cores during the application of rock. Sources of underwater noise will include the presence of vessels and the noise associated with the application of rock cover. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Umbilical cutting techniques when required,are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under the Impact of Decommissioning Operations Offshore subcriterion are similar and considered to be Lower Impact. Existing rock berms remain undisturbed. *New/ additional rock berm of similar specification to existing berms is to be added at exposed ends only, this option is recognised to result in short term localised disturbance during rock placement.* *The additional rock cover means the introduction of a different habitat type to the area. This will potentially impact on existing ecosystem, by allowing other species to settle in the area, although area impacted is relatively small.* No materials returned onshore. Impacts are therefore considered lower impact for waste processing.	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. All chemical cores in the umbilicals have been flushed and cleaned with only water based hydraulic fluid remaining in the cores, under this option any discharges from the lines during the trenching and burial is not expected to have a significant impact The SUTUs at each end of the umbilical will remain in place and will contain the water base hydraulic fluid in the cores during trenching and burial. Sources of underwater noise will include the presence of vessels and the noise associated with trenching and burial. These underwater noise sources are not considered to have a significant impact on marine mammals or fish species in the area. Umbilical cutting techniques when required,are similar for all options and explosives will not be used. Impacts across all environmental aspects evaluated under the Impact of Decommissioning Operations Offshore subcriterion are similar and considered to be Lower Impact. Existing rock berms remain undisturbed. *This option is recognised to result in short term localised disturbance during the trenching and burying activities with additional trench transitioning (Jet trenching of the Burghley umbilical will be required at the Balmoral end as it exits directly from a rock berm on seabed surface i.e. no existing trench transitions are at this location).* No materials returned onshore. Impacts are therefore considered lower impact for waste processing	Vessel durations and vessel types are similar for all options and all vessels will be MARPOL compliant. Some minor/ localised seabed disturbance in very small areas at cut locations on seabed where the exposed sections of the umbilicals and at both ends within the trench transition. Existing rock berms remain undisturbed with no additional material to be introduced to the seabed to support decommissioning activities. Recovery of the ecosystem in the impacted area is expected to commence as soon as the decommissioning activities are completed. Therefore the long term impact of this option on the existing habitat is not considered significant. Total quantities returned onshore only c.735m of umbilical (c. 13te total, 10te steel, 1te copper and 2te plastics). Considered not significantly different to Options 2a) and 2b) but less than option 1a). Impacts are therefore considered low. Only *c*. 13te of wast materials is returned onshore this is mostly steel which can be recycled. It is anticipated that the *c*. 2te of plastics may be incinerated rather than being directed to landfill. Overall quantities associated with this option are not significant and impacts are therefore considered lower impact for waste processing.
AVERAGE RATING THIS CRITERIA	Moderate Impact	Moderate Impact	Moderate Impact	Lower Impact
SOCIETAL	The umbilicals will be fully removed and although the disturbed rock berm material associated with the Burghley umbilical crossings will be scattered and left in place, over trawl trials will be carried out to ensure an accessible seabed for trawlers before leaving the worksite, therefore no impact on commercial fisheries is anticipated. Although more materials are returned onshore when compared to the other decommissioning options being evaluated, the quantity being returned is not expected to result in the creation of new jobs. In addition, impacts on communities and amenities as a result of increased road traffic, odour and noise are not expected to be significant as only *c*. 314te of materials will be returned to licensed and currently operating yards and recycling/ disposal facilities.	The umbilicals are trenched and buried for most of their route and are predicted to remain so, the existing rock berms associated with the Burghley umbilical only will be left in place and are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. The new rock berms at exposed sections at each end of umbilical route will also be installed to be over trawlable and consistent in specification with existing rock berms. Therefore it is considered that this option will have a lower impact on commercial fisheries. No impact either beneficial or detrimental to communities and amenities as no materials returned, such that no new onshore jobs anticipated and no onshore disruption anticipated.	The umbilicals are trenched and buried for most of their route and are predicted to remain so, the existing rock berms associated with the Burghley umbilical only will be left in place and are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. The exposed sections of umbilical at both ends of the existing rock berm are to trenched an buried to a depth greater than 0.6m. Therefore it is considered that this option will have a lower impact on commercial fisheries. No impact either beneficial or detrimental to communities and amenities as no materials returned, such that no new onshore jobs anticipated and no onshore disruption anticipated.	The umbilicals are trenched and buried for most of their route and are predicted to remain so, the existing rock berms associated with the Burghley umbilical only will be left in place and are over trawlable, have been stable since original installation and will be monitored periodically post decommissioning to ensure/ maintain stability. The exposed sections of umbilical at both ends of the existing rock berm are to are to be cut and removed. Therefore it is considered that this option will have a lower impact on commercial fisheries. In addition, impacts on communities and amenities as a result of increased road traffic, odour and noise are not expected to be significant as only *c* . 13te of materials will be returned to licensed and currently operating yards and recycling/ disposal facilities.
AVERAGE RATING THIS CRITERIA	Not Significantly Different	Not Significantly Different	Not Significantly Different	Not Significantly Different
ECONOMIC RISK	Comparative execution cost estimated to be £940,000 (172%) of the lowest cost options. However since only £392,000 more than lowest cost option, considered to be low impact and not significantly different from other options. Minimal potential ongoing cost liability as both umbilicals are removed. Post project assessment survey and over trawl trial only anticipated and considered to be Low Impact.	Comparative execution cost estimated to be £879,000 (169%) of lowest cost options. However since only £331,000 more than lowest cost option, considered to be low impact and not significantly different from other options. *The umbilical routes will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion and therefore considered to be a Moderate Impact from a potential ongoing cost liability perspective.* Opportunities to carry out monitoring with Group A and other Balmoral assets decommissioned in-situ.	Comparative execution cost estimated to be £548,000 (joint lowest cost option). *The umbilical routes will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion and therefore considered to be a Moderate Impact from a potential ongoing cost liability perspective.* Opportunities to carry out monitoring with Group A and other Balmoral assets decommissioned in-situ.	Comparative execution cost estimated to be £548,000 (joint lowest cost option). *The umbilical routes will continue to be monitored. Potential for at least 2 to 3 periodic monitoring surveys to review behaviour of site post project completion and therefore considered to be a Moderate Impact from a potential ongoing cost liability perspective.* Opportunities to carry out monitoring with Group A and other Balmoral assets decommissioned in-situ.
AVERAGE RATING THIS CRITERIA	Lower Impact	Moderate Impact	Moderate Impact	Moderate Impact
OVERALL RATING	Lower Impact	Moderate Impact	Moderate Impact	Lower Impact
OVERALL RANKING	**1st =**	**3rd**	**4th**	**1st =**
RANKING OBSERVATIONS	Ranking is based on the average rating by main criteria only achieved for each decommissioning option. The application of this average rating across the five main criteria means that each main criteria has equal influence on the outcome of the evaluation. This differs from the Visual rating Summary (heatmap) where each individual sub-criteria is counted and infuences the outcome more where main criteria for specific criteria that has a greater number of sub-crieria (e.g Safety and Environmental). The application of these average ratings by main criteria does not alter the rankings of Options 1a), 2a) and 2c) which remain the same as the ranking in the Visual Ratings Summary (Heatmap) it does change the ranking of Option 2b) from previously ranked 3rd = to become ranked 4th.			
Rating Count	Red = 0 Amber = 1 Green = 2 Not significantly different = 2	Red = 0 Amber = 2 Green = 1 Not significantly different = 2	Red = 0 Amber = 3 Green = 0 Not significantly different = 2	Red = 0 Amber = 1 Green = 2 Not significantly different = 2
COMMENTS AND RECOMMENDATIONS	As this average ratings to main criteria has not changed the ranking significantly the comments and recommendations described in the Visual Ratings Summary (Heatmap) remain justified.			

Updated Rating Workbook - B&B Group B.xlsx

Umbilicals Fully trenched, buried to > 0.6 m DOC

Two umbilicals, each in a separate trench consisting of:
- One 102mm OD Control / CI umbilical x 5.27km long (Beauly)
- One 130mm OD Control / CI umbilical x 10.382km long (Burghley)

SENSITIVITY 1 ANALYSIS (HEATMAP)

Assessment Criteria	Decommissioning Options		1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options		a)	a)	b)	c)
			REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	Risk of Major Project Failure		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Technical Complexity & Track Record		Lower Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	Risk During Project Execution	To Project Personnel	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Those on Land	Moderate Impact	Lower Impact	Lower Impact	Lower Impact
		To Other Users of the Sea	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Residual (Long Term) Risk To Other Users of the Sea		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ENVIRONMENTAL	Impact of Decommissioning Operations Offshore		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
	Change of Habitat - Long Term		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing		Moderate Impact	Lower Impact	Lower Impact	Lower Impact
SOCIETAL	Impact on Commercial Fisheries		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Socio-economic Impact on Communities and Amenities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ECONOMIC RISK	Cost for Decommissioning/ Removal activities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Cost for long term monitoring / Remediation activities		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	OVERALL RATING		Moderate Impact	Moderate Impact	Moderate Impact	Lower Impact
	OVERALL RANKING		4th	3rd	2nd	1st
	RANKING OBSERVATIONS		Under this sensitivity analysis: - Option 2c) remains ranked 1st and its performance against the other decommissioning options improves as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber). - Four sub-criteria have been re-rated from Lower Impact (Green) to Moderate Impact (Amber) for Option 1a), the fact that 6 of the 14 sub-criteria have been rated as not significantly different means that Option 1a) has changed 50% of its remaining ratings to its detriment in terms of performance overall and moves its ranking from 1st = to 4th out of 4 decommissioning options evaluated. - Option 2b improves its ranking compared to Option 2a) and moves from 3rd = to 2nd as the cost of long term monitoring has been re-rated as Lower Impact (Green) instead of Moderate Impact (Amber). - Options 2a) and 2b) are not rated significantly different overall from Option 2c) with only having 2 more (2a) and 1more (2b) Moderate Impact (Amber) rating than Option 2c)			
	Rating Count		Red = 0 Amber = 5 Green = 3 Not significantly different = 6	Red = 0 Amber = 2 Green = 6 Not significantly different = 6	Red = 0 Amber = 1 Green = 7 Not significantly different = 6	Red = 0 Amber = 0 Green = 8 Not significantly different = 6
	COMMENTS AND RECOMMENDATIONS		This sensitivity analysis reinforces the decision to nominate Option 2c) as the most preferred decommissioning option in the CA report and in the DP. The fact the original evaluation (see Visual Rating Summary) ranks Option 1a) as 1st= promotes the decision that options 1a) and 2c) should be taken forward to carried forward to C&P tendering for the execution phase. The fact that Options 2a) and 2b) are rated only marginally worse than Option 2c) promotes the decision that all 4 decommissioning options should be taken forward to carried forward to C&P tendering for the execution phase.			

Updated Rating Workbook - B&B Group B.xlsx

Umbilicals Fully trenched, buried to > 0.6 m DOC

Two umbilicals, each in a separate trench consisting of:
- One 102mm OD Control / CI umbilical x 5.27km long (Beauly)
- One 130mm OD Control / CI umbilical x 10.382km long (Burghley)

SENSITIVITY 2 - WITH ECONOMIC CRITERIA REMOVED (HEATMAP)

Assessment Criteria	Decommissioning Options		1. TOTAL REMOVAL BY:	2. REMEDIATE IN-SITU WITH:		
	Sub Criteria/ / Sub Options		a)	a)	b)	c)
			REVERSE REELING	EXPOSED SECTIONS ROCK COVERED	EXPOSED SECTIONS TRENCHED AND BURIED	EXPOSED SECTIONS CUT AND REMOVED
TECHNICAL FEASIBILITY	Risk of Major Project Failure		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Technical Complexity & Track Record		Lower Impact	Lower Impact	Moderate Impact	Lower Impact
SAFETY	Risk During Project Execution	To Project Personnel	Not significantly different	Not significantly different	Not significantly different	Not significantly different
		To Those on Land	Not significantly different	Not significantly different	Not significantly different	Not significantly different
		To Other Users of the Sea	Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Residual (Long Term) Risk To Other Users of the Sea		Not significantly different	Not significantly different	Not significantly different	Not significantly different
ENVIRONMENTAL	Impact of Decommissioning Operations Offshore		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Seabed Disturbance- Short Term		Moderate Impact	Moderate Impact	Moderate Impact	Lower Impact
	Change of Habitat - Long Term		Lower Impact	Moderate Impact	Lower Impact	Lower Impact
	Waste Processing		Not significantly different	Not significantly different	Not significantly different	Not significantly different
SOCIETAL	Impact on Commercial Fisheries		Not significantly different	Not significantly different	Not significantly different	Not significantly different
	Socio-economic Impact on Communities and Amenities		Not significantly different	Not significantly different	Not significantly different	Not significantly different
OVERALL RATING			Lower Impact	Moderate Impact	Moderate Impact	Lower Impact
OVERALL RANKING			2nd	3rd =	3rd =	1st =
RANKING OBSERVATIONS	Under this sensitivity analysis where the ratings for Cost for Decommissioning/ Removal activities and Cost for long term monitoring / remediation activities have not been considered : - Option 2c) remains ranked 1st and its performance against the other decommissioning options improves compared to the workshop evaluation as the cost of long term monitoring which attracted a Moderate Impact (Amber) rating has not been considered. - Options 2a) and 2b) remain ranked 3rd = as the cost of long term monitoring which attracted a Moderate Impact (Amber) rating in the workshop evaluation has not been considered. - Option 1a)'s ranking drops from 1st = to 2nd as the benefit it gained from having a Lower Impact (Green) rating for Cost for long term monitoring / Remediation activities, compared to the Moderate Impact (Amber) rating applied to the Remediate in-situ options for this sub-criterion in the workshop evaluatio has not been considered .					
Rating Count			Red = 0 Amber = 1 Green = 2 Not significantly different = 9	Red = 0 Amber = 2 Green = 1 Not significantly different = 9	Red = 0 Amber = 2 Green = 1 Not significantly different = 9	Red = 0 Amber = 0 Green = 3 Not significantly different = 9
COMMENTS AND RECOMMENDATIONS	Although there is a slight change to the ranking of Option 1a) compared to the workshop evaluation (see VRS heatmap worksheet) it does not change the overall rankings, not does it change the fact that all four decommissioning options remain rated very similar. Therefore the comments and recommendations described in the Visual Ratings Summary (Heatmap) remain justified.					