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BANFF & KYLE DECOMMISSIONING PROJECT

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REPORT – BANFF & KYLE PHASE 2 & 3 DECOMMISSIONING SUPPORT - COMPARATIVE ASSESSMENT REPORT

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CONTENTS

EXECUTIVE SUMMARY

CNRI have conducted a Comparative Assessment (CA) for the decommissioning of the subsea infrastructure associated with the Banff & Kyle fields. The following steps from the Oil and Gas UK CA Guidelines have been completed:

This CA report for the Banff & Kyle fields presents the methodology, decisions taken, the preparation works carried out, and the outcomes (recommendations) from the internal and external (with stakeholders) workshops.

The CA for the Banff & Kyle field subsea infrastructure has focussed on four decommissioning groups - groups 1, 2, 4 and 8, as described in the table below.

All other decommissioning groups of the Banff & Kyle Subsea Infrastructure were confirmed at the CA Scoping and Screening stage to be fully removed from the field. The outcome of the CA process has made the following recommendations:

Grp	Title	Decommissioning Approach
1	Rigid Pipelines, Trenched and Buried.	Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial – Pipelines will be disconnected – Rock placement over surface laid sections of lines out with existing trench – Rock placement at all areas of spans and exposure
2	Flexibles/Umbilicals Trenched and Buried	Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial – Lines will be disconnected – Rock placement over surface laid sections of lines out with existing trench Note: There are no areas of spans or exposure associated with the lines in Group 2.
3	Flexibles/Umbilicals, Surface Laid	Full Removal
4	Rigid Pipelines, Trenched and Rock Covered	Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial – Lines will be disconnected – Rock placement over surface laid sections of lines out with existing trench Note: There are no areas of spans or exposure associated with the lines in Group 4.
5	Spools and Jumpers	Full Removal
6	Subsea Installations (Structures)	Full Removal
7	Protection / Stabilisation	Full Removal

Grp	Title	Decommissioning Approach
8	FSO Mooring Piles and Remaining Chains	Option 5 – Leave in-situ: Remove pile below seabed to a depth to ensure that any remains are unlikely to become uncovered – Dredge out pile internals – Cut piles below seabed using internal pile cutter In line with current guidance, any piles will be severed below the natural seabed level at such a depth to ensure that any remains are unlikely to become uncovered. CNRI will aim to achieve a cut depth in line with current guidance, however consideration will be given to the prevailing seabed conditions and currents. Any deviation from this Guidance will be discussed and agreed with OPRED. – to a depth to ensure that any remains are unlikely to become uncovered – Recover pile top section to vessel – Lift, tension and cut remaining chain at the seabed
9	FPSO Mooring Scour	Full Remediation

The decisions were reached on completion of an appropriate amount of preparatory study work, with clear decision outcomes.

1 INTRODUCTION

1.1 Background

CNRI are conducting a Comparative Assessment (CA) for the remaining infrastructure in their Banff and Kyle Fields. The fields were originally tied back to an FPSO (Banff) which has since been removed along with the associated risers and mooring system.

The current Banff and Kyle Fields consists of subsea wellheads, subsurface completions, rigid pipelines, static umbilicals, static flowlines, spools, jumpers and various subsea structures. The FPSO mooring systems have been removed from the field. The dynamic risers and umbilicals which previously connected the subsea production system to the FPSO have been removed. The STL Buoy/FSO moorings have been removed, apart from 8 off mooring piles, each with a short length of chain (up to 10m in length).

The subsea wellheads are to be addressed as part of a plugging and abandonment (P&A) campaign and are out with this scope.

Production and gas lift pipelines and flowlines have been purged free of hydrocarbons, flushed and left filled with raw seawater.

Umbilical cores have been flushed through apart from several blocked cores.

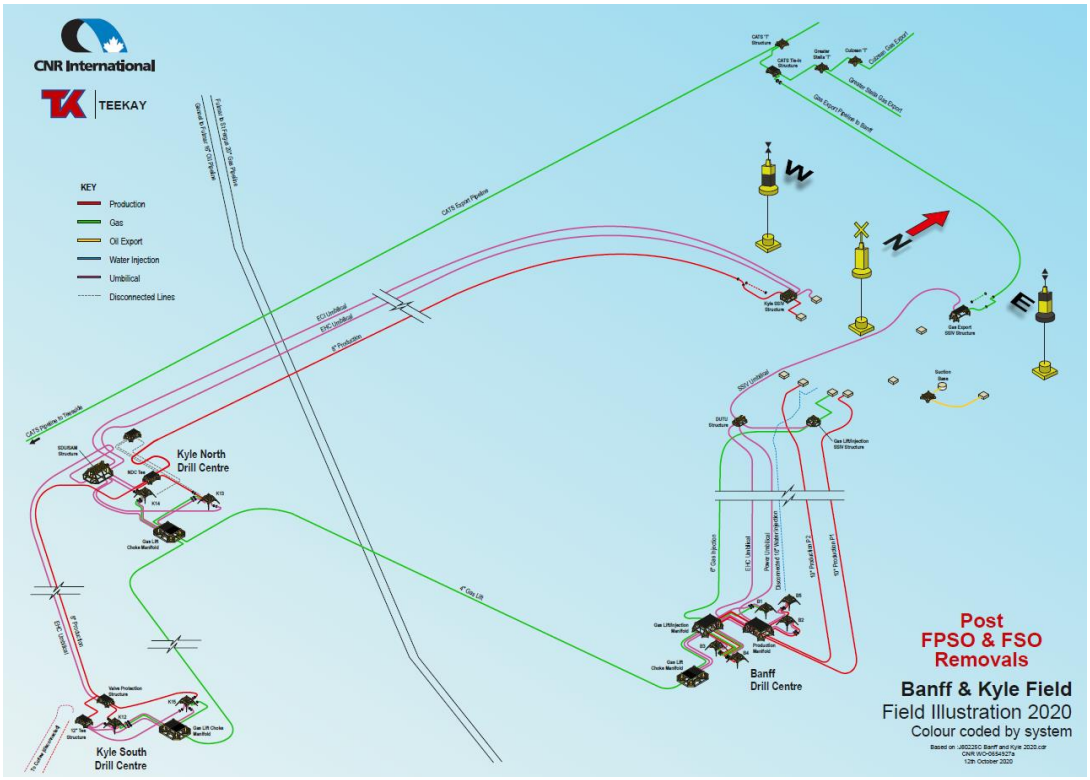


Figure 1.1: Banff and Kyle Fields Remaining Seabed Infrastructure

1.2 Purpose

The purpose of this document is to present a Comparative Assessment (CA) for the Subsea Infrastructure of the Banff & Kyle Fields in support of the Decommissioning Programme (DP). It is produced in satisfaction of the requirement to perform a CA for any potential derogation application for subsea equipment as detailed in the OGUK Decommissioning CA Guidelines ref. [1].

It describes the field infrastructure addressed, the decommissioning options considered, the CA methodology conducted, and the recommendations made during the CA process.

1.3 Report Structure

This CA Report contains the following:

> Section 1 – An introduction to the document and project, including acronyms and references.
> Section 2 – An overview of the CA methodology and definition of the scoping and boundaries of the CA.
> Section 3 – The decommissioning groups identified and the initial decommissioning approach.
> Section 4 – The CA outcome obtained for Group 1 – Rigid Pipelines, Trenched and Buried.
> Section 5 – The CA outcome obtained for Group 2 – Flexibles/Umbilicals Trenched and Buried.
> Section 6 – The CA outcome obtained for Group 4 – Rigid Pipelines, Trenched and Rock Covered.
> Section 7 – The CA outcome obtained for Group 8 – FSO Mooring Piles and Remaining Chains.
> Section 8 – Recommendations
> Appendix A – Evaluation Methodology.
> Appendix B – Stakeholder CA Workshop Minutes.
> Appendix C – Group 1 – Detailed Evaluation Results.
> Appendix D – Group 2 – Detailed Evaluation Results.
> Appendix E – Group 4 – Detailed Evaluation Results
> Appendix F – Decommissioning Methodologies and Datasheets – all groups

1.4 Terms, Abbreviations and Acronyms

AHP	Analytical Hierarchy Process
API	American Petroleum Institute
BEIS	Department of Business, Energy and Industrial Strategy
CA	Comparative Assessment
CATS	Central Area Transmission System
CNRI	Canadian Natural Resources International
CP	Cathodic Protection
CSV	Construction Support Vessel
DP	Decommissioning Programme
DUTA	Dynamic Umbilical Termination Unit
DWC	Diamond Wire Cutting
EMT	Environmental Management Team
FAR	Fatal Accident Rate
FSO	Floating Storage and Offloading
FPSO	Floating Production, Storage and Offloading
HCE	High Consequence Events
HSE	Health and Safety Executive
IP	Institute of Petroleum (now the Energy Institute)
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point

MCDA	Multi-Criteria Decision Analysis
MEI	Major Environmental Incident
MFE	Mass Flow Excavator
MPA	Marine Protected Area
MS	Much Stronger
MW	Much Weaker
NFFO	National Federation of Fishermen's Organisations
NORM	Naturally Occurring Radioactive Material
OD	Outside Diameter
ODU	Offshore Decommissioning Unit
OGUK	Oil & Gas UK
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
P&A	Plugging and Abandonment
PL	Pipeline
PLL	Potential for Loss of Life
PLU	Pipeline (umbilical)
POB	Personnel on Board
S	Stronger
SAM	Subsea Accumulator Module
SDU	Subsea Distribution Unit
SFF	Scottish Fishermen's Federation
SHE	Safety, Health, Environment
SRB	Sulphite Producing Bacteria
STL	Submerged Turret Loading
SSIV	Subsea Safety Isolation Valve
TUTU	Topside Umbilical Termination Unit
UK	United Kingdom
VC	Video Conference
VMS	Very Much Stronger
VMW	Very Much Weaker
W	Weaker

1.5 References

1.	OGUK Decommissioning CA Guidelines	OGUK – Guidelines for Comparative Assessment in Decommissioning Programmes, Dated: October 2015, ISBN: 1 903 004 55 1, Issue: 1.
2.	BEIS Guidance Notes	BEIS, Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines, Nov 2018.
3.	CA Screening Report	Banff & Kyle Phase 2 and 3 Decommissioning Support – Comparative Assessment Screening Report, Doc. No.: BFD399029-XDS-EN-REP-00003_REVA1, Rev.: A1, Dated 30/11/2020.
4.	Risk Analysis of Decommissioning Activities	Safetec, Joint Industry Project Report “Risk Analysis of Decommissioning Activities (http://www.hse.gov.uk/research/misc/safetec.pdf), 2005
5.	Analytical Hierarchy Process	T.L. Saaty, The Analytical Hierarchy Process, 1980
6.	OGUK North Sea Pipeline Decommissioning Guidelines	Decommissioning of Pipelines in the North Sea Region – 2013, Issued by Oil & Gas UK
7.	IP 2000	Guidelines for the Calculations of estimates of energy use and gaseous emissions in the decommissioning of offshore structures.

2 COMPARATIVE ASSESSMENT METHODOLOGY

2.1 Overview

Comparative Assessment is a process by which decisions are made on the most appropriate approach to decommissioning. As such it is a core part of the overall decommissioning planning process being undertaken by CNRI for the Banff & Kyle Decommissioning Project (Subsea Infrastructure).

The OGUK Decommissioning CA Guidelines ref. [1] were prepared in 2015 by Oil and Gas UK, where seven steps to the CA process were recommended. Table 2-1 introduces each of these steps, along with a status and commentary to demonstrate the current position.

Title	Scope	Status	Commentary
Scoping	Decide on appropriate CA method, confirm criteria, identify boundaries of CA (physical and phase).	✓	CA methodology and criteria established for screening to ensure appropriate evaluation phase. Detailed in Section 2.2 and Appendix A.
Screening	Consider alternative uses and deselect unfeasible options.	✓	Screening workshops were held in Q3 2020 the screening workshops were attended by members of the CNRI project team. Screening outcomes are documented in CA Screening Report [3]
Preparation	Undertake technical, safety, environmental and other appropriate studies. Undertake stakeholder engagement.	✓	Studies identified during screening phase undertaken to inform the evaluation of the remaining options. Detailed in Section 2.4.
Evaluation	Evaluate the options using the chosen evaluation methodology.	✓	Internal workshops held Q4 2020 and Stakeholder Workshop on 17/11/2020. Evaluation methodology described in Section 2.5 and outcomes detailed in Section 4, 5 and 6. More detail can be found in Appendix A.
Recommendation	Document the recommendation in the form of narrative supported by charts explaining key trade-offs.	✓	The emerging recommendations for the decommissioning options selected are as identified during the Stakeholder Workshop and as detailed in the CA Report (this document). Recommendations can be found in Section 7.
Review	Review the recommendation with internal and/or external stakeholders.	✓	The Stakeholder CA Review Workshop was held on 17th November 2020 and the minutes can be found in Appendix B.
Submit	Submit to OPRED as part of/alongside Decommissioning Programme.	✓	Planned Q2 2021

Table 2-1: CA Process Overview and Status

2.2 Scoping

The scoping phase of the CA process addresses the following elements:

- Boundaries for the CA;
- Physical attributes of equipment;
- Decommissioning options.

These are addressed in the following sub-sections.

2.2.1 CA Boundaries

The CA Scoping phase includes the definition of the boundaries of the CA. Offshore oil and gas production systems are complex and are often interconnected, and as a result of that, it is important to understand the limitations of the scope. The Banff and Kyle subsea infrastructure is tied back to the CATS gas pipeline. The boundary of the infrastructure is the tie-in flange at the CATS Tie-In Structure. Fluids export was via the FPSO and FSO which have been removed from the field.

The infrastructure that will be considered under this CA is as follows:

- Banff & Kyle Fields' subsea infrastructure addressed within this CA is as follows:
  - All subsea structures (installations) including their foundations;
  - All rigid and flexible subsea flowlines;
  - All control and chemical jumpers;
  - All spools;
  - All umbilicals;
  - All mattresses and deposits;
  - FSO mooring piles & remaining chains.

The starting conditions for the CA are defined below:

- The following will be complete prior to the Banff & Kyle subsea infrastructure decommissioning scope commencing:
  - The pipelines will be cut / disconnected from subsea infrastructure;
  - The umbilicals will be cut / disconnected from subsea infrastructure;
  - The CATS system will be physically isolated from the Banff export pipeline.

2.2.2 Physical Attributes of Equipment

All equipment within the scope of the Banff & Kyle Decommissioning Project (subsea infrastructure) is considered along with the physical attributes that define the equipment. Attributes considered include the following:

- Structures:
  - Type;
  - Weight / size / shape;
  - General arrangement;
  - Installation method / foundation type;
  - Integrity issues.
- Pipelines / Flowlines / Spools:
  - Pipeline number;

- Type (rigid / flexible);
- Service (gas / oil / water);
- Material / diameter / wall thickness / coatings / length;
- Seabed configuration (trenched / buried / surface laid);
- Details of crossings / mattresses;
- As-left cleanliness / ability to clean lines;
- Integrity issues.

> Umbilicals / Jumpers:

- Material / diameter / wall thickness / coatings / length;
- Seabed configuration (trenched / buried / surface laid);
- Details of crossings / mattresses;
- As-left cleanliness / ability to clean lines / chemicals used;
- Integrity issues.

The equipment associated with the Banff & Kyle Decommissioning Project (subsea infrastructure) is summarised in Table 3-1 herein.

2.2.3 Decommissioning Groups

Once the equipment to be decommissioned and their attributes are captured, it is desirable to group similar items of equipment together. This has the benefit that many items can be considered as a single group and can reduce the number of items for consideration from potentially hundreds, down to a few, thus streamlining the process.

For the Banff & Kyle Decommissioning Project (Subsea Infrastructure) the decommissioning groups are summarised in Table 3-1 herein.

2.2.4 Decommissioning Options

With the decommissioning groups established, all potential decommissioning options for each of the groups are identified. The base case for all groups is full removal as per the BEIS Guidance Notes ref. [2] and it is only those decommissioning groups where default full removal is not considered to be the clear recommended solution, that alternative decommissioning options are considered.

Alongside full removal options, the following partial removal scenarios should be considered as specified in the BEIS Guidance Notes ref. [2] and OGUK North Sea Pipeline Decommissioning Guidelines ref. [6].

> Re-Use.

> Full Removal:

- Cut and Lift - Cut pipe into small sections and recover;
- Reverse Installation without de-burial – Recover pipe using reverse s-lay or reverse reeling;
- Reverse Installation with de-burial – Recover pipe using reverse s-lay or reverse reeling.

> Leave In-Situ with Major Intervention:

- Rock cover entire length including surface laid sections out with trench / cover;
- Re-Trench and bury entire length including surface laid sections out with trench / cover.

> Leave In-Situ with Minor Intervention:

  - Rock cover areas of spans, exposure and shallow burial and surface laid portions of lines. Remove surface laid sections out with trench / cover;
  - Trench and bury areas of spans, exposure and shallow burial. Remove surface laid sections out with trench / cover;
  - Cut and Lift areas of spans, exposure and shallow burial. Remove surface laid sections out with trench / cover;
  - Accelerated Decomposition of lines using reverse cathodic protection / chemicals / etc.
- Leave In-Situ and Minimal Intervention:
  - Cut and Lift surface laid sections out with trench / cover only.
- Leave In-Situ and Do Nothing.

Table 3-1 lists the decommissioning groups and identifies those which were judged to be appropriate for decommissioning by full removal and those where full removal was not considered the clear recommended solution. Of those groups where full removal was not considered the clear recommended solution, the proposed decommissioning options for each of those groups are detailed as follows:

- Section 4.2 for Group 1 – Rigid Pipelines, Trenched and Buried;
- Section 5.2 for Group 2 – Flexible Flowlines and Umbilicals, Trenched and Buried;
- Section 6.2 for Group 4 – Rigid Flowlines, Trenched and Rock Back-filled.

2.3 Screening Phase

The screening phase of the comparative assessment was carried out during a series of workshops held in Q3 2020. The methodology adopted, workshop attendance and outcomes obtained are detailed fully in the CA Screening Report ref. [3]. The methodology is briefly summarised below.

- Identify decommissioning groups for full removal;
- Review proposed decommissioning options for each remaining group;
- Assess decommissioning options and record assessment and outcome in screening worksheets;
- Record actions required to support retained decommissioning options;
- Compile Screening Report.

The decommissioning options for the remaining groups were assessed against the primary assessment criteria suggested in the OGUK Decommissioning CA Guidelines ref. [1]. These are:

- Safety;
- Environmental;
- Technical;
- Societal;
- Economic.

The assessment was performed using a coarse Red / Amber / Green method, as recommended in the OGUK Decommissioning CA Guidelines ref. [1]. An additional category of 'showstopper', coloured dark grey, was used. These categories are described Table 2-2.

Category	Description
Attractive	The option is considered attractive i.e. it has positive attributes in terms of the criterion being assessed.
Acceptable	The option is considered acceptable i.e. its attributes are not positive or negative in terms of the criterion being assessed.
Unattractive	The option is considered unattractive i.e. it has negative attributes in terms of the criterion being assessed.
Showstopper	The option is considered unacceptable. Should an option be assessed as unacceptable against any of the criteria, no further assessment is required.

Table 2-2: Screening Assessment Categories

The cumulative assessment for each decommissioning option was then captured based on some basic ground rules. These are:

- Three or more criteria assessed as red resulted in the option being screened out (red).
- For similar full removal options, the likely least onerous option was retained (green) with any more onerous option considered as a sub-set of the less onerous option (light grey). Should the easiest full removal option be selected, the manner in which the removal would be conducted would be agreed with the removal contractor during execution to maintain flexibility.
- For similar leave in-situ options, the most onerous option was retained (green) with any less onerous options considered as a sub-set of the more onerous option (light grey). This approach promotes the principle of not unduly 'burdening' the retained full removal option.
- This approach was considered appropriate to ensure that the best-case full removal options were compared to the most onerous leave in-situ options. This ensures, during the evaluation phase, that the assessment is not skewed such that leave in-situ options are selected over full removal options.

The outcomes for each group are summarised in Table 4-2, Table 5-2 and Table 6-2.

2.4 Preparation Phase

During the preparation phase, detailed studies / analyses are conducted to provide information to support the Evaluation phase of the Comparative Assessment. The detailed studies / analyses that may be required are often identified early in the CA process. These studies / analyses are then supplemented by additional studies / analyses identified during the screening phase of the CA.

The studies / analyses conducted during the preparation phase of the CA process are as follows:

- Burial Status Review — Review of historical survey data to understand current and historical burial status of lines.
- Method Statements — Detailed method statements were developed for options carried forward to ascertain the activities and resources required to deliver the option.
- Emissions Assessment — Fuel consumption and atmospheric emissions assessment performed for options carried forward based upon activities and resources identified in method statements.
- Environmental Impact Review — Environmental impact reviews were conducted for options carried forward in areas of planned discharges, unplanned

discharges and seabed disturbance based on activities and resources identified in method statements. Underwater noise impact was based on a qualitative assessment of the vessels and activities employed as detailed in the method statements.

The findings of the studies / analyses are gathered in preparation for the evaluation phase of the CA. The key information obtained from these studies / analyses, used during the evaluation phase are provided in the attributes tables, included in Appendix C, Appendix D and Appendix E.

2.5 Evaluation Phase

The evaluation phase of the comparative assessment is where the remaining decommissioning options for each group are evaluated against each other. This evaluation process is conducted according to the OGUK Decommissioning CA Guidelines ref. [1] and employs the data obtained during the preparation phase as summarised in the attributes tables, included in Appendix C and Appendix D.

The evaluation phase was performed during several evaluation workshops where the decommissioning project team and field partners were represented. This enabled the supporting information for each of the decommissioning groups and associated decommissioning options to be interrogated and increased in maturity and definition.

Once the evaluation of the remaining decommissioning groups and options was ready, a CA Workshop was convened with external stakeholders; the CA process to date was described and the evaluation of the remaining options was reviewed. This CA Stakeholder Workshop enabled the invited stakeholders to gain familiarity with the evaluation methodology and the information generated through the supporting studies and analyses. It also allowed the evaluation to be challenged in key areas and, at the culmination of the workshop, outcomes for each of the decommissioning groups were validated.

The CA Stakeholder Workshop was held via VC / Microsoft Teams Tuesday 17th November 2020. The attendees were as detailed in Table 2-3.

Company	Name	Role
CNRI	David Hennessy	Subsea Engineer
	Isabelle Pouncey	Observer - Ninian North
	Jonathan Hoare	Pipelines Technical Authority
	Kerry Langworthy	SHE Advisor / Decommissioning Focal Point
	Kirsty Lal	Project Engineer - Decommissioning
	Peter Ronnie	SHE Manager
	Roy Aspden	Decommissioning Manager
	Sarah Gill	Technical Assistant - Developments
	Stephen Brown	Project leader Banff & Kyle Decommissioning
Dana Petroleum	Anne Milne	Joint Venture Manager
HSE	Bill Chilton	Offshore Diving & Decommissioning
	Stephanie Enz	Pipelines Technical Authority

Company	Name	Role
OPRED	Claire Thomson	Decommissioning Manager
	Helen McArthur	Assistant Decommissioning Manager
	Julie Cook	Environmental Manager
	Stewart Welsh	Senior Decommissioning Manager
Premier Oil	Pieter voor de Poorte	Decommissioning Lead
Teekay	Kenny Ironside	Decommissioning Representative
	Tom Griffiths	Director, Technical & Projects
SFF	Andrew Third	Industry Advisor
	Steven Alexander	Offshore Liaison
Xodus Group	Deborah Morgan	Project Manager
	John Foreman	Comparative Assessment Lead
	Nic Duncan	Decommissioning Consultant

Table 2-3: Stakeholder Workshop Attendees & Roles

3 BANFF & KYLE AREA DECOMMISSIONING GROUPS

Table 3-1 lists all decommissioning groups identified for the Banff & Kyle Subsea Infrastructure. Early CA scoping and screening activities, detailed in the CA Screening Report ref. [3], identified the decommissioning groups where full removal is the recommended decommissioning approach (highlighted in grey).

The remaining groups are subjected to the remainder of the CA process to identify the recommended decommissioning option. These outcomes are also captured in Table 3-1.

Grp	Title	Description	Decommissioning Approach
1	Rigid Pipelines, Trenched and Buried	All rigid pipelines, trenched and backfilled.	Subject to full Comparative Assessment
2	Flexibles/Umbilicals Trenched and Buried	All flexible flowlines and umbilicals, trenched and backfilled.	Subject to full Comparative Assessment
3	Flexibles/Umbilicals, Surface Laid	A single umbilical, surface laid in shallow trench.	Full Removal Note 1
4	Rigid Pipelines, Trenched and Rock Covered	All rigid pipelines, trenched and rock covered.	Subject to full Comparative Assessment
5	Spools and Jumpers	All spools associated with the tie-in of pipelines to structures / risers. All jumpers associated with the tie-in of umbilicals to structures / risers.	Full Removal
6	Subsea Installations (Structures)	All subsea structures (installations).	Full Removal
7	Protection / Stabilisation	All protection, support and stabilisation materials such as mattresses and grout bags.	Full Removal
8	Moorings and Related Scour	The moorings and scour / impact to the seabed caused by the moorings.	Full Removal

Table 3-1: Decommissioning Groups and Initial Decommissioning Recommendation

Note 1: Post-screening, the decommissioning approach for Group 3 was adjusted from being considered for full CA to being full removal. This adjustment was made due to the surface laid nature of the single short line in this group (PLU4522 – Banff Power Cable).

3.1 Decommissioning Groups for Full CA

In summary, the decommissioning groups for the Banff & Kyle subsea Infrastructure where full removal was not considered to be the clear recommended solution and that are to be subjected to the full CA process are:

- Group 1 – Rigid Pipelines, Trenched and Buried
- Group 2 – Flexibles/Umbilicals Trenched and Buried
- Group 4 – Rigid Pipelines, Trenched and Rock Covered

4 GROUP 1 – RIGID PIPELINES, TRENCHED AND BURIED

4.1 Group 1 Characteristics

The items that make up Group 1 and their key characteristics are listed in *It should be noted that any differences between pipeline lengths between the DP and supporting documentation can be accounted for by the omission of spool and jumper lengths where these have been scoped out of CA. Full pipeline lengths in line with the relevant Pipeline Works Authorisation (PWA) are presented in the DP.

Table 4-1.

ID	Description	OD (inches)	Length (km)*
PL1546	10” Banff Oil Production Pipeline (P2), Manifold to Riser Base	10	1.546
PL1547	10” Banff Oil Production Pipeline (P1), Manifold to Riser Base	10	1.546
PL1548	10” Banff Water Injection Pipeline, Riser Base to Manifold	10	1.715
PL1550	12” Banff Oil Export Pipeline, Tie-in Spool to 12” Flowline	12	1.248
PL1660	8” Kyle Oil Production Pipeline, North Kyle DC to Riser Base	8	12.023
PL1797	8” Kyle Oil Production Pipeline, Kyle North Tee Structure to Kyle South Tee Structure	8	3.370
PL1798	12” Curlew Production Pipeline, Kyle South 12” Tee Structure to Curlew FPSO	12	17.383
PL2388	4” Kyle Gas Lift Pipeline, Kyle North Gas Lift / Choke Manifold to Kyle South Gas Lift / Choke Manifold	4	3.289

*It should be noted that any differences between pipeline lengths between the DP and supporting documentation can be accounted for by the omission of spool and jumper lengths where these have been scoped out of CA. Full pipeline lengths in line with the relevant Pipeline Works Authorisation (PWA) are presented in the DP.

Table 4-1: Group 1 Items

4.2 Group 1 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse, red / amber / green methodology. The assessment performed and the outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 4-2.

Group 1 – Rigid Pipelines, Trenched and Buried			
Category	**Option**	**Description**	**Discussion**
Re-use	1 – Re-use	- Leave pipelines in-situ for use in any potential new developments	Ruled out as a showstopper as no potential re-use in-situ options for these lines.
Full removal	2a – Cut and lift with de-burial	- Pipelines will be disconnected - De-burial of pipelines using MFE Note 1 - Recover by cutting into sections and removal	Retained as the least onerous and credible Full Removal option.
	2b – Reverse Installation (S-lay) without de-burial	- Lines will be disconnected - No de-burial prior to removal - Recover by reverse s-lay	Screened out due to concerns regarding the lines having the integrity required to perform reverse installation.
	2c – Reverse Installation (S-lay) with de-burial	- Lines will be disconnected - De-burial of line using MFE Note 1 - Recover by reverse s-lay	Screened out due to concerns regarding the lines having the integrity required to perform reverse installation.

Group 1 – Rigid Pipelines, Trenched and Buried			
Category	**Option**	**Description**	**Discussion**
Leave in-situ (major intervention)	3a – Rock placement over entire line	- Pipelines will be disconnected - Rock placement over full length of pipelines to address areas of spans, exposure & shallow burial - No recovery of pipelines	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify fully rock covering lines already fully buried.
Leave in-situ (major intervention)	3b – Retrench and bury entire line	- Pipelines will be disconnected - Re-trench and backfill full length of pipelines to remove areas of spans, exposure & shallow burial depth - No recovery of pipelines - No introduction of new material	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify trenching lines already fully buried.
Leave in-situ (minor intervention)	4a – Rock placement over areas of spans, exposures and shallow burial	- Pipelines will be disconnected - Removal and recovery of surface laid sections out with existing trench [Note 2] - Rock placement to remediate snag risk from cut ends - Rock placement at all areas of spans, exposure and shallow burial depth	Retained as a viable leave in-situ option and should be evaluated.
	4b – Trench & bury areas of spans, exposures and shallow burial	- Pipelines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Trench / bury areas of spans, exposure and shallow burial depth - Minimal introduction of new material	Ruled out as a technical showstopper due to the technical challenges associated with trenching lines due to geotechnical conditions in this area (stiff clays).
	4c – Remove areas of spans, exposures and shallow burial	- Pipelines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques, including de-burial where required	Retained as a viable leave in-situ option and should be evaluated.
	4d – Accelerated decomposition	- Pipelines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Introduce material / techniques to accelerate the decomposition process - Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Ruled out as a technical showstopper as accelerated decomposition not a viable solution for polymer coated rigid lines as polymer coating would remain.
Leave in-situ (minimal intervention)	5 – Remove ends and remediate snag risk	- Pipelines will be disconnected - Removal and recovery of surface laid section out with existing trench - Rock placement to remediate snag risk from cut ends	Retained as a viable leave in-situ option and should be evaluated.
Leave in-situ (do nothing)	6 – Leave as-is	- There will be no planned subsea intervention - Appropriate legislative considerations shall be addressed and any advisory zones implemented for remaining subsea infrastructure	Ruled out as a safety showstopper due to the sections of line out with the trench leaving an unacceptable potential snagging risk.

Table 4-2: Group 1 Decommissioning Options & Screening Summary

Note 1: After Screening, the project team shared historical issues regarding the geotechnical conditions in the area. The seabed conditions of stiff clays are such that de-burial by MFE is unlikely to be successful as experienced during previous remediation activities in this area. As such, all de-burial operations for retained options were modified to be excavation using bucket excavator rather than using MFE.

Note 2: After Screening, the rock cover option was adjusted to include rock cover of surface laid portions of line ends out with existing trench. This aligns with the approach executed by CNRI during the Murchison decommissioning programme.

4.3 Group 1 Decommissioning Options for Evaluation

The decommissioning options for Group 1 that remained after screening and which were taken forward to the evaluation phase are therefore:

- Full Removal
  - 2a – Cut and lift with de-burial
- Leave in-situ (minor intervention)
  - 4a – Rock placement over areas of spans, exposures and shallow burial
  - 4c – Remove areas of spans, exposures and shallow burial
- Leave in-situ (minimal intervention)
  - 5 – Remove ends & remediate snag risk

4.4 Group 1 Evaluation Summary

<table>
<tr><th colspan="3">Group 1 – Rigid Pipelines, Trenched and Buried</th></tr>
<tr><td colspan="3">Note: for full attributes tables and assessment see Appendix C</td></tr>
<tr><td rowspan="6">Evaluation</td><td>Safety</td><td>Option 4a is assessed as being the preferred option from a safety perspective.
Option 4a is preferred from a risk exposure to Operations Personnel perspective. This is due to the shorter durations associated with the offshore scope to rock cover the line ends and areas of spans and exposure compared to the other options and there being no offshore lifting associated with the rock cover option. It is also preferred from an onshore risk exposure perspective as there is no material returned for processing.
Option 2a is preferred to the other options in the Legacy Risk criterion due to the line being fully removed (albeit with two under crossings remaining). The difference in risk profile between Option 2a and the rock cover / exposure removal options is assessed as minimal as the remaining lines are rock covered or trenched and buried along their entire lengths. There is a stronger preference for Option 2a over Option 5 as spans and exposures would remain in Option 5.</td></tr>
<tr><td>Environment</td><td>Option 4c and Option 5 are assessed as being equally preferred from an environmental perspective.
Option 4a, 4c and 5 are equally preferred over Option 2a from an Operational Marine Impact perspective due to the cumulative impact of releases from cutting the lines into short sections for recovery in Option 2a. These releases would have a low environmental impact as the lines will be flushed and cleaned to best endeavours. Option 2a was also less preferred than the other options due to the noise impact associated with the vessels being onsite for extended offshore durations and the Diamond Wire Cutting (DWC) at the crossing locations although, again the noise impact is assessed as being minimal.
Option 2a is less preferred than the other options from an Atmospheric Emissions perspective as the fuel use and atmospheric emissions are higher due to the longer duration offshore operations.
Option 4c and Option 5 are preferred with respect to Seabed Disturbance as the full removal option results in a large area of moderate seabed disturbance from the de-burial of the lines by bucket excavation to gain access for cutting. They are also preferred over Option 4a due to the introduction of additional rock cover, resulting in permanent habitat change.
Option 2a is preferred from a Legacy Marine Impacts perspective as there is limited legacy marine impact as the lines are removed (although two under crossings will remain in-situ). The Legacy Marine Impact from the lines left in-situ, while less preferred to the full removal option, are expected to be minimal as lines are flushed and cleaned to best endeavours and any releases / degradation products will occur over a long time frame and over a wide area.</td></tr>
<tr><td>Technical</td><td>Option 4a, Option 4c and Option 5 are assessed as being equally preferred from a technical perspective.
All options are considered technically feasible as they use largely routine approaches. However, Option 2a was less preferred to the other options due to the challenges associated with excavating the lines (necessary due to geotechnical conditions) to gain access for cutting and challenges in remediating the affected area to allow the area to be overtrawlable. All options were assessed as being equally preferred from an Ease of Recovery from Excursion and Use of Proven Technology and Equipment perspective.</td></tr>
<tr><td>Societal</td><td>Option 2a and Option 4c are assessed as being equally preferred from a societal perspective.
With respect to Societal impact on Fishing, Option 2a and Option 4c are preferred as these present a clear seabed for future fishing operations. Option 4a introduces additional rock berms and Option 5 leaves residual spans and exposures in-situ
The Socio-economic Impacts on Communities and Ammeneties for all options were considered largely balanced as, while there is more useful, recyclable material (steel) returned in the full removal option, there is also the polymer coatings returned which are likely to go to landfill.</td></tr>
<tr><td>Economic</td><td>Option 4a is assessed as being the preferred option from an Economic perspective.
From a short-term cost perspective, Option 4a is preferred as it is around a quarter of the cost of the next lowest cost option. The full removal option is more than 40 times more expensive.
For long-term costs, the legacy costs associated with monitoring, surveying and managing potential snag hazards for all options are similar and equally preferred.</td></tr>
<tr><td>Summary</td><td>Option 4a was preferred (or equally preferred) against the Safety, and Technical criteria. It was marginally less preferred against the Environmental and Societal criteria, but this was insufficient to offset the strong preference for Option 4a against the Safety criterion.
Once the Economics criterion was considered, this strengthens the preference for Option 4a.

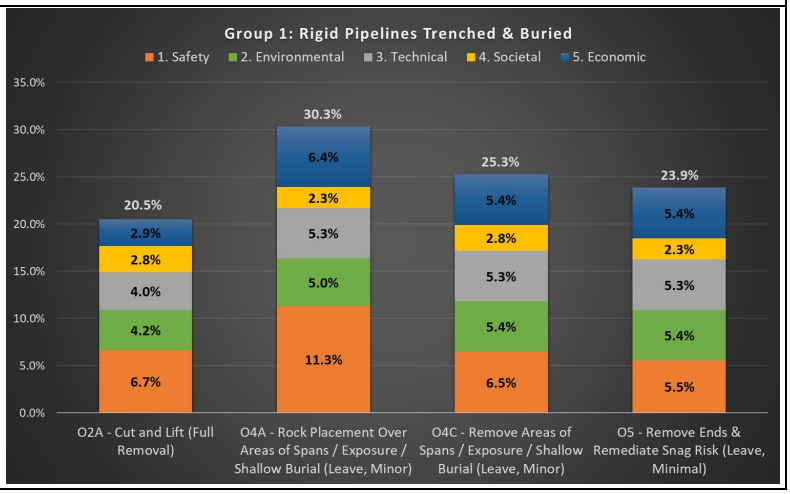
Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial will form the emerging recommendation for decommissioning Group 1.</td><td> 
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Table 4-3: Group 1 Evaluation Summary

5 GROUP 2 – FLEXIBLES/UMBILICALS TRENCHED AND BURIED

5.1 Group 2 Characteristics

The items that make up Group 2 and their key characteristics are listed in *It should be noted that any differences between pipeline lengths between the DP and supporting documentation can be accounted for by the omission of spool and jumper lengths where these have been scoped out of CA. Full pipeline lengths in line with the relevant Pipeline Works Authorisation (PWA) are presented in the DP.

Table 5-1.

ID	Description	OD (inches)	Length (km)*
PL2052	6" Banff Gas Lift / Injection Flowline, Gas Lift / Injection Riser base to Gas Lift / Injection Manifold	6	1.800
PLU1552 1-2	Umbilical (Hydraulic / Chemical), FPSO TUTU to Banff Manifold	4.75	1.750
PLU1553, PLU1554.1-7	Umbilical (Hydraulic / Chemical), DUTA to Banff Manifold	4.75	1.625
PL1661.1-22	Kyle Umbilical (Electrical / Hydraulic / Chemical), DUTA to Well K14	5.4	11.926
PLU3117	Kyle Umbilical (Electrical / Chemical), Kyle SSIV to North Kyle SDU / SAM	4	12.292
PL1799.1-8	Main Kyle Umbilical, Kyle North SDU/SAM to Kyle South SDU	5.4	3.607
PL1800	Curlew Control Umbilical	5.5	17.55

*It should be noted that any differences between pipeline lengths between the DP and supporting documentation can be accounted for by the omission of spool and jumper lengths where these have been scoped out of CA. Full pipeline lengths in line with the relevant Pipeline Works Authorisation (PWA) are presented in the DP.

Table 5-1: Group 2 Items

5.2 Group 2 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse, red / amber / green methodology. The assessment performed and the outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 5-2.

Group 2 – Flexibles/Umbilicals Trenched and Buried			
Category	**Option**	**Description**	**Discussion**
Re-use	1 – Re-use	- Leave lines in-situ for use in any potential new developments	Ruled out as a showstopper as no potential re-use in-situ options for these lines.
Full removal	2a – Cut and lift with de-burial	- Lines will be disconnected - De-burial of lines using MFE Note 1 - Recover by cutting into sections and removal	Considered a more onerous full removal option than the more efficient reverse reeling operations in Option 2b.
	2b – Reverse Installation (Reeling) without de-burial	- Lines will be disconnected - No de-burial prior to removal - Recover by reverse reeling	Retained as the least onerous and credible Full Removal option as integrity of the lines expected to be sufficient to allow reverse reeling without de-burial.

Group 2 – Flexibles/Umbilicals Trenched and Buried			
Category	**Option**	**Description**	**Discussion**
	2c – Reverse Installation (Reeling) with de-burial	- Lines will be disconnected - De-burial of lines using MFE Note 1 - Recover by reverse s-lay	Considered a more onerous full removal option than Option 2b due to the inclusion of de-burial prior to reverse reeling.
Leave in-situ (major intervention)	3a – Rock placement over entire line	- Lines will be disconnected - Rock placement over full length of lines to address areas of spans, exposure & shallow burial - No recovery of lines	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify fully rock covering line already fully buried.
	3b – Retrench and bury entire line	- Lines will be disconnected - Re-trench and backfill full length of lines to remove areas of spans, exposure & shallow burial depth - No recovery of lines - No introduction of new material	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify trenching line already fully buried.
Leave in-situ (minor intervention)	4a – Rock placement over exposures	- Lines will be disconnected - Removal and recovery of surface laid sections out with existing trench Note 2 - Rock placement to remediate snag risk from cut ends - Rock placement at all areas of spans, exposure and shallow burial depth Note 3	Retained as a viable leave in-situ option and should be evaluated.
	4b – Trench & bury exposures	- Lines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Trench / bury areas of spans, exposure and shallow burial depth Note 3 - Minimal introduction of new material	Ruled out as a technical showstopper due to the technical challenges associated with trenching lines due to geotechnical conditions in this area (stiff clays).
	4c – Remove exposures	- Lines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques, including de-burial where required Note 3	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4d – Accelerated decomposition	- Lines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Introduce material / techniques to accelerate the decomposition process - Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Ruled out as a technical showstopper as accelerated decomposition not a viable solution for flexible flowlines / umbilicals due to their construction.
Leave in-situ (minimal intervention)	5 – Remove ends and remediate snag risk	- Lines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends	As there are no areas of spans, exposure or shallow burial, removing the ends of the line out with the trench presents a leave in-situ option that should be evaluated.

Group 2 – Flexibles/Umbilicals Trenched and Buried			
Category	**Option**	**Description**	**Discussion**
Leave in-situ (do nothing)	6 – Leave as-is	- There will be no planned subsea intervention - Appropriate legislative considerations shall be addressed and any advisory zones implemented for remaining subsea infrastructure	Ruled out as a safety showstopper due to the sections of line out with the trench leaving an unacceptable potential snagging risk.

Table 5-2: Group 2 Decommissioning Options and Screening Summary

Note 1: After Screening, the project team shared historical issues regarding the geotechnical conditions in the area. The seabed conditions of stiff clays are such that de-burial by MFE is unlikely to be successful as experienced during previous remediation activities in this area. As such, all de-burial operations for retained options were modified to be excavation using bucket excavator rather than using MFE.

Note 2: After Screening, the rock cover option was adjusted to include rock cover of surface laid portions of line ends out with existing trench. This aligns with the approach executed by CNRI during the Murchison decommissioning programme.

Note 3: During the burial status review conducted as part of the Preparation phase, there were no areas of spans or exposure identified for the lines within this group.

5.3 Group 2 Decommissioning Options for Evaluation

The decommissioning options for Group 2 remaining after screening and taken forward to evaluation are:

- Full Removal
  - 2b – Reverse Installation (Reeling) without de-burial
- Leave in-situ (minor intervention)
  - 4a – Rock placement over areas of spans, exposures and shallow burial
- Leave in-situ (minimal intervention)
  - 5 – Remove ends & remediate snag risk

5.4 Group 2 Evaluation Summary

<table>
<tr><th colspan="3">Group 2 – Flexibles/Umbilicals Trenched and Buried</th></tr>
<tr><td colspan="3">Note: for full attributes tables and assessment see Appendix D</td></tr>
<tr><td></td><td>Safety</td><td colspan="2">Option 4a is assessed as being the preferred option from a safety perspective.
Option 4a is preferred from a risk exposure to Operations Personnel perspective. This is due to the shorter durations associated with the offshore scope to rock cover the line ends compared to the other options and there being no offshore lifting associated with the rock cover option. It is also preferred from an onshore risk exposure perspective as there is no material returned for processing.
Option 2b is preferred to the other options in the Legacy Risk criterion due to the line being fully removed (albeit with two under crossings remaining). The difference in risk profile between Option 2b and the partial removal options is assessed as minimal as the remaining lines are rock covered or trenched and buried along their entire lengths.</td></tr>
<tr><td></td><td>Environment</td><td colspan="2">Option 5 is assessed as being the preferred option from an environmental perspective.
Option 4a and 5 are equally preferred over Option 2b from an Operational Marine Impact perspective due to the cumulative impact of releases from reverse reeling the lines in Option 2a. These releases would have a low environmental impact as the lines will be flushed and cleaned to best endeavours however, they would be released in one location when reverse reeling. Additionally, the Banff Umbilical (PLU1554) and the Kyle Umbilical (PL1661) have blocked cores containing Scale Inhibitor (RX-6034 - 62 litres) and Wax Inhibitor (RX-2099 - 2,509 litres, RX-7020 - 12 litres and RX-7014 - 1,138 litres) which cannot be flushed and cleaned. The releases of the contents of these lines will have the greatest environmental impact.
All options are equally preferred from an Atmospheric Emissions perspective as the fuel use and atmospheric emissions are largely similar across all options.
Option 5 is preferred with respect to Seabed Disturbance as the full removal option results in a large area of seabed disturbance from reverse reeling the lines. The impact is reduced as the reverse reeling is performed by pulling the lines through the existing cover. The rock cover option is less preferred due to the introduction of additional rock cover, resulting in permanent habitat change.
Option 2b is preferred from a Legacy Marine Impacts perspective as there is limited legacy marine impact as the lines are removed (although two under crossings will remain in-situ). The Legacy Marine Impact from the lines left in-situ, while less preferred to the full removal option, are expected to be minimal as lines are flushed and cleaned to best endeavours (with the exception of the blocked cores) and any releases / degradation products will occur over a long time frame and over a wide area.</td></tr>
<tr><td></td><td>Technical</td><td colspan="2">Option 4a and Option 5 are assessed as being equally preferred from a technical perspective.
All options are considered technically feasible as they use largely routine approaches and are equally preferred from a Technical Feasibility perspective.
Option 2b is marginally less preferred from an Ease of Recovery from Excursion perspective due to the challenges associated with finding and connecting to the buried line end after any unplanned excursion.
All options were assessed as being equally preferred from a Use of Proven Technology and Equipment perspective, again due to the use of routine operations / equipment.</td></tr>
<tr><td></td><td>Societal</td><td colspan="2">Option 2b is assessed as being the preferred option from a societal perspective.
With respect to Societal impact on Fishing, Option 2b is preferred as this presents a clear seabed for future fishing operations. Option 4a introduces additional rock berms and Option 5 leaves the lines in-situ albeit fully trenched and buried.
The Socio-economic Impacts on Communities and Ammeneties for all options were considered largely balanced as, while there is more useful, recyclable material (steel, copper) returned in the full removal option, there is also the polymers from the flexible flowlines and umbilicals returned which are likely to go to landfill.</td></tr>
<tr><td></td><td>Economic</td><td colspan="2">Option 4a is assessed as being the preferred option from an economic pespective.
From a short-term cost perspective, Option 4a is preferred as it is less than half the cost of the next lowest cost option (Option 5). The full removal option is more than seven times more expensive.
For long-term costs, the legacy costs associated with monitoring, surveying and managing potential snag hazards for all options are similar and equally preferred.</td></tr>
<tr><td></td><td>Summary</td><td>Option 4a was preferred (or equally preferred) against the Safety, and Technical criteria. It was marginally less preferred against the Environmental and Societal criteria, but this was insufficient to offset the strong preference for Option 4a against the Safety criterion.
Once the Economics criterion was considered, this strengthens the preference for Option 4a.

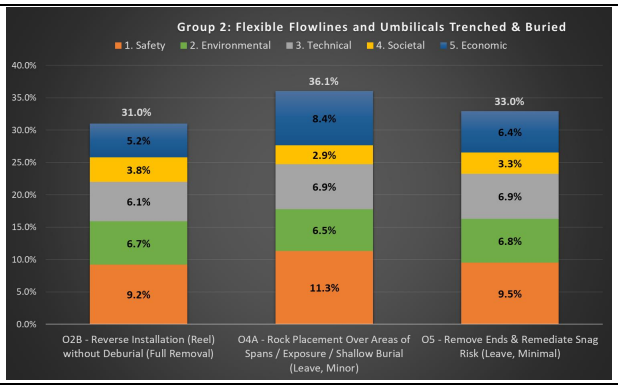
Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial will form the emerging recommendation for decommissioning Group 2.</td><td> 
</td></tr>
</table>

Table 5-3: Group 2 Evaluation Summary

6 GROUP 4 – RIGID PIPELINES, TRENCHED AND ROCK COVERED

6.1 Group 4 Characteristics

The items that make up Group 4 and their key characteristics are listed in *It should be noted that any differences between pipeline lengths between the DP and supporting documentation can be accounted for by the omission of spool and jumper lengths where these have been scoped out of CA. Full pipeline lengths in line with the relevant Pipeline Works Authorisation (PWA) are presented in the DP.

Table 6-1.

ID	Description	OD (inches)	Length (km)*
PL1549	6" Banff Gas Export Pipeline, API Transition Spool to CATS Tie-in	6	6.268
PL2387	4" Kyle Gas Lift Pipeline, Banff Gas Lift / Injection Manifold to Kyle North Gas Lift / Choke Manifold	4	10.252

*It should be noted that any differences between pipeline lengths between the DP and supporting documentation can be accounted for by the omission of spool and jumper lengths where these have been scoped out of CA. Full pipeline lengths in line with the relevant Pipeline Works Authorisation (PWA) are presented in the DP.

Table 6-1: Group 4 Items

6.2 Group 4 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse, red / amber / green methodology. The assessment performed and the outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 6-2.

Group 4 – Rigid Pipelines, Trenched and Rock Covered			
Category	**Option**	**Description**	**Discussion**
Re-use	1 – Re-use	- Leave lines in-situ for use in any potential new developments	Ruled out as a showstopper as no potential re-use in-situ options for these lines.
Full removal	2a – Cut and lift with de-burial	- Pipelines will be disconnected - De-burial of pipelines using MFE Note 1 - Recover by cutting into sections and removal	Retained as the least onerous and credible Full Removal option.
	2b – Reverse Installation (S-lay) without de-burial	- Lines will be disconnected - No de-burial prior to removal - Recover by reverse s-lay	Screened out due to concerns regarding the lines having the integrity required to perform reverse installation.
	2c – Reverse Installation (S-lay) with de-burial	- Lines will be disconnected - De-burial of line using MFE Note 1 Recover by reverse s-lay	Screened out due to concerns regarding the lines having the integrity required to perform reverse installation.
Leave in-situ (major intervention))	3a – Rock placement over entire line	- Lines will be disconnected - Rock placement over full length of lines to address areas of spans, exposure & shallow burial - No recovery of lines	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify fully rock covering lines already fully buried.

Group 4 – Rigid Pipelines, Trenched and Rock Covered			
Category	**Option**	**Description**	**Discussion**
	3b – Retrench and bury entire line	- Line will be disconnected - Re-trench and backfill full length of lines to remove areas of spans, exposure & shallow burial depth - No recovery of lines - No introduction of new material	Ruled out as a technical showstopper as there are insufficient areas of spans, exposure or shallow burial to justify trenching lines already fully buried.
Leave in-situ (minor intervention)	4a – Rock placement over exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench Note 2 - Rock placement to remediate snag risk from cuts ends - Rock placement at all areas of spans, exposure and shallow burial depth Note 3	Retained as a viable leave in-situ option and should be evaluated.
	4b – Trench & bury exposures	- Lines will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Trench / bury areas of spans, exposure and shallow burial depth Note 3 - Minimal introduction of new material	Ruled out as a technical showstopper due to the challenges associated with trenching rock covered lines.
	4c – Remove exposures	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Removal of areas of spans, exposure and shallow burial depth using cut and lift techniques, including de-burial where required Note 3	Ruled out as a technical showstopper as there are no areas of spans, exposure or shallow burial. As there are no areas to address, this option becomes the same as Option 5.
	4d – Accelerated decomposition	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends - Introduce material / techniques to accelerate the decomposition process - Potential options include reverse polarity CP, Sulphate Reducing Bacteria (SRBs), chemicals, etc.	Ruled out as a technical showstopper as accelerated decomposition not a viable solution for polymer coated rigid lines as polymer coating would remain.
Leave in-situ (minimal intervention)	5 – Remove ends and remediate snag risk	- Line will be disconnected - Removal and recovery of surface laid sections out with existing trench - Rock placement to remediate snag risk from cut ends	As there are no areas of spans, exposure or shallow burial, removing the ends of the line out with the trench presents a leave in-situ option that should be evaluated.
Leave in-situ (do nothing)	6 – Leave as-is	- There will be no planned subsea intervention - Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure	Ruled out as a safety showstopper due to the sections of line out with the trench leaving an unacceptable potential snagging risk.

Table 6-2: Group 4 Decommissioning Options and Screening Summary

Note 1: After Screening, the project team shared historical issues regarding the geotechnical conditions in the area. The seabed conditions of stiff clays are such that de-burial by MFE is unlikely to be successful as experienced during previous

remediation activities in this area. As such, all de-burial operations for retained options were modified to be excavation using bucket excavator rather than using MFE.

Note 2: After Screening, the rock cover option was adjusted to include rock cover of surface laid portions of line ends out with existing trench. This aligns with the approach executed by CNRI during the Murchison decommissioning programme.

Note 3: During the burial status review conducted as part of the Preparation phase, there were no areas of spans or exposure identified for the lines within this group.

6.3 Group 4 Decommissioning Options for Evaluation

The decommissioning options for Group 4 remaining after screening and taken forward to evaluation are:

- Full Removal
  - 2a – Cut and lift with de-burial
- Leave in-situ (minor intervention)
  - 4a – Rock placement over areas of spans, exposures and shallow burial
- Leave in-situ (minimal intervention)
  - 5 – Remove ends & remediate snag risk

6.4 Group 4 Evaluation Summary

Group 4 – Rigid Pipelines, Trenched and Rock Covered	
Note: for full attributes tables and assessment see Appendix E	
Safety	**Option 4a is assessed as being the preferred option from a safety perspective.** Option 4a is preferred from a risk exposure to Operations Personnel perspective. This is due to the shorter durations associated with the offshore scope to rock cover the line ends compared to the other options and there being no offshore lifting associated with the rock cover option. It is also preferred from an onshore risk exposure perspective as there is no material returned for processing. Option 2a is preferred to the other options in the Legacy Risk criterion due to the line being fully removed (albeit with an under crossing remaining). The difference in risk profile between Option 2b and the partial removal options is assessed as minimal as the remaining lines are rock covered or trenched and buried along their entire lengths.
Environment	**Option 5 is assessed as being the preferred option from an environmental perspective.** Option 4a and 5 are equally preferred over Option 2a from an Operational Marine Impact perspective due to the cumulative impact of releases from cutting the lines into short sections for recovery in Option 2a. These releases would have a low environmental impact as the lines will be flushed and cleaned to best endeavours. Option 2a was also less preferred than the other options due to the noise impact associated with the vessels being onsite for extended offshore durations and the Diamond Wire Cutting (DWC) at the crossing locations although, again the noise impact is assessed as being minimal. Option 2a is less preferred than the other options from an Atmospheric Emissions perspective as the fuel use and atmospheric emissions are higher due to the longer duration offshore operations. Option 5 is preferred with respect to Seabed Disturbance as the full removal option results in a large area of moderate seabed disturbance from the excavation and distribution of the existing rock cover over the lines to gain access for cutting. The rock cover option is less preferred due to the introduction of additional rock cover, resulting in permanent habitat change. Option 2a is preferred from a Legacy Marine Impacts perspective as there is limited legacy marine impact as the lines are removed (although an under crossing will remain in-situ). The Legacy Marine Impact from the lines left in-situ, while less preferred to the full removal option, are expected to be minimal as lines are flushed and cleaned to best endeavours and any releases / degradation products will occur over a long time frame and over a wide area.
Technical	**Option 4a and Option 5 are assessed as being equally preferred from a technical perspective.** All options are considered technically feasible as they use largely routine approaches. However, Option 2a was less preferred to the other options due to the challenges associated with excavating the lines (necessary due to geotechnical conditions) to gain access for cutting and challenges in remediating the affected area to allow the area to be over-trawlable. All options were assessed as being equally preferred from an Ease of Recovery from Excursion and Use of Proven Technology and Equipment perspective.
Societal	**All options are assessed as being equally preferred from a societal perspective.** With respect to Societal impact on Fishing, all options are equally preferred as, while the lines are removed in Option 2a, the lines left in-situ are fully trenched and buried. The rock berms (4 off) introduced in Option 4a were considered insufficient to express a preference. The Socio-economic Impacts on Communities and Ammeneties for all options were considered largely balanced as, while there is more useful, recyclable material (steel) returned in the full removal option, there is also the polymer coatings returned which are likely to go to landfill.
Economic	**Option 4a is assessed as being the preferred option from an economic pespective.** From a short-term cost perspective, Option 4a is preferred as it is around half the cost of the next lowest cost option (Option 5). The full removal option is more than eighteen times more expensive. For long-term costs, the legacy costs associated with monitoring, surveying and managing potential snag hazards for all options are similar and equally preferred.
Summary	Option 4a was preferred (or equally preferred) against the Safety, Technical and Societal criteria. It was marginally less preferred against the Environmental criterion, but this was insufficient to offset the preference against the other criteria. Once the Economics criterion was considered, this strengthens the preference for Option 4a. **Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial will form the emerging recommendation for decommissioning Group 4.**

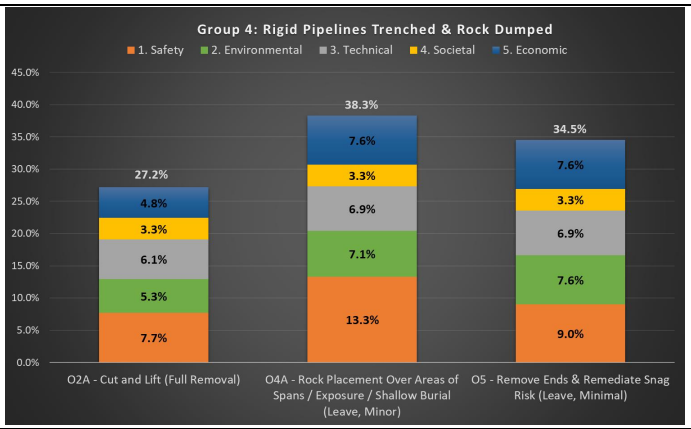


Table 6-3: Group 4 Evaluation Summary

7 GROUP 8 – MOORINGS PILES AND REMAINING CHAIN

7.1 Group 8 Characteristics

The items that make up Group 8 and their key characteristics are listed in Table 7-1.

Description	OD (mm)	Length (m)
8 off 1,830 mm diameter, three lengths (A, B and C) steel mooring piles c/w 10 m of mooring chain (max.) each	1,830	A: 28
		B: 24
		C: 30

Table 7-1: Group 8 Items

7.2 Group 8 Decommissioning Options & Screening Outcome

During the Screening Phase, all potential decommissioning options were assessed against the Safety, Environmental, Technical, Societal and Economic criteria using a coarse, red / amber / green methodology. The assessment performed and the outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 7-2.

Group 8 – FSO Mooring Piles and Remaining Chain			
Category	**Option**	**Description**	**Discussion**
Full removal	2B – Reverse Installation without De-burial	- Dredge around top of pile to provide access for vibro-hammer - Vibro-hammer used to extract pile from seabed - Recover piles to vessel and return to shore for processing	Ruled out as a technical showstopper as the capability of vibro-hammer to extract piles of this size is not proven and a significant over-pull of piles is expected to be necessary. Insufficient technical confidence in this technique to carry it through to evaluation
	2C – Reverse Installation with De-burial	- Fully excavate piles using excavator grab - Recover piles to vessel and return to shore for processing - Back fill excavation with seabed and / or rock	Retained as the most feasible full removal option.
Leave in-situ (major intervention)	3A – Rock cover exposed piles and chains	- Deploy rock over exposed piles and chain locations via a fall pipe vessel	Option ruled out as the infrastructure is not removed with additional rock installed proud of the surrounding seabed.
Leave in-situ (minimal intervention)	5 – Leave in-situ: Remove below seabed	- Dredge out pile internals below seabed - Cut piles below seabed using internal pile cutter to a depth to ensure that any remains are unlikely to become uncovered - Recover pile top section to vessel - Lift, tension and cut remaining chain at the seabed	Retained as a viable leave in-situ option and should be evaluated.
Leave in-situ (minimum intervention)	6 – Leave As-is	- There will be no planned subsea intervention - Appropriate legislative considerations shall be addressed, and any advisory zones implemented for remaining subsea infrastructure - Exposed pile tops and chains will remain unmitigated	Option ruled out as unacceptable from a residual safety perspective.

Table 7-2: Group 4 Decommissioning Options and Screening Summary

7.3 Group 8 Decommissioning Options for Evaluation

The decommissioning options for Group 4 remaining after screening and taken forward to evaluation are:

- Full Removal
  - 2c – Reverse installation with de-burial
- Leave in-situ (minimal intervention)
  - 5 – Leave in-situ: Remove pile below seabed

7.4 Group 8 Evaluation

It should be noted that during the screening phase of the comparative assessment it was clear that performing a full evaluation of Option 2c, where the mooring piles are fully excavated and removed versus Option 5, partial removal below seabed with minimal dredging, using an MCDA approach as per other groups, would not be a justified or efficient use of project resources given the large differences between these options against the majority of criteria. As such, it was deemed appropriate to perform the evaluation using a narrative based method, similar to the approach adopted during screening. This is in keeping with the CA Guidelines, ref. [1] where a lighter approach is acceptable where the assessment and thus the likely outcome is clear.

Group 8 – Mooring Piles and Remaining Chains		
Evaluation	Safety	**Option 5 is assessed as the most preferred option.** The method statements developed for each Option demonstrate that the Option 2C will require approximately 50 days to execute, whereas Option 5 is estimated to require approximately 10 days to execute. Thus, the exposure to personnel is 5 times greater for Option 2C. Given the partial removal of the piles below seabed with Option 5, there is not expected to be any material difference between the Options with regards to residual risk. As such, from a safety perspective, Option 5 is most preferred.
	Environment	**Option 5 is assessed as the most preferred option.** The extent of excavation required to fully de-bury the piles, Option 2C, is unattractive from a seabed disturbance perspective. Approximately 200,000 m3 of soils requires to be excavated and replaced. Whereas, for Option 5 a relatively small quantity of soils will require to be dredged, mostly internally, to facilitate the pile cutting and removal below seabed. In line with current guidance, any piles will be severed below the natural seabed level at such a depth to ensure that any remains are unlikely to become uncovered. CNRI will aim to achieve a cut depth in line with current guidance, however consideration will be given to the prevailing seabed conditions and currents. Any deviation from this Guidance will be discussed and agreed with OPRED. Mooring chains will be removed to shore From an environmental perspective, Option 5 is most preferred.
	Technical	**Option 5 is assessed as the most preferred option.** Both Options involve equipment with good track records. The technical risk associated with Option 2C, full removal and the associated excavation is considerably greater than the partial removal, Option 5. There is a significant risk of Option 2C encountering challenges that prolong the operation compared to Option 5. That said, Option 5 is not without technical risk. It may not be possible to excavate the pile internals sufficiently below seabed to allow for the pile internal cutting tool to reach target depth in all cases. In balance, Option 5 is preferred from a Technical perspective.
	Societal	**Option 2C is assessed as the most preferred option.** The only difference between the Options from a Societal perspective is the quantity of material returned to shore. There is more recyclable material returned to shore with Option 2C. There is not expected to be any land fill requirement with either Option. There is no difference between the Options with regard to commercial fishing operations. From a Societal perspective Option 2C is preferred.
	Economi c	**Option 5 is assessed as the most preferred option.** The Option 2C operation is estimated to cost approximately £ 9.24M versus £ 1.74M for Option 5. Post decommissioning monitoring is assumed to not be required for Option 5. Option 5 is preferred from an economic perspective.
	Sum mary	**Option 5 is assessed as the most preferred option.** In summary, Option 5 is the clear preference. The only criterion where Option 2C is preferred is Societal and that is a relatively marginal preference.

Table 7-3: Group 8 Evaluation Summary

8 RECOMMENDATIONS

The outcomes obtained from performing the comparative assessment of the decommissioning groups and decommissioning options for the Banff & Kyle subsea infrastructure are summarised here.

There were several groups where full removal was the recommended decommissioning approach without any further comparative assessment. These are:

- Group 3 – Flexibles/Umbilicals, Surface Laid
- Group 5 – Spools and Jumpers
- Group 6 – Subsea Installations (Structures)
- Group 7 – Protection / Stabilisation

There was one group where full removal was already completed with remediation of the remaining seabed scour recommended.

- Group 9 – FPSO Moorings and Associated Scour

The full comparative assessment process was applied to the remaining decommissioning groups (1, 2, 4 and 8). The recommended decommissioning options for these groups follow below.

8.1 Group 1 Recommendations

The recommended decommissioning option for Group 1 – Rigid Pipelines, Trenched and Buried is:

- Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial
  - Pipelines will be disconnected
  - Rock placement over surface laid sections of lines out with existing trench
  - Rock placement at all areas of spans and exposure

The following sections provide a summary of the evaluation of the four most viable Group 1 decommissioning options (Option 2c, Option 4a, Option 4c and Option 5) against the five criteria and why this recommendation has been made.

8.1.1 Safety

Option 4a has the lowest risk exposure of all options for operations personnel. This is due to the short offshore durations associated with the scope to rock cover the line ends and limited areas of spans and exposure when compared to the other options, particularly the full removal option which requires the use of divers to support the cutting operations at an under crossing location. It also has the lowest onshore risk exposure as no material is returned for processing. There is also the lowest potential for high consequence events due to there being no offshore lifting associated with this option.

The full removal option was preferred from a legacy risk perspective, however while Option 4a leaves the lines in-situ, they are trenched and rock covered, or surface laid and rock covered over their entire length. Additionally, there is a commitment to survey and monitor the lines to ensure any future snag risk is managed.

Overall, there is a preference for Option 4a from a Safety perspective.

8.1.2 Environment

All partial removal options are marginally preferred to the full removal option from an Operational Marine Impact perspective. This is due to the increased releases from cutting the lines into sections and the greater noise impact from extended vessel operations on-site and the DWC of the lines at crossing locations in the full removal option. It is noted that these impacts are expected to be low, hence the small preference for the other options.

The partial removal options are also marginally preferred to the full removal option from an Atmospheric Emissions, Fuel Use and Other Consumptions perspective due to the increased emissions from the extended offshore scope in the full removal option. Again, the impact is expected to be low hence the small preference for the other options.

From a Seabed Disturbance perspective, the full removal Option was the least preferred due to the large area of significant impact caused by the excavation of the lines prior to removal by cut and lift. This was followed by the rock cover option due to the smaller area of impact, although this is permanent in nature. The remaining options were equally preferred due to the minimal areas of low impact seabed disturbance. It is noted that the only line in this group that is within the East of Gannet & Montrose Marine Protected Area is PL1550 which is a 1.2 km line and only represents a small portion (total group line length around 49km) of the seabed disturbance in all options and is therefore not dominant in the assessment made.

It is recognised that the full removal option is preferred from a legacy environmental impact perspective, however, the legacy impact from the lines remaining in-situ in the other options is expected to be low due to the lines being flushed and cleaned prior to decommissioning and any residual contents or degradation products being released in small quantities over a long time period.

Overall, there is a small preference for Option 4c and Option 5 ahead of Option 4a with Option 2a being least preferred from an Environmental perspective.

8.1.3 Technical

All partial removal options were equally preferred over the full removal option from a Technical Feasibility perspective. While the operations for all options are considered feasible, there are challenges associated with the scale of the excavation required to gain access to the lines for removal by cut and lift. There are also challenges associated with remediating the excavation to return the seabed to an overtrawlable condition due to the geotechnical conditions of stiff clays in this area.

All other technical considerations such as Ease of Recovery from Excursion and Use of Proven Technology were considered similar across all options.

Overall, there is an equal preference for Option 4a, Option 4c and Option 5 over the full removal option from a Technical perspective.

8.1.4 Societal

Option 2a and Option 4c were preferred over Option 4a and Option 5 from a Societal – Fishing perspective due to these presenting a clear seabed as the final decommissioning solution. The rock berms and the remaining spans / exposures in Option 4a and Option 5 respectively being less preferred from a fishing operations perspective.

The assessment against the Socio-economic Impact on Amenities and Communities was largely balanced for all options. The key consideration was the societal benefits of returning the steel for recycling in the full removal option, but this was offset by the polymer coatings of the lines which would be likely to be destined for limited landfill capacity.

Overall Option 2a and Option 4c are preferred from a Societal perspective.

8.1.5 Economic

The preferred option from a Short-term Costs perspective was Option 4a as it is four times lower than the next lowest cost option with the full removal option being more than 40 times more expensive.

All options have some residual surveying and monitoring associated with them with the full removal option having two under crossings that will remain until the 3rd party line is removed. All options were considered equally preferred from a Long-term Costs perspective.

Overall, Option 4a is preferred from an Economic perspective.

8.2 Group 2 Recommendations

The recommended decommissioning option for Group 2 - Flexibles/Umbilicals Trenched and Buried is:

- Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial
  - Pipelines will be disconnected
  - Rock placement over surface laid sections of lines out with existing trench

Note: There are no areas of spans or exposure associated with the lines in Group 2.

The following sections provide a summary of the evaluation of the three most viable Group 2 decommissioning options (Option 2b, Option 4a and Option 5) against the five criteria and why this recommendation has been made.

8.2.1 Safety

Option 4a has the lowest risk exposure of all options for operations personnel. This is due to the short offshore durations associated with the scope to rock cover the line ends when compared to the other options, particularly the full removal option which requires the use of divers to support the cutting operations at the under crossing locations (2 off). It also has the lowest onshore risk exposure as no material is returned for processing. There is also the lowest potential for high consequence events due to there being no offshore lifting associated with this option.

The full removal option was preferred from a legacy risk perspective, however, while Option 4a leaves the lines in-situ, they are trenched and buried, or surface laid and rock covered over their entire length. Additionally, there is a commitment to survey and monitor the lines to ensure any future snag risk is managed.

Overall, there is a preference for Option 4a from a Safety perspective.

8.2.2 Environment

All partial removal options are marginally preferred to the full removal option from an Operational Marine Impact perspective. This is due to the increased releases from cutting the lines into sections, particularly from the blocked cores containing small quantities of Wax, Scale and Corrosion Inhibitor, and the greater noise impact from extended vessel operations on-site and the DWC of the lines at crossing locations in the full removal option. It is noted that these impacts are expected to be low, hence the small preference for the other options.

All options are equally preferred from an Atmospheric Emissions, Fuel Use and Other Consumptions as, while there are differences in the fuel use and emissions across the options, these differences were considered insufficient to express a preference.

From a Seabed Disturbance perspective, Option 4a was least preferred due to the area of permanent habitat change from the rock cover over the line ends. Option 2b was next, with the large area of seabed impact being considered short-term and temporary in nature as it is caused by reverse reeling these lines through the existing cover. The preferred option was Option 5 where recovering the line ends only, had the lowest impact on the seabed.

It is recognised that the full removal option is preferred from a legacy environmental impact perspective, however, the legacy impact from the lines remaining in-situ in the other options is expected to be low due to the lines being flushed and cleaned prior to decommissioning and any residual contents or degradation products being released over a long time period. It is noted that the blocked cores result in small residual quantities of Wax, Scale and Corrosion Inhibitor, however the legacy environmental impact of these remain low.

Overall, there is a small preference for Option 5 ahead of Option 2b with Option 4a being least preferred from an Environmental perspective.

8.2.3 Technical

All options employ largely routine operations and were considered equally preferred from a Technical Feasibility and Use of Proven Technology perspective.

When considering the Ease of Recovery from Excursion criterion, it was recognised that there would be challenges associated with locating and reconnecting to the line end in the full removal by reverse reeling option after an unplanned excursion.

Overall, there is an equal preference for Option 4a and Option 5 over the full removal option from a Technical perspective.

8.2.4 Societal

Option 2b was preferred over Option 4a and Option 5 from a Societal – Fishing perspective due it presenting a clear seabed as the final decommissioning solution. Option 5 was preferred over Option 4a due to the rock berms introduced over the line ends in Option 4a.

The assessment against the Socio-economic Impact on Amenities and Communities was largely balanced for all options. The key consideration was the societal benefits of returning the steel and copper for recycling in the full removal option but this was offset by the polymer coatings / packers of the lines which would be likely to be destined for limited landfill capacity.

Overall Option 2b is preferred from a Societal perspective.

8.2.5 Economic

The preferred option from a Short-term Costs perspective was Option 4a as it is less than half the cost of the next lowest cost option with the full removal option being more than seven times more expensive.

All options have some residual surveying and monitoring associated with them, with the full removal option having under crossings (2 off) that will remain until the 3rd party line is removed. All options were considered equally preferred from a Long-term Costs perspective.

Overall, Option 4a is preferred from an Economic perspective.

8.3 Group 4 Recommendations

The recommended decommissioning option for Group 4 - Rigid Pipelines, Trenched and Rock Covered is:

- Option 4a – Rock Placement Over Areas of Spans / Exposure / Shallow Burial
  - Pipelines will be disconnected
  - Rock placement over surface laid sections of lines out with existing trench

Note: There are no areas of spans or exposure associated with the lines in Group 4.

The following sections provide a summary of the evaluation of the three most viable Group 4 decommissioning options (Option 2a, Option 4a and Option 5) against the five criteria and why this recommendation has been made.

8.3.1 Safety

Option 4a has the lowest risk exposure of all options for operations personnel. This is due to the short offshore durations associated with the scope to rock cover the line ends when compared to the other options, particularly the full removal option which requires the use of divers to support the cutting operations at an under crossing location. It also has the lowest onshore risk exposure as no material is returned for processing. There is also the lowest potential for high consequence events due to there being no offshore lifting associated with this option.

The full removal option was preferred from a legacy risk perspective, however while Option 4a leaves the lines in-situ, they are trenched and rock covered, or surface laid and rock covered over their entire length. Additionally, there is a commitment to survey and monitor the lines to ensure any future snag risk is managed.

Overall, there is a preference for Option 4a from a Safety perspective.

8.3.2 Environment

All partial removal options are marginally preferred to the full removal option from an Operational Marine Impact perspective. This is due to the increased releases from cutting the lines into sections and the greater noise impact from extended vessel operations on-site and the DWC of the lines at crossing locations in the full removal option. It is noted that these impacts are expected to be low, hence the small preference for the other options.

The partial removal options are also marginally preferred to the full removal option from an Atmospheric Emissions, Fuel Use and Other Consumptions perspective due to the increased emissions from the extended offshore scope in the full removal option. Again, the impact is expected to be low hence the small preference for the other options.

From a Seabed Disturbance perspective, the full removal Option was the least preferred due to the large area of significant impact caused by the excavation and distribution of the existing rock cover over the lines prior to removal by cut and lift. This was followed by the rock cover option due to the smaller area of impact, although this is permanent in nature. The remaining option of recovering the line ends only was preferred due to the minimal area of low impact seabed disturbance.

It is recognised that the full removal option is preferred from a legacy environmental impact perspective, however, the legacy impact from the lines remaining in-situ in the other options is expected to be low due to the lines being flushed and cleaned prior to decommissioning and any residual contents or degradation products being released over a long time period.

Overall, there is a small preference for Option 5 ahead of Option 4a with Option 2a being least preferred from an Environmental perspective.

8.3.3 Technical

All partial removal options were equally preferred over the full removal option from a Technical Feasibility perspective. While the operations for all options are considered feasible, there are challenges associated with

the scale of the excavation required to gain access to the lines for removal by cut and lift. There are also challenges associated with remediating the excavation to return the seabed to an overtrawlable condition as the trenches are back filled with rock which would be dispersed following excavation.

All other technical considerations such as Ease of Recovery from Excursion and Use of Proven Technology were considered similar across all options.

Overall, there is an equal preference for Option 4a and Option 5 over the full removal option from a Technical perspective.

8.3.4 Societal

All options were equally preferred from a Societal – Fishing perspective as, while Option 2a and Option 5 both present a clear seabed as the final decommissioning solution, the introduction of four small rock berms in Option 4a was considered insufficient to express a preference for the other options.

The assessment against the Socio-economic Impact on Amenities and Communities was largely balanced for all options. The key consideration was the societal benefits of returning the steel for recycling in the full removal option, but this was offset by the polymer coatings of the lines which would be likely to be destined for limited landfill capacity.

Overall, all options are equally preferred from a Societal perspective.

8.3.5 Economic

Option 4a and Option 5 are equally preferred option from a Short-term Costs perspective as, while Option 5 is double the cost of Option 4a, the low cost of both options resulted in both options being equally preferred. The full removal option is more than 18 times more expensive than Option 4a.

All options have some residual surveying and monitoring associated with them with the full removal option having two over crossings remaining until the 3rd party line is removed. All options were considered equally preferred from a Long-term Costs perspective.

Overall, Option 4a is preferred from an Economic perspective.

8.4 Group 8 Recommendations

The recommended decommissioning option for Group 8 – FSO Mooring Piles and Remaining Chain is:

- Option 5 – Partial Removal of the Piles
  - Dredge piles internally;
  - Install internal pile cutting tools and cut piles to a depth to ensure that any remains are unlikely to become uncovered;
  - Recover upper section of piles to surface and replace dredged soils into remaining holes.

The following sections provide a summary of the evaluation of the two most viable Group 8 decommissioning options (Option 2C and Option 5) against the five criteria and why this recommendation has been made.

8.4.1 Safety

Option 5 has the lowest risk exposure of the options for operations personnel. This is due to the shorter offshore durations associated with the scope to partially remove the piles to a depth to ensure that any remains are unlikely to become uncovered, versus the full removal option which requires a considerable amount of excavation to access the full length of each pile. It also has the lowest onshore risk exposure as less material is returned for processing. There is also the lowest potential for high consequence events as there is less weight to recover from each pile with this option.

There is no difference between the options from a legacy risk perspective.

Overall, there is a preference for Option 5 from a Safety perspective.

8.4.2 Environment

From both vessel duration on site and seabed disturbance perspectives the full removal case is considerably less favourable to the partial removal case. The quantity of excavation required to fully de-bury the piles is calculated as approximately 200,000 m^3 and this equates to approximately 10,000 m^2 of seabed disturbance. As the piles are located within the East of Gannet & Montrose MPA this amount of disturbance would be significantly less preferred.

The duration on site to conduct the full removal is estimated as at least three times as long as the partial removal option, resulting in three times as much fuel use, vessel discharges and gaseous emissions.

Overall, the preference for Option 5 is clear.

8.4.3 Technical

The difference between full removal and partial removal options from a technical perspective comes down to the overall complexity of the tasks. Both options involve equipment with comparable track records. The technical risk associated with Option 2C, full removal and the associated excavation is considerably greater than the partial removal, Option 5 as there is a significant risk of Option 2C encountering challenges that prolong the operation compared to Option 5. The technical risk associated with Option 5 is associated with the ability to excavate the pile internals sufficiently below seabed to allow for the pile internal cutting tool to reach a depth at which the piles will not become exposed. If this was not achievable the alternative would be to externally excavate the pile and cut externally.

On balance, Option 5 is preferred from a Technical perspective.

8.4.4 Societal

Both options were equally preferred from a fishing perspective, both should result in a clear seabed following remediation.

The only difference between the options from a societal perspective is the quantity of material returned to shore. There is more recyclable material returned to shore with Option 2C. There is not expected to be any land fill requirement with either option as the piles are steel.

From a Societal perspective there is a slight preference for Option 2C.

8.4.5 Economic

From a short term cost perspective, Option 5 is preferred over Option 2C as it represents a fifth of the cost.

Long term costs are associated with post decommissioning monitoring and remediation. There is not expected to be a requirement for post decommissioning monitoring with the partial removal option as the target depth of cut, 3.0 m below seabed, is in line with no requirement for monitoring of other pile / well conductor removed to 3.0 below seabed. Should it be found that post decommissioning monitoring is required for a period, it would not cost enough to overturn the preference for Option 5, partial removal.

Option 5 is preferred from an economic perspective.

APPENDIX A EVALUATION METHODOLOGY

Appendix A.1 CA Evaluation Methodology

CNRI has selected a Multi Criteria Decision Analysis (MCDA) methodology for the evaluation phase of the CA. This methodology uses a pairwise comparison system based on the methodologies of the Analytical Hierarchy Process (AHP) by T.L. Saaty, described in various publications, such as Analytical Hierarchy Process ref. [5]. This allows the relative importance of each differentiating criteria to be judged against each other in a qualitative way, supported by quantification where appropriate. The key steps for the evaluation phase of the CA are as follows:

- Define Differentiating Criteria – this was completed in Q3 2020 and listed in Appendix A.2
- Define Options – completed as part of CA Screening;
- Pre-populate worksheets for internal CA workshops – based on all the studies undertaken the worksheets were pre-populated in advance of the internal CA workshops;
- Perform internal CA workshop;
- Discuss attributes of each option against each differentiating criteria – the discussion was recorded 'live' during the workshop in order that informed opinion and experience was factored into the decision-making process;
- Perform scoring (see Section Appendix A.5);
- Perform sensitivity analyses to test the decision outcomes;
- Export worksheets as a formal record of the workshop attendees' combined opinion on the current preferred options, the 'Emerging Recommendations';
- Evaluate whether the CA needs to 'recycle' to the Preparation phase to obtain any further information to help inform decision making;
- Discuss Emerging Recommendations with stakeholders (November 2020); and
- Recycle process as required prior to decision on the selected options which will be presented in the Decommissioning Programme and assessed in the Environmental Impact Assessment.

The sections below describe how the MCDA methodology has been applied.

Appendix A.2 Differentiating Criteria & Approach to Assessment

A key step in setting up the CA was agreeing and defining the appropriate criteria that differentiates between each of the tabled options. As a starting point, the criteria considered for this CA were taken from the BEIS Guidelines for Decommissioning of Offshore Oil and Gas Installations and Pipelines [2] which are as follows:

- Safety
- Environmental
- Economic
- Technical
- Societal

These differentiating criteria were found to be appropriate for the decommissioning options tabled and were taken forward as the primary differentiating criteria for the CA. Additional sub-criteria and definitions were added for clarity and are shown in Figure 8.1.

Criteria	Sub-Criteria	Description	Approach to Assessment
1. Safety	1.1 Operations Personnel	This sub-criterion considers elements that impact risk to offshore personnel and includes, project teams, project vessel crews, diving teams, and survey vessel crews. This sub-criterion also considers elements that impact risk to onshore personnel and includes, dismantling, recycling or disposal operations, material transfer, and onshore handling. Any requirement for handling HazMat / NORM shall also be addressed here. This sub-criterion also includes any inherent potential for high consequence events i.e. major accident hazard type events. It applies to all onshore and offshore personnel involved in the project. Considerations such as lifting operations, dropped object, operational vessel collision risks and back of deck working may be considered.	Quantitative data is used to compare the decommissioning options against this criterion. Potential for Loss of Life (PLL) metrics are calculated based on the Fatal Accident Rate (FAR) x Hours of Exposure for each of the worker groups and is considered a suitable metric for Comparative Assessment purposes. The FAR is taken from the summary report of the Joint Industry Project investigating the Risk Analysis into Decommissioning Activities issued by Safetec [4]. The Hours of Exposure is taken from the various studies / method statements developed to define the decommissioning options. A narrative of the potential for High Consequence Events is provided to allow a qualitative comparison.
	1.2 Legacy Risk	This sub-criterion addresses residual safety risk to other sea users i.e. fishermen, military vessel crews, commercial vessel crews and passengers, other sea users, that is provided by the option. Issues such as residual snag risk, collision risk, etc. may be considered. Legacy safety impact from survey and monitoring activities also considered.	Informed by expert judgment upon the understanding of the operations associated with the decommissioning options. Legacy risk informed by an assessment of the fishing operations conducted in the area of interest and the knowledge of the burial status of the lines being assessed. Survey & monitoring impact uses calculated PLLs as per 1.1.

Criteria	Sub-Criteria	Description	Approach to Assessment
2. Environmental	2.1 Operational Marine Impact	This sub-criterion addresses the marine environmental impact caused by performing the decommissioning option. Covers both planned impacts (inherent to the option being assessed) and potential unplanned impacts (accidental releases, both large and small in scale and encompassing Major Environmental Incidents (MEIs)). Impacts may be from Project Vessels, Supply Boats, Survey vessels, etc. Examples include; Noise generated by vessels, cutting operations, any explosives, etc., discharges from vessels and from removing infrastructure such as residual pipeline contents.	Planned and unplanned marine impacts are narrative judgement informed by estimates of volumes / composition of any releases. Impacts from vessels are qualitative in nature. Marine noise impact is a qualitative judgement informed by the vessel durations, subsea cutting operations and other operations that generate marine noise.
	2.2 Atmospheric Emissions & Fuel Consumption	This sub-criterion addresses the atmospheric emissions, fuel consumption and energy consumption from performing the decommissioning option. This may be from Project Vessels, Survey vessels, etc. Impacts may be greenhouse gas emissions such as CO_2, NO_x, SO_2, etc. Fuel and energy consumption are included and are tightly correlated to atmospheric emissions. Energy / emissions / resource consumption required to replace materials not recovered for re-use or recycling is also covered.	Fuel use, emissions and energy consumption are calculated for vessel operations using IP 2000 ref. [7] factors for decommissioning of offshore structures. Emissions and energy associated with recycling of recovered materials and replacement of material left in situ are also calculated [7]. Fuel use, and emissions are provided in metric tonnes. Energy is provided in joules.
	2.3 Seabed Disturbance	This sub-criterion addresses the direct and indirect seabed disturbance caused by performing the decommissioning option. Impacts that are both permanent and temporary in nature are considered. The level of impact caused and any specific seabed concerns, such as protected areas or habitat changes may be covered.	Assessment based on quantifying the area of disturbance and by type of disturbance (dredging, rock dump, trenching, backfilling, mass flow excavation) in combination with an understanding of the baseline environment in the area as shown by the outputs from the environmental surveys.
	2.4 Legacy Marine Impacts	This sub-criterion addresses the marine environmental impact caused after the decommissioning option has been performed. Covers the long-term impact of any infrastructure left in-situ such as release of materials into the marine environment, environmental impact from legacy monitoring and remediation i.e. planned and unplanned releases from vessels, vessel noise, etc. also considered.	Planned and unplanned marine impacts are narrative judgements informed by estimates of volumes / composition of any releases and the duration these may occur over. Impacts from vessels are qualitative in nature.

Criteria	Sub-Criteria	Description	Approach to Assessment
3. Technical	3.1 Technical Feasibility	This sub-criterion relates to the technical feasibility of delivering the various decommissioning options. Considers potential of failure to deliver the decommissioning option broadly within the timescale / budget / endorsed decommissioning programme. Inherent technical challenges also considered.	For all three criteria, assessment is based on definition of the decommissioning option provided in the method statements. Qualitative judgement is provided in areas of feasibility / technical failure / technical challenges / ease of recovery / novelty / track record. Scored 1 – 6 with 1 being most technically feasible and 6 least technically feasible.
	3.2 Ease of Recovery from Excursion	This sub-criterion addresses the inherent ability for the decommissioning option to recover from any unplanned excursions and complete the option as planned. Consequence of failure to deliver the decommissioning option as planned also considered.	
	3.3 Use of Proven Technology and Equipment	This sub-criterion relates to the technical risk associated with any novel equipment, operations or techniques that are inherent to the decommissioning option. Considers Technical Novelty / Track Record / Availability of novel equipment / technology.	

Criteria	Sub-Criteria	Description	Approach to Assessment
4. Societal	4.1 Fishing	This sub-criterion addresses the impact of the option on commercial fishing operations. Type and intensity of fishing operations factored into assessment. It includes consideration of impacts from both the decommissioning activities any residual impacts post decommissioning such as reinstatement of access to area. It addresses commercial impacts as safety impacts are addressed in criteria 1.2.	A qualitative judgement that provides a narrative (rather than quantification) regarding the positive and negative impacts of the decommissioning option on commercial fishing operations. Area of impact in m^2 may be included. Scored 1 – 6 with 1 being least impactful and 6 most impactful.
	4.2 Socio-economic Impacts on Amenities and Communities	This sub-criterion addresses any positive or negative socio-economic impacts on other users, where the impact may be from dismantling, transporting, treating, recycling and land filling activities relating to the decommissioning option. Additionally, Issues such as impact on the health, well-being, standard of living, structure or coherence of communities or amenities are considered here e.g. business or jobs creation, increase in noise, dust or odour pollution during the decommissioning option which has a negative impact on communities, increased traffic disruption due to extra-large transport loads, etc.	Assessment of impact on other users is a qualitative narrative considering both positive and negative impacts of the decommissioning option on waste paths, recycling, employment and general community impacts. Tonnage and types of material returned may be included. Scored 1 – 6 with 1 being least impactful and 6 most impactful.
5. Economic	5.1 Short-term Costs	This sub-criterion addresses the cost of delivering the option as described. No long-term cost element is considered here.	Cost data (£ k)
	5.2 Long-term Costs	This sub-criterion addresses the costs associated with any long-term liabilities such as on-going monitoring and any potential future remediation costs.	Cost data (£ k)

Table 8-1: Sub-criteria Definition

Appendix A.3 Differentiator Weighting

The 5 differentiating criteria and associated sub-criteria carry the following weights which reflects CNRIs position to prioritise Safety considerations:

- 1 Safety [30%]
  - 1.1 Operations Personnel (incl. HCEs) [15%]
  - 1.2 Legacy [15%]
- 2 Environment [20%]
  - 2.1 Operational Marine Impact [4%]
  - 2.2 Emissions / Fuel / Energy / Other Cons. [8%]
  - 2.3 Seabed (incl. Ops and Legacy) [4%]
  - 2.5 Legacy Marine Impact [4%]
- 3 Technical [20%]
  - 3.1 Technical Feasibility [6.66%]
  - 3.2 Ease of Recovery from Excursion [6.66%]
  - 3.3 Use of Proven Technology [6.66%]
- 4 Societal [10%]
  - 4.1 Fishing Industry [5%]
  - 4.2 Socio-economic Impacts [5%]
- 5 Economics [20%]
  - 5.1 Short-term Costs [10%]
  - 5.2 Long-term Costs [10%]

Appendix A.4 Option Attributes

The next step in the CA process was to describe and discuss the attributes of each option with respect to each of the differentiating criteria. In preparation, all relevant data and information developed during the preparation phase were pre-populated into the attributes table for each option. Appendix C, Appendix D and Appendix E contain the completed Attributes Tables for Groups 1, 2 and 4 respectively.

Any additional discussion around the relative merits of the options was also recorded in the attributes matrix. A summary discussion of why options are considered more or less attractive with respect to each of the differentiating criteria was also recorded. An easy-to-read version of this matrix was supplied to stakeholders as part of the recommendation review process.

Appendix A.5 Option Pair-Wise Comparison

Once the option attributes were compiled and discussed, a pair-wise comparison was performed for each of the differentiating criteria where the proposed options were compared against each other. The pairwise comparison adopted in this case used phrases such as stronger, much stronger, weaker, much weaker, etc. to make qualitative judgements (often based on quantitative data) of the options against each other. Adopting these phrases rather than the more common numerical 'importance scale' from the Analytical Hierarchy Process (AHP) is often more intuitive and representative of the sentiment of a workshop.

One of the challenges of applying the numerical importance scale historically, is that often when scoring a pair of options against each other as a score of 3, delegates implied the comparison was 3 times better, etc. rather than 'slightly better' as the importance scale suggests.

To manage this, CNRI chose to apply the principles of the AHP by replacing numbers in the pairwise comparison matrix with a narrative or descriptive approach. This is already programmed into the AHP in the

importance scale explanations (see Table 8-2). It was agreed that three positions from equal (and their reciprocals) would be sufficient for this CA. These positions were:

Title	Scope	Relative Preference Ratio
Neutral	Equal Importance, equivalent to 1 in the AHP importance scale.	50 / 50
Stronger (S) / Weaker (W)	Moderate importance of one criteria / option over the other, equivalent to 1.5 in the AHP importance scale.	60 / 40
Much Stronger (MS) / Much Weaker (MW)	Essential / strong importance of one criteria / option over the other equivalent to 5 or 6 in the AHP importance scale.	75 / 25
Very Much Stronger (VMS) / Very Much Weaker (VMW)	Extreme importance of one criteria / option over the other equivalent to 8 or 9 in the AHP importance scale.	90 / 10

Table 8-2: Explanation of Phrasing Adopted for Pairwise Comparison

It should be noted that the relative preference ratios depicted above relate to a two option example. Where there are more than two options being compared, the relative preference ratios varying according to the preferences selected but will always be a share of the 100% available for that judgement. For the relative preferences derived for each option within each group against each criterion, see the pairwise matrices in Appendix C, Appendix D, and Appendix E.

Using this transposed scoring system made it simpler and, more importantly, more effective at capturing the mind-set and feeling of the attendees at the workshops. Phrases such as 'what are the relative merits of pipeline removal on a project versus rock dumping from a safety perspective? Are these Neutral to each other? Are they stronger? If so, how much stronger? If you had to prioritise one over the other, which would it be?' This promoted a collaborative dynamic in the workshop and enabled the collective mind-set of the attendees to be captured. Where there was quantitative data to provide back-up and evidence to support the collective assertions, so much the better.

A summary example of the completed pair-wise comparisons for differentiating criteria versus options are shown in Figure 8.1.

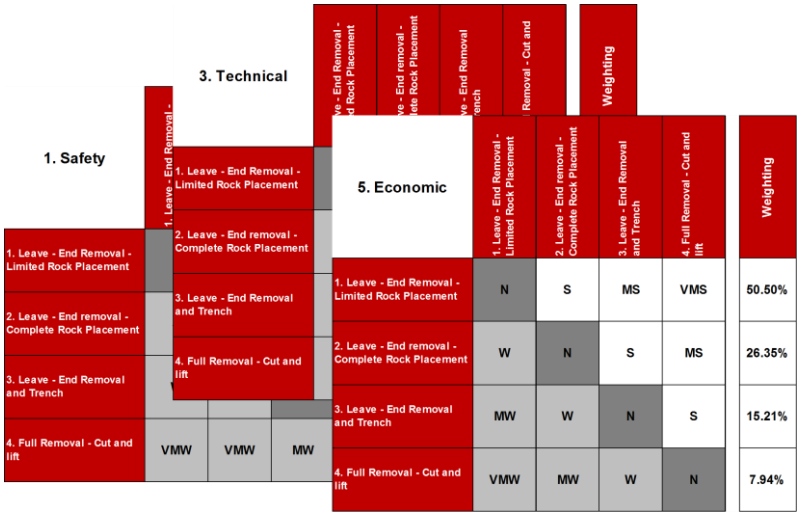


Figure 8.1: Example Option Pair-Wise Comparison

Appendix A.6 Visual Output and Sensitivities

The decision-making tool used the above pairwise comparisons to automatically generate a visual output indicating the highest scoring option i.e. the option which represents the most 'successful' solution in terms of its overall contribution to the set of differentiating criteria. At this stage, opportunity was provided to fine tune the judgements provided, to ensure that all attendees were happy to endorse the outcome. The visual outputs from each decision point are included in Appendix C, Appendix D and Appendix E. An example of the visual output obtained is shown in Figure 8.2.

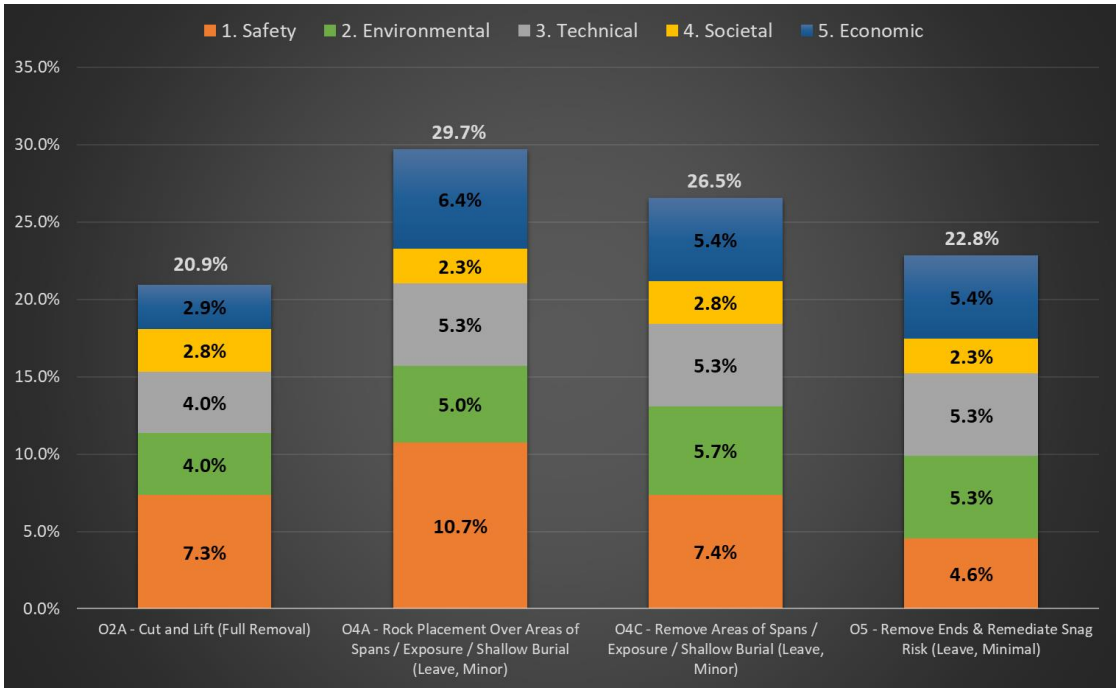


Figure 8.2: CA Visual Output Example

The CA output can then easily be stress tested by the workshop attendees by undertaking a sensitivity analysis:

> By applying a modification to the weighting of the criteria – bearing in mind that the base case for this assessment is to have all criteria equally weighted, and / or

> Modifying the pair-wise comparison of the options against each other within the criteria where appropriate.

These sensitivities will help inform workshop attendees as to whether a particular aspect is driving a preferred option, or indeed if the preferred option remains the same when the sensitivities are applied.

APPENDIX B STAKEHOLDER CA WORKSHOP MINUTES

Banff & Kyle Decommissioning CA Stakeholder Engagement

Location: Video Conference

Date: 17th November 2020

Reference: A-400315-S00-MINS-001

Minuted by: Xodus

Issued on: 1st December 2020

Approached for Invitation:

Organisation
The Department for Business, Energy and Industrial Strategy (BEIS) – Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)
The Department for Business, Energy and Industrial Strategy (BEIS) – Environmental Management Team (EMT)
Health and Safety Executive (HSE)
Scottish Fishermen's Federation (SFF)
National Federation of Fishermen's Organisations (NFFO)
Joint Nature Conservation Committee (JNCC)
Dana Petroleum
Premier Oil

Attending:

Name	Organisation
Claire Thomson	BEIS OPRED ODU
Helen McArthur	
Stewart Welsh	
Julie Cook	BEIS OPRED EMT
Steven Alexander	SFF
Andrew Third	
Bill Chilton	HSE
Stephanie Enz	
Kerry Langworthy	CNR International
David Hennessy	
Stephen Brown	
Jonathan Hoare	
Peter Ronnie	
Roy Aspden	
Kirsty Lal	

Name	Organisation
Isabelle Pouncey	CNR International
Sarah Gill	
Tom Griffiths	Teekay
Kenny Ironside	
Pieter voor de Poorte	Premier Oil
Paul Newby	
Anne Milne	Dana Petroleum
Deborah Morgan	Xodus
John Foreman	
Nic Duncan	

Distribution: Attendees and Invitees

Item	Issue	Action
1.0	**Introduction & Presentation**	
1.1	The workshop was introduced by CNRI followed by a brief overview of the field history, environmental baseline and relevant infrastructure under consideration. Banff Field > Banff FPSO has left the field and is currently located at Loch Kishorn. > Banff pipelines and umbilicals have been flushed and cleaned Note 1. > Banff subsea wells are shut in and positively isolated. > CATS V5 structure is positively isolated from the gas export pipeline (PL1549). Kyle > Kyle pipelines and umbilicals have been flushed and cleaned Note 1. > Kyle subsea wells are shut in and positively isolated. Note 1 PL1661 (Kyle) and PLU1552 / PLU1553 / PLU1554 have blocked cores that were not able to be flushed.	Info
2.0	**Environmental Baseline**	
2.1	The environmental baseline and relevant impacts were described by Xodus Group. Disturbance to the Seabed and Physical Presence being retained with all other impacts scoped out. It was also noted that the soils across the site are muddy with clay deposits and minimal seabed mobility.	Info

Item	Issue	Action
3.0	**Comparative Assessment Methodology and Status**	
3.1	A synopsis of the CA process conducted to date was provided by Xodus including a summary of the pipeline status assessment conducted.	Info
3.2	CNRI provided an overview of the method statements developed to generate data for the evaluation phase.	Info
3.3	An explanation the operation of the evaluation process to be conducted was provided by Xodus along with a breakdown of the criteria / sub-criteria and associated weightings by CNRI. These weightings are as have been used on the previous three successful decommissioning projects executed by CNRI. For reference a copy of the presentation slides are appended to these minutes.	Info
4.0	**Group 1: Rigid Pipelines Trenched & Buried – Evaluation**	
4.1	Group 1 includes the following infrastructure: > PL1546, P2 10" Banff Oil Production, 1,546 m > PL1547, P1 10" Banff Oil Production, 1,546 m > PL1548, 10" Water Injection, 1,715 m > PL2388, 4" Gas Lift Pipeline, 3,289 m > PL1550, 12" Banff Oil Export, 1,248 m > PL1798, 12" Curlew Production Pipeline, 17,383 m > PL1660, Kyle 8" Production Pipeline, 12,023 m > PL1797, 8" Production Pipeline, 3,291 m Total length of this group is 42,041 m. There were 23 instances on exposures and spans identified, totalling 345m. None of the spans were FishSafe reportable spans.	Info
4.2	Four options were evaluated for this scope: > Option 2a – Cut and Lift with De-Burial > Option 4a – Rock Placement over Ends / Exposures > Option 4c – Remove Exposures > Option 5 – Remove Ends and Remediate Snag Hazards	Info
4.3	**1.0 Safety**	
4.3.1	1.1 Operational Personnel – no change to evaluated scores.	Info
4.3.2	1.2 Legacy Risk – no change to evaluated scores.	Info
4.4	**2.0 Environmental**	
4.4.1	2.1 Operational Marine Impact – no change to evaluated scores.	Info

Item	Issue	Action
4.4.2	2.2 Atmospheric Emissions, Fuel and Energy Consumption – no change to evaluated scores.	Info
4.4.3	2.3 Seabed Disturbance – no change to evaluated scores.	Info
4.4.4	2.4 Legacy Marine Impacts – no change to evaluated scores.	Info
4.5	**3.0 Technical**	
4.5.1	3.1 Technical Feasibility – no change to evaluated scores.	Info
4.5.2	3.2 Ease of Recovery from Excursion – no change to evaluated scores.	Info
4.5.3	3.3 Use of Proven Technology and Equipment – no change to evaluated scores.	Info
4.6	**4.0 Societal**	
4.6.1	4.1 Fishing – no change to evaluated scores.	Info
4.6.2	4.2 Socio-Economic – no change to evaluated scores.	Info
4.7	**5.0 Economic**	
4.7.1	5.1 Short Term Cost – no change to evaluated scores.	Info
4.7.1	5.2 Long Term Cost – no change to evaluated scores.	Info
4.8	**Results:** Option 4A was determined to be the preferred option. There were no challenges made against any of the previously evaluated scores. A query was made regarding whether the creation of additional hard substrate could be at all beneficial. OPRED advised that JNCC would likely clarify that the addition of hard substrate would not be beneficial, and that general preference is to minimise the use of rock. The HSE noted that preference would be to avoid or at least minimise the application of manned diving techniques, however these operations are minimised in this case.	Info

Item	Issue	Action
5.0	**Group 2: Flexible Flowlines & Umbilicals Trenched & Buried – Evaluation**	
5.1	Group 2 includes the following infrastructure: > PL2052, 6" Banff Gas Lift/ Injection, 1,800 m > PLU1552, PLU1553, PLU1554.1 –7, Banff Chemical Injection System, Controls and Chemical Umbilical, 1,990 m > PLU3117, Kyle ECI Umbilical (Electrical/ Chemical), 12,292 m > PL1800, Curlew Control Umbilical, 17,550 m > PL1799.1 –19, Main Kyle Umbilical, 3,607 m > PL1661.1 –22, EHC Umbilical, 11,926 m Total length of this group is 49,165 m. There were no instances on exposures and spans identified.	Info
5.2	Three options were evaluated for this scope: > Option 2b – Reverse Reel without De-Burial > Option 4a – Rock Placement over Ends / Exposures > Option 5 – Remove Ends and Remediate Snag Hazards	Info
5.3	**1.0 Safety**	
5.3.1	1.1 Operational Personnel – no change to evaluated scores.	Info
5.3.2	1.2 Legacy Risk – no change to evaluated scores.	Info
5.4	**2.0 Environmental**	
5.4.1	2.1 Operational Marine Impact – no change to evaluated scores.	Info
5.4.2	2.2 Atmospheric Emissions, Fuel and Energy Consumption – no change to evaluated scores.	Info
5.4.3	2.3 Seabed Disturbance – no change to evaluated scores.	Info
5.4.4	2.4 Legacy Marine Impacts – no change to evaluated scores.	Info
5.5	**3.0 Technical**	
5.5.1	3.1 Technical Feasibility – no change to evaluated scores.	Info
5.5.2	3.2 Ease of Recovery from Excursion – no change to evaluated scores.	Info
5.5.3	3.3 Use of Proven Technology and Equipment – no change to evaluated scores.	Info
5.6	**4.0 Societal**	
5.6.1	4.1 Fishing – no change to evaluated scores.	Info

Item	Issue	Action
5.6.2	4.2 Socio-Economic – no change to evaluated scores.	Info
5.7	**5.0 Economic**	
5.7.1	5.1 Short Term Cost – no change to evaluated scores.	Info
5.7.2	5.2 Long Term Cost – no change to evaluated scores.	Info
5.8	**Results:** Option 4A was determined to be the preferred option, although with quite a tight margin. OPRED raised a query as to whether criteria weightings were factored in to the results presented. This was confirmed by demonstration, reduction of applied weighting. It was noted that even a slight difference between resultant scores demonstrate a preference. CNRI noted that they had relevant experience with flexible removal from the Murchison decommissioning project and advised that such a close result shall be scrutinised in more detail.	Info
6.0	**Group 4: Rigid Pipelines Trenched & Rock Covered – Evaluation**	
6.1	Group 4 includes the following infrastructure: > PL2387, 4" Gas Lift Pipeline, 10,252 m > PL1549, 6" Banff Gas Export, 6,268 m Total length of this group is 16,520 m. There were no instances on exposures and spans identified.	Info
6.2	Three options were evaluated for this scope: > Option 2a – Cut and Lift with De-Burial > Option 4a – Rock Placement over Ends / Exposures > Option 5 – Remove Ends and Remediate Snag Hazards	Info
6.3	**1.0 Safety**	
6.3.1	1.1 Operational Personnel – a challenge was made to the initial score for Option 2a versus Option 4a as it was inconsistent with the same comparison in Group 1. Much Weaker (MW) was changed to Very Much Weaker (VMW). This was accepted by the participants.	Info
6.3.2	1.2 Legacy Risk – no change to evaluated scores.	Info
6.4	**2.0 Environmental**	
6.4.1	2.1 Operational Marine Impact – no change to evaluated scores.	Info

Item	Issue	Action
6.4.2	2.2 Atmospheric Emissions, Fuel and Energy Consumption – no change to evaluated scores.	Info
6.4.3	2.3 Seabed Disturbance – no change to evaluated scores.	Info
6.4.4	2.4 Legacy Marine Impacts – no change to evaluated scores.	Info
6.5	**3.0 Technical**	
6.5.1	3.1 Technical Feasibility – no change to evaluated scores.	Info
6.5.2	3.2 Ease of Recovery from Excursion – no change to evaluated scores.	Info
6.5.3	3.3 Use of Proven Technology and Equipment – no change to evaluated scores.	Info
6.6	**4.0 Societal**	
6.6.1	4.1 Fishing – no change to evaluated scores.	Info
6.6.2	4.2 Socio-Economic – no change to evaluated scores.	Info
6.7	**5.0 Economic**	
6.7.1	5.1 Short Term Cost – no change to evaluated scores.	Info
6.7.2	5.2 Long Term Cost – no change to evaluated scores.	Info
6.8	**Results:** Option 4A was determined to be the preferred option. There were no comments on the outcome.	Info
7.0	**AOB**	
	There were no actions identified.	Info

APPENDIX C GROUP 1 – DETAILED EVALUATION RESULTS

Appendix C.1 Group 1 Attributes Table

		O2A - Cut and Lift (Full Removal)			O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)		O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
		- Lines already cut / disconnected at ends. - Lines will be excavated using bucket excavator to access for cutting. - Lines cut into sections using hydraulic shears recovered to vessel and returned to shore for processing.			- Lines already cut / disconnected at ends. - Surface laid sections (out with trench) will be rock covered. - Rock placement at all areas of spans and exposure.		- Lines already cut / disconnected at ends. - Surface laid sections (out with trench) cut into sections using hydraulic shears, recovered to vessel and returned to shore for processing. - Removal of areas of spans and exposure using cut and lift techniques (including excavation where required) with hydraulic shears. - Rock placement to remediate snag risk from cut ends.	- Lines already cut / disconnected at ends. - Surface laid sections (out with trench) cut into sections using hydraulic shears, recovered to vessel and returned to shore for processing. - Rock placement to remediate snag risk from cut ends.
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 9.2 / 12,104 / 9.08E-04 Divers: 18 / 9.2 / 3,961 / 3.84E-03 CSV: 76 / 273.3 / 249,231 / 1.87E-02 Total offshore hours: 265,297 hrs Total offshore PLL: 2.34E-02 Resource Type: Days / Hours / PLL Engineering & Management: 3,672.1 / 29,376 / 1.18E-04 Project Management: 3,362.0 / 26,896 / 1.08E-04 Onshore Operations (includes Cleaning & Disposal): 139.0 / 8,896 / 1.09E-03 Total onshore hours: 65,168 hrs Total onshore PLL: 1.32E-03 Total operational hours: 330,466 hrs Total operational PLL: 2.48E-02			Vessel Type: PoB / Days / Hours / PLL Rockdump Vessel: 20 / 7.1 / 1,714 / 1.29E-04 Total offshore hours: 1,714 hrs Total offshore PLL: 1.29E-04 Resource Type: Days / Hours / PLL Engineering & Management: 51.5 / 412 / 1.65E-06 Project Management: 65.0 / 520 / 2.08E-06 Total onshore hours: 932 hrs Total onshore PLL: 3.73E-06 Total operational hours: 2,645 hrs Total operational PLL: 1.32E-04		Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 24.3 / 22,143 / 1.66E-03 Rockdump Vessel: 20 / 13.4 / 3,216 / 2.41E-04 Total offshore hours: 25,359 hrs Total offshore PLL: 1.90E-03 Resource Type: Days / Hours / PLL Engineering & Management: 348.5 / 2,788 / 1.12E-05 Project Management: 347.0 / 2,776 / 1.11E-05 Onshore Operations (includes Cleaning & Disposal): 5.0 / 320 / 3.94E-05 Total onshore hours: 5,884 hrs Total onshore PLL: 6.16E-05 Total operational hours: 31,244 hrs Total operational PLL: 1.96E-03	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 21.7 / 19,763 / 1.48E-03 Rockdump Vessel: 20 / 7.2 / 1,721 / 1.29E-04 Total offshore hours: 21,484 hrs Total offshore PLL: 1.61E-03 Resource Type: Days / Hours / PLL Engineering & Management: 320.6 / 2,565 / 1.03E-05 Project Management: 325.0 / 2,600 / 1.04E-05 Onshore Operations (includes Cleaning & Disposal): 4.0 / 256 / 3.15E-05 Total onshore hours: 5,421 hrs Total onshore PLL: 5.21E-05 Total operational hours: 26,905 hrs Total operational PLL: 1.66E-03
		Largely routine operations. Potential for dropped object from multiple lifts through water column (2910 (486 if bundled) lifts). In addition there is the offloading associated with transferring the pipeline to quayside.			Largely routine operations. No potential for dropped object as no lifting with this option.		Largely routine operations. Potential for dropped object from multiple lifts through water column (110 (19 if bundled) lifts). In addition there is the offloading associated with transferring the pipeline to quayside.	Largely routine operations. Potential for dropped object from multiple lifts through water column (75 (13 if bundled) lifts). In addition there is the offloading associated with transferring the pipeline to quayside.
		VMW	MW	MW	MS	MS	W	
Summary		The assessment of the Operations Personnel sub-criterion is as follows: Option 2A is assessed as being Very Much Weaker than Option 4A as the risk exposure is much higher due to the extended offshore operations and the use of divers for addressing the under crossing location in Option 2A versus the small offshore scope and no onshore handling of returned material in Option 4A. Option 2A also has potentially thousands of lifts through the water column to the vessel whereas there is no offshore lifting associated with Option 4A. Option 2A is assessed as being Much Weaker than Option 4C due to the higher risk exposure from the greater offshore scope, the use of divers and much more offshore lifting in Option 2A. Option 2A is also assessed as being Much Weaker than Option 5, again due to the higher risk exposure from the greater offshore scope, the use of divers and much more offshore lifting in Option 2A. Option 4A is assessed as being Much Stronger than both Option 4C and Option 5 as the offshore scope is smaller and impacts fewer personnel due to lower PoB on the Rockdump Vessel versus the CSV. There is also a significant number of offshore lifts of the lines through the water column to the vessel in Option 4C and Option 5. Option 4C is assessed as being Weaker than Option 5 due to a combination of the larger offshore scope and the higher number of offshore lifts. **Overall, Option 4A is the preferred option from a risk to Operations Personnel perspective.**						

		O2A - Cut and Lift (Full Removal)			O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)		O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
1. Safety	1.2 Legacy Risk	A small legacy risk remains with Option 2A as a single under crossing will remain. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 12.1 / 6,405 / 4.80E-04			The lines remain in-situ with this option although the majority of their length is trenched and buried as areas of spans or exposure will be rock covered. Their surface laid line ends will also be rock covered to mitigate potential snag hazard. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 16.1 / 8,496 / 6.37E-04		The lines remain in-situ with this option although their entire length is fully trenched and buried as areas of spans or exposure will be removed, as will the surface laid line ends. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 16.1 / 8,496 / 6.37E-04	The lines remain in-situ with this option although the majority of their length is trenched and buried as there are minimal areas of spans or exposure (345m total) although these will remain. Their surface laid line ends will be removed. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 15.5 / 8,189 / 6.14E-04
		S	**S**	**MS**	**W**	**N**	**S**	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 2A is assessed as being Stronger than Option 4A and Option 4C as the potential for future snag risk is reduced as the lines are removed. Option 2A is assessed as being Much Stronger than Option 5 as there are areas of spans and exposure that will remain in Option 5 which presents a greater legacy safety risk. The crossing that remains in Option 2A shall be left in an overtrawlable condition. Option 4A is assessed as being Weaker than Option 4C due to the introduction of rock berms from rock cover over the line ends and areas of spans and exposures in Option 4A. Option 4A is assessed as Neutral to Option 5 as the rock berms from covering the line ends and areas of spans and exposures (Option 4A) and the remaining areas of spans and exposures (Option 5) were considered largely similar from a legacy risk perspective. Option 4C is assessed as being Stronger than Option 5 as Option 4C leaves a clear seabed as the remaining lines will be full trenched and buried. It is noted that the as left condition of all options will be overtrawlable with a survey & monitoring programme performed to ensure that the as left condition remains overtrawlable. **Overall, Option 4C is the preferred option from a risk to Other Users perspective.**						
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): 282 days Tooling noise: 8 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 282 days it is the highest of the options being evaluated.			Vessel Noise (days on-site): 4 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 4 days it the lowest of the options being evaluated.		Vessel Noise (days on-site): 31 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 31 days it is higher than Option 4A, similar to Option 5 and much lower than Option 2A.	Vessel Noise (days on-site): 22 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 22 days it is higher than Option 4A, similar to Option 4C and much lower than Option 2A.
		W	**W**	**W**	**N**	**N**	**N**	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 2A is assessed as being Weaker than all partial removal options due to a combination of the low impact releases from the cutting of the lines and the noise generated by the extended durations of vessels on site. All other options are assessed as being Neutral to each other as the impacts are similar and low for all partial removal options. **Overall, Option 4A, Option 4C and Option 5 are equally preferred from an Operational Marine Impact perspective.**						

		O2A - Cut and Lift (Full Removal)			O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)		O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
2. Environmental	2.2 Atmospheric Emissions, Fuel & Energy Consumption	Vessel Emissions (in tonnes): Fuel: 8,070 CO2: 25,581 NOx: 479.35 SO2: 32.28 Vessel Energy Use: 347,003 GJ Material Emissions (CO2 in tonnes): Recovered Material: 4,222 Remaining Material: Total: 4,222 Energy Use (in GJ): Recovered Material: 128,478 Remaining Material: Rock: N/A			Vessel Emissions (in tonnes): Fuel: 518 CO2: 1,642 NOx: 30.77 SO2: 2.07 Vessel Energy Use: 22,277 GJ Material Emissions (CO2 in tonnes): Recovered Material: Remaining Material: 7,873 Total: 7,873 Energy Use (in GJ): Recovered Material: Remaining Material: 104,200 Rock: 11,200 tonnes		Vessel Emissions (in tonnes): Fuel: 1,264 CO2: 4,007 NOx: 75.08 SO2: 5.06 Vessel Energy Use: 54,347 GJ Material Emissions (CO2 in tonnes): Recovered Material: 127 Remaining Material: 7,637 Total: 7,764 Energy Use (in GJ): Recovered Material: 1,375 Remaining Material: 101,075 Rock: 1,344 tonnes	Vessel Emissions (in tonnes): Fuel: 1,065 CO2: 3,375 NOx: 63.24 SO2: 4.26 Vessel Energy Use: 45,780 GJ Material Emissions (CO2 in tonnes): Recovered Material: 110 Remaining Material: 7,669 Total: 7,779 Energy Use (in GJ): Recovered Material: 1,188 Remaining Material: 101,500 Rock: 384 tonnes
		W	W	W	N	N	N	
	Summary	The assessment of the Atmospheric Emissions, Fuel & Energy Consumptions sub-criterion is as follows: Option 2A is assessed as being Weaker than all partial removal options as the emissions generated and fuel / energy consumed are greater than all other options. All other options are assessed as being Neutral to each other as, while there are differences in the material consumed and the emissions generated by the options, these differences were considered insufficient to express a preference from an environmental impact perspective. **Overall, Option 4A, Option 4C and Option 5 are equally preferred from an Atmospheric Emissions, Fuel & Energy Consumptions perspective.**						
2. Environmental	2.3 Seabed Disturbance	Operational Seabed Disturbance: Short Term Disturbance: 245,020 m2 Legacy Seabed Disturbance: N/A			Operational Seabed Disturbance: Habitat Loss (Rock Cover): 11,200 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Cover): 11,200 m2		Operational Seabed Disturbance: Habitat Loss (Rock Bags): 1,188 m2 Short Term Disturbance: 500 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Bags): 1,188 m2	Operational Seabed Disturbance: Habitat Loss (Rock Cover): 506 m2 Short Term Disturbance: 1,680 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Cover): 506 m2
		W	W	W	W	W	N	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Option 2A is assessed as being Weaker than all partial removal options due to the significant area and impact of the disturbance caused by excavating the lines to gain access for cutting, particularly in the prevailing geotechnical conditions, where any disturbance will take a long time period to recover. Option 4A is assessed as being Weaker than the other partial removal options due to it having the largest area of permanent habitat loss from the introduction of rock cover over the line ends. Option 4C is assessed as being Neutral to Option 5 as the seabed impact both operationally and for the long-term, were considered similar. Note: the only line that is within the East of Gannet & Montrose Marine Protected Area is PL1550 which is a 1.2 km line and only represents a small portion (total line length around 49km) of the seabed disturbance in all options and is therefore not dominant in the assessment made. **Overall, Option 4C and Option 5 are equally preferred from a Seabed Disturbance perspective.**						
2. Environmental	2.4 Legacy Marine Impacts	The legacy marine impact from this full removal option is limited to the impact associated with the survey & monitoring of the single under crossing which remains in-situ. This is expected to be minimal. Vessel Days: Survey Vessel (Legacy): 12.1 Total vessel days: 12.1 days			Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Vessel Days: Survey Vessel (Legacy): 16.1 days		Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Vessel Days: Survey Vessel (Legacy): 16.1 days	Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Vessel Days: Survey Vessel (Legacy): 15.5 days
		S	S	S	N	N	N	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 2A is assessed as being Stronger than all partial removal options as removing the lines leaves limited legacy marine impact. The environmental impacts associated with the lines remaining in-situ are expected to be low as any residual contents and degradation products will be released slowly over a long time period. All other options are assessed as being Neutral to each other as the legacy marine impact is expected to be similar for all partial removal options. **Overall, Option 4A, Option 4C and Option 5 are equally preferred from a Legacy Marine Impacts perspective.**						

		O2A - Cut and Lift (Full Removal)			O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)		O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
3. Technical	3.1 Technical Feasibility	Concept is technologically feasible. The scale is considerable and supply chain and assets may require some development to accommodate the option. (Score 2) Excavation along the lines on this scale will present technical challenges on a cumulative basis, particularly with the prevailing geotechnical conditions. There are also concerns surround the ability to return the seabed to and overtrawlable status.			Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain. (Score 1)		Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain and assets may require some development to accommodate the option. (Score 1)	Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain and assets may require some development to accommodate the option. (Score 1)
		MW	**MW**	**MW**	**N**	**N**	**N**	
	Summary	The assessment of the Technical Feasibility sub-criterion is as follows: Option 2A is assessed as being Much Weaker than the other options due to the potential challenges excavating (necessary due to geotechnical conditions) along the lines to allow access for cutting. This is a cumulative technical concern due to the scale of the operations. There are also concerns regarding the ability to return the seabed to an overtrawlable status given the excavation required and the geotechnical conditions. All other options are assessed as being Neutral to each other as they employ largely routine operations. **Overall, Option 4A, Option 4C and Option 5 are equally preferred from a Technical Feasibility perspective.**						
3. Technical	3.2 Ease of Recovery from Excursion	Recovery is achievable with existing in-field equipment. (Score 1)			Recovery is achievable with existing in-field equipment. (Score 1)		Recovery is achievable with existing in-field equipment. (Score 1)	Recovery is achievable with existing in-field equipment. (Score 1)
		N	**N**	**N**	**N**	**N**	**N**	
	Summary	The assessment of the Ease of Recovery from Excursion sub-criterion is as follows: All options are assessed as being Neutral to each other as the ability to recover from an unplanned excursion is considered similar for all options. **Overall, all options are equally preferred from an Ease of Recovery from Excursion perspective.**						
3. Technical	3.3 Use of Proven Technology and Equipment	Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)			Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)		Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)	Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)
		N	**N**	**N**	**N**	**N**	**N**	
	Summary	The assessment of the Use of Proven Technology and Equipment sub-criterion is as follows: All options are assessed as being Neutral to each other as they are delivered using routine operations with equipment that is readily available and has an extensive track record. **Overall, all options are equally preferred from an Use of Proven Technology and Equipment perspective.**						
4. Societal	4.1 Fishing	Short term disruption may occur during operations. Thereafter seabed clear for fishing. (Score 2)			Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock. (Score 2)		Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock. (Score 2)	Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock. (Score 2)
		S	**N**	**S**	**W**	**N**	**S**	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 2A is assessed as being Stronger than Option 4A due to the lines being removed versus the rock berms introduced and Option 5 due to the remaining areas of spans and exposures. Option 2A is assessed as being Neutral to Option 4C as they both present a clear seabed albeit with the line remaining in-situ in Option 4C. Option 4A is assessed as being Weaker than Option 4C due to the rock berms introduced versus a clear seabed (albeit with the line remaining). Option 4A is assessed as being Neutral to Option 5 due the rock berms versus the remaining areas of spans and exposures being considered similar. Option 4C is assessed as being Stronger than Option 5 due to it being presenting a clear seabed, albeit with the line remaining in-situ versus the remaining areas of spans and exposures. **Overall, Option 2A and Option 4C are equally preferred from a Societal impact on Fishing perspective.**						

		O2A - Cut and Lift (Full Removal)			O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)		O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
4. Societal	4.2 Socio-economic Impacts on Amenities and Communities	Short term impact on communities, positive from an economic perspective. (Score 2) Materials Returned: Steel: 4,168 tonnes (recyclable) Polymer: 560 tonnes (landfill)			No impact. (Score 1) Materials Returned:		No impact. (Score 1) Materials Returned: Steel: 125 tonnes (recyclable) Polymer: 17 tonnes (landfill)	No impact. (Score 1) Materials Returned: Steel: 108 tonnes (recyclable) Polymer: 15 tonnes (landfill)
		N	**N**	**N**	**N**	**N**	**N**	
	Summary	The assessment of the Socio-economic Impacts on Amenities and Communities sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there is more useful (recyclable) material returned in Option 2A (steel), this is offset by the significant quantity of material that will be likely to be destined for landfill (polymer). Overall the positive and negative societal impacts were considered to be balanced for all options. **Overall, all options are equally preferred from a Socio-economic Impacts on Amenities and Communities perspective.**						
5. Economic	5.1 Short-term Costs	£32.946 Million			£0.817 Million		£3.568 Million	£3.351 Million
		VMW	**VMW**	**VMW**	**S**	**S**	**N**	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Very Much Weaker than Option 4A as the cost to execute the option is more than 40 times greater or around £33 million more. Option 2A is assessed as being Very Much Weaker than Option 4C as the execution cost is almost 10 times greater or around £30 million more. Option 2A is assessed as being Very Much Weaker than Option 5 as the execution cost is around 10 times greater or around £30 million more. Option 4A is assessed as being Stronger than Option 4C as the execution cost for Option 4C is around 4 times greater or around £2.7 million more. Option 4A is assessed as being Stronger than Option 5 as the execution cost for Option 5 is around 4 times greater or around £2.5 million more. Option 4C is assessed as being Neutral to Option 5 as the execution costs are similar. **Overall, Option 4A is the preferred option from a Short-term Cost perspective.**						
5. Economic	5.2 Long-term Costs	Surveys: £0.606 Million FLTC: N/A Total Legacy Cost: £0.606 Million			Surveys: £0.804 Million FLTC: N/A Total Legacy Cost: £0.804 Million		Surveys: £0.804 Million FLTC: N/A Total Legacy Cost: £0.804 Million	Surveys: £0.775 Million FLTC: £300 Total Legacy Cost: £0.776 Million
		N	**N**	**N**	**N**	**N**	**N**	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: All options are assessed as being Neutral to each other as, while the legacy costs for surveying & monitoring associated with the partial removal options are greater than the full removal option, there remains the requirement to monitor the under crossings (2 off) remaining in Option 2A. **Overall, all options are equally preferred from a Long-term Cost perspective.**						

Appendix C.2 Group 1 Pairwise Comparison Matrices - Safety

1.1 Operations Personnel	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	VMW	MW	MW	6.2%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	VMS	N	MS	MS	56.1%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	MS	MW	N	W	16.9%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	MS	MW	S	N	20.7%

1.2 Legacy Risk	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	S	S	MS	38.2%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	W	N	19.3%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	S	N	S	26.2%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	MW	N	W	N	16.3%

Appendix C.3 Group 1 Pairwise Comparison Matrices - Environment

2.1 Operational Marine Impact	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	W	W	W	18.2%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	N	27.3%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	N	27.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	N	N	N	27.3%

2.2 Atmospheric Emissions, Fuel & Energy Consumption	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	W	W	W	18.2%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	N	27.3%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	N	27.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	N	N	N	27.3%

2.3 Seabed Disturbance	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	W	W	W	18.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	W	W	22.1%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	S	N	N	29.9%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	S	N	N	29.9%

2.4 Legacy Marine Impacts	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	S	S	S	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	N	N	22.2%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	N	N	22.2%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	W	N	N	N	22.2%

Appendix C.4 Group 1 Pairwise Comparison Matrices – Technical

3.1 Technical Feasibility	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	MW	MW	MW	10.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	MS	N	N	N	30.0%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	MS	N	N	N	30.0%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	MS	N	N	N	30.0%

3.2 Ease of Recovery from Excursion	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	N	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	N	25.0%

3.3 Use of Proven Technology and Equipment	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	N	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	N	25.0%

Appendix C.5 Group 1 Pairwise Comparison Matrices – Societal

4.1 Fishing	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	S	N	S	30.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	W	N	20.0%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	S	N	S	30.0%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	W	N	W	N	20.0%

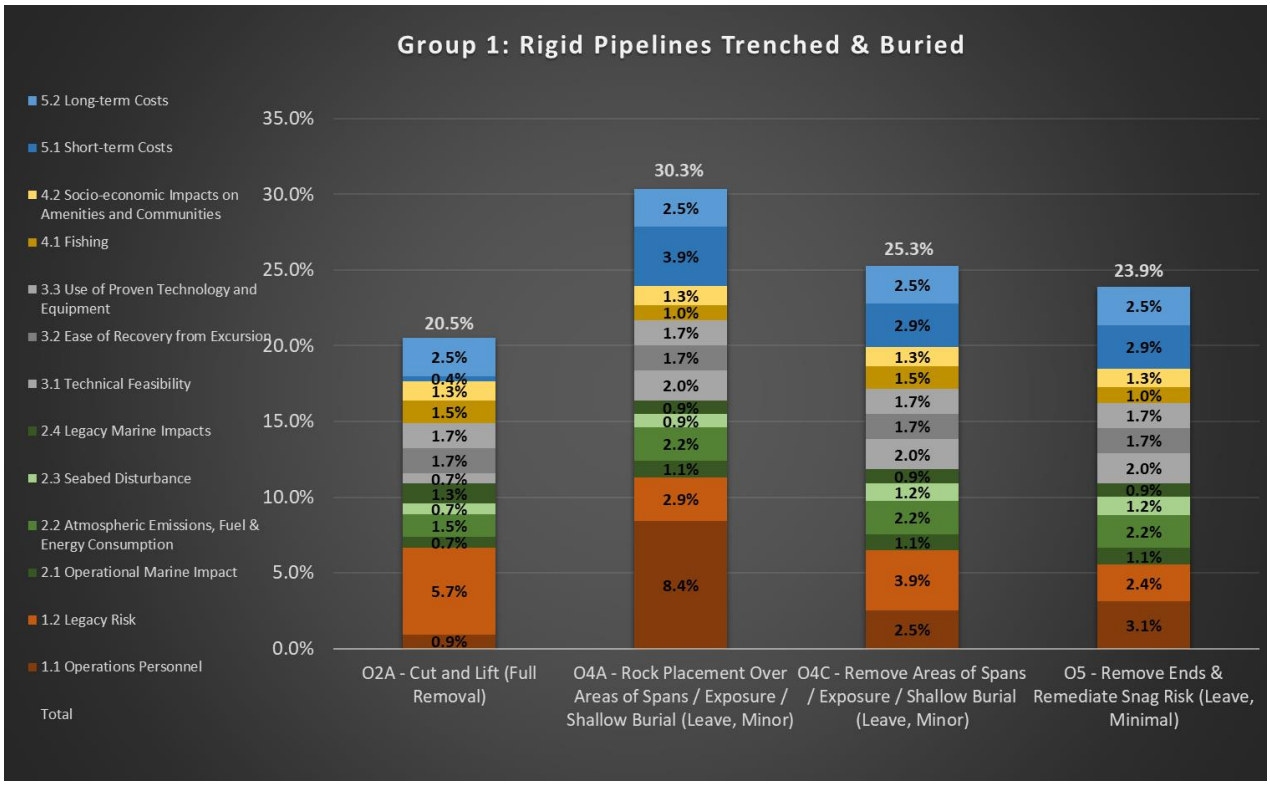
4.2 Socio-economic Impacts on Amenities and Communities	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	N	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	N	25.0%

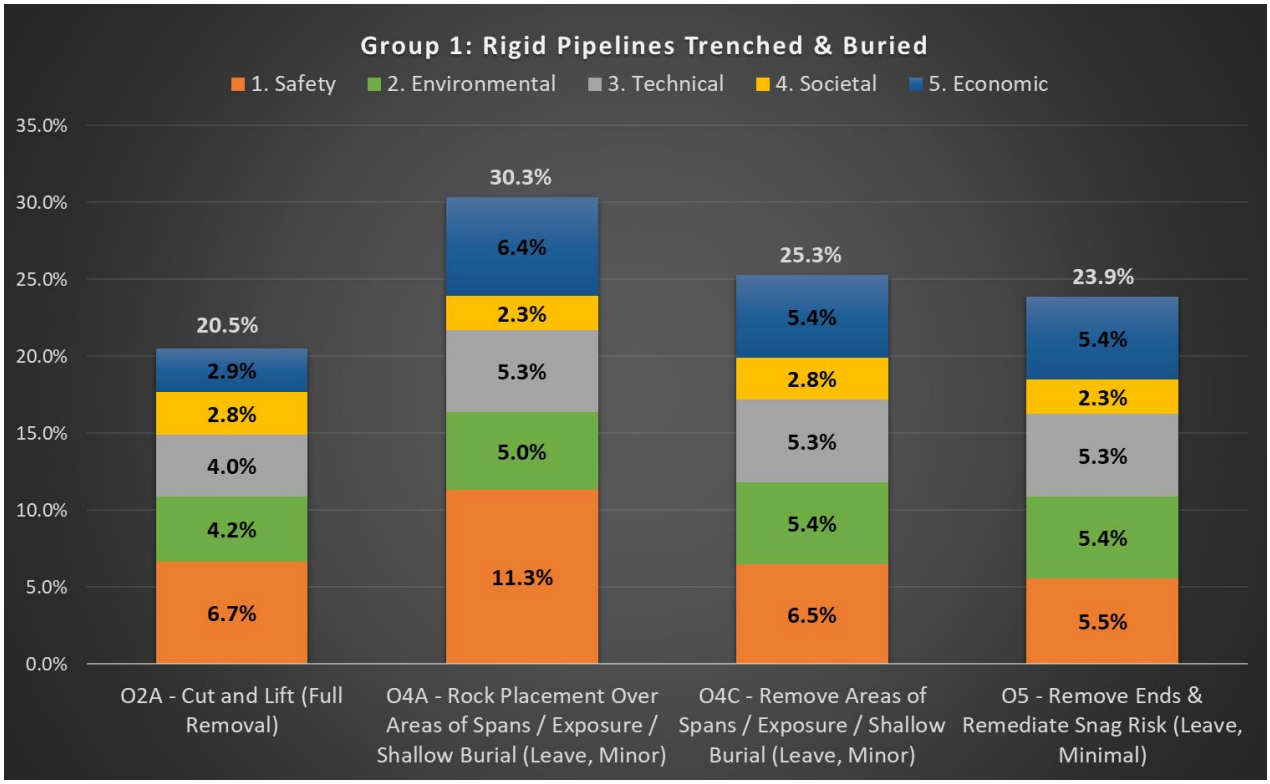
Appendix C.6 Group 1 Pairwise Comparison Matrices - Economic

5.1 Short-term Costs	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	VMW	VMW	VMW	3.5%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	VMS	N	S	S	39.0%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	VMS	W	N	N	28.7%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	VMS	W	N	N	28.7%

5.2 Long-term Costs	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	N	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O4C - Remove Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	N	25.0%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	N	25.0%

Appendix C.7 Group 1 Results Charts





APPENDIX D GROUP 2 – DETAILED EVALUATION RESULTS

Appendix D.1 Group 2 Attributes Table

		O2B - Reverse Installation (Reel) without Deburial (Full Removal)		O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
		- Lines already cut / disconnected at ends. - Line ends will be lifted and the line reverse reeled to vessel and returned to shore for processing.		- Lines already cut / disconnected at ends. - Surface laid sections (out with trench) will be rock covered. - Rock placement at all areas of spans and exposure.	- Lines already cut / disconnected at ends. - Surface laid sections (out with trench) cut into sections using hydraulic shears, recovered to vessel and returned to shore for processing. - Rock placement to remediate snag risk from cut ends.
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 14.2 / 18,704 / 1.40E-03 Divers: 18 / 14.2 / 6,121 / 5.94E-03 CSV: 76 / 33.1 / 30,160 / 2.26E-03 Total offshore hours: 54,986 hrs Total offshore PLL: 9.60E-03 Resource Type: Days / Hours / PLL Engineering & Management: 741.2 / 5,929 / 2.37E-05 Project Management: 764.0 / 6,112 / 2.44E-05 Onshore Operations (includes Cleaning & Disposal): 37.0 / 2,368 / 2.91E-04 Total onshore hours: 14,409 hrs Total onshore PLL: 3.39E-04 Total operational hours: 69,395 hrs Total operational PLL: 9.94E-03		Vessel Type: PoB / Days / Hours / PLL Rockdump Vessel: 20 / 9.0 / 2,170 / 1.63E-04 Total offshore hours: 2,170 hrs Total offshore PLL: 1.63E-04 Resource Type: Days / Hours / PLL Engineering & Management: 66.2 / 529 / 2.12E-06 Project Management: 88.0 / 704 / 2.82E-06 Total onshore hours: 1,233 hrs Total onshore PLL: 4.93E-06 Total operational hours: 3,403 hrs Total operational PLL: 1.68E-04	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 19.9 / 18,158 / 1.36E-03 Total offshore hours: 18,158 hrs Total offshore PLL: 1.36E-03 Resource Type: Days / Hours / PLL Engineering & Management: 248.5 / 1,988 / 7.95E-06 Project Management: 265.0 / 2,120 / 8.48E-06 Onshore Operations (includes Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 4,172 hrs Total onshore PLL: 2.43E-05 Total operational hours: 22,330 hrs Total operational PLL: 1.39E-03
		Largely routine operations. Potential for dropped object from initiations (9 x initiations).		Largely routine operations. No potential for dropped object as no lifting with this option.	Largely routine operations. Potential for dropped object from multiple lifts through water column (56 lifts). In addition there is the offloading associated with transferring the flowline / umbilical to quayside.
		MW	**W**	**S**	
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 2B is assessed as being Much Weaker than Option 4A as the risk exposure is much higher due to the extended offshore operations and the use of divers for addressing the crossing locations in Option 2B versus the small offshore scope and no onshore handling of returned material in Option 4A. Option 2B is assessed as being Weaker than Option 5 due to the higher risk exposure from the greater offshore scope and the use of diver in Option 2B. Option 4A is assessed as being Stronger than Option 5 as the offshore scope is smaller and impacts fewer personnel due to lower PoB on the Rockdump Vessel versus the CSV. There is also a significant number of offshore lifts of the lines through the water column to the vessel in Option 5. **Overall, Option 4A is the preferred option from a risk to Operations Personnel perspective.**			
1. Safety	1.2 Legacy Risk	A small legacy risk remains with Option 2B as the under crossings (2 off) will remain. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 12.3 / 6,468 / 4.85E-04		The lines remain in-situ with this option although the majority of their length is fully trenched and buried as there are no areas of spans or exposure. Their surface laid line ends will be rock covered to mitigate potential snag hazard. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 16.1 / 8,490 / 6.37E-04	The lines remain in-situ with this option although they are fully trenched and buried as there are no areas of spans or exposure. Their surface laid ends will be removed. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 16.1 / 8,501 / 6.38E-04
		S	**S**	**W**	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 2B is assessed as being Stronger than both partial removal options as the potential for future snag risk is reduced as the lines are removed. The crossings that remain shall be left overtrawlable. Option 4A is assessed as being Weaker than Option 5 due to the introduction of rock berms from rock cover over the line ends in Option 4A. It is noted that the as left condition of all options will be overtrawlable with a survey & monitoring programme performed to ensure that the as left condition remains overtrawlable. **Overall, Option 2B is the preferred option from a risk to Other Users perspective.**			
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): 21 days Tooling noise: 8 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends will lead to a discharge of fluids from within the lines. Reverse reeling will also result in the residual contents of the lines being evacuated to the sea. However, given the prior cleaning of the lines, the concentration and quantity of discharges should still be low overall. One notable exception to these lines being cleaned to best endeavours is the Banff Umbilical (PL1554) and the Kyle Umbilical (PL1661) which have cores that cannot be flushed and cleaned prior to decommissioning due to blockage. As such, the residual contents (Banff - Scale Inhibitor RX-6034 - 62 litres) (Kyle - Wax Inhibitor - RX-2099 - 2,509 litres, RX-7020 - 12 litres and RX-7014 - 1,138 litres) could be released to sea during reverse reeling. This is considered worst case and is permitted accordingly. This will have the most significant environmental impact of all options although is still anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 21 days it is higher than Option 4A and similar to Option 5.		Vessel Noise (days on-site): 6 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. There are no planned discharges from the lines under this rock cover option. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 6 days it is the lowest of the options being evaluated.	Vessel Noise (days on-site): 17 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends will lead to a discharge of fluids from within the lines. However, given the prior cleaning of the lines, the concentration and quantity of discharge should still be low overall. One notable exception to these lines being cleaned to best endeavours is the Banff Umbilical (PL1554) and the Kyle Umbilical (PL1661) which have cores that cannot be flushed and cleaned prior to decommissioning due to blockage. As such, a small amount of the residual contents (Banff - Scale Inhibitor RX-6034 - 62 litres) (Kyle - Wax Inhibitor - RX-2099 - 2,509 litres, RX-7020 - 12 litres and RX-7014 - 1,138 litres) could be released at the cut locations and is permitted accordingly. These releases will be small quantities and the environmental impact is anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 17 days it is higher than Option 4A and similar to Option 2B.
		W	**W**	**N**	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 2B is assessed as being Weaker than the partial removal options as the residual contents of the lines will be released in one location during the reverse reeling operations in Option 2B. Additionally, there are residual chemicals (Scale and Wax Inhibitor) in PL1554 and PL1661 that that cannot be flushed due to blockage. Option 4A is assessed as being Neutral to Option 5 as while there are small differences in the impact on the marine environment from these options, these differences were considered insufficient to express a preference. **Overall, Option 4A and Option 5 are equally preferred from an Operational Marine Impact perspective.**			

		O2B - Reverse Installation (Reel) without Deburial (Full Removal)		O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
2. Environmental	2.2 Atmospheric Emissions, Fuel & Energy Consumption	Vessel Emissions (in tonnes): Fuel: 1,445 CO2: 4,582 NOx: 85.85 SO2: 5.78 Vessel Energy Use: 62,150 GJ Material Emissions (CO2 in tonnes): Recovered Material: 601 Remaining Material: Total: 601 Energy Use (in GJ): Recovered Material: 11,791 Remaining Material: Rock: N/A		Vessel Emissions (in tonnes): Fuel: 551 CO2: 1,745 NOx: 32.70 SO2: 2.20 Vessel Energy Use: 23,672 GJ Material Emissions (CO2 in tonnes): Recovered Material: 5 Remaining Material: 1,937 Total: 1,942 Energy Use (in GJ): Recovered Material: 61 Remaining Material: 26,300 Rock: 8,400 tonnes	Vessel Emissions (in tonnes): Fuel: 947 CO2: 3,001 NOx: 56.23 SO2: 3.79 Vessel Energy Use: 40,708 GJ Material Emissions (CO2 in tonnes): Recovered Material: 11 Remaining Material: 1,919 Total: 1,930 Energy Use (in GJ): Recovered Material: 155 Remaining Material: 26,050 Rock: 192 tonnes
		N	N	N	
	Summary	The assessment of the Atmospheric Emissions, Fuel & Energy Consumptions sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there are differences in the material consumed and the emissions generated by the options, these differences were considered insufficient to express a preference from an environmental impact perspective **Overall, all option are equally preferred from an Atmospheric Emissions, Fuel & Energy Consumptions perspective.**			
2. Environmental	2.3 Seabed Disturbance	Operational Seabed Disturbance: Short Term Disturbance (Reverse Installation w/o Deburial): 98,330 m2 Legacy Seabed Disturbance: N/A		Operational Seabed Disturbance: Habitat Loss (Rock Cover): 8,400 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Cover): 8,400 m2	Operational Seabed Disturbance: Habitat Loss (Rock Bags): 255 m2 Short Term Disturbance: 4,200 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Bags): 255 m2
		N	N	W	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: All options are assessed as being Neutral to each other. The larger area of short-term disturbance associated with pulling the lines through existing cover in Option 2B was considered to have a similar impact as the smaller areas of permanent habitat loss associated with Option 4A and Option 5. **Overall, all options are equally preferred from a Seabed Disturbance perspective.**			
2. Environmental	2.4 Legacy Marine Impacts	The legacy marine impact from this full removal option is limited to the impact associated with the survey & monitoring of the under crossings (2off) which remain in-situ. This is expected to be minimal. Vessel Days: Survey Vessel (Legacy): 12.3 Total vessel days: 12.3 days		Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Vessel Days: Survey Vessel (Legacy): 16.1 days	Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Vessel Days: Survey Vessel (Legacy): 16.1 days
		S	S	N	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 2B is assessed as being Stronger than the partial removal options as removing the lines leaves limited legacy marine impact. The environmental impacts associated with the lines remaining in-situ are expected to be low as any residual contents and degradation products will be released slowly over a long time period. It is noted that PL1554 and PL1661 have residual Wax and Scale Inhibitor in blocked cores that cannot be flushed prior to the being left in-situ. The legacy marine impact is still considered low. Option 4A is assessed as being Neutral to Option 5 as the environmental impact of the lines remaining in-situ is similar for both options. **Overall, Option 2B is the preferred option from a Legacy Marine Impacts perspective.**			
3. Technical	3.1 Technical Feasibility	Concept is technologically feasible. The scale is comparable with similar scopes completed. (Score 1) There remains concern re: ability to Reverse Reel these lines through existing cover without deburial first which provides additonal technical risks / challenges. Assessed as Neutral to other options however run sensitivity to change to Weaker than other options.		Concept is technologically feasible. The scale is comparable with similar scopes completed. (Score 1)	Concept is technologically feasible. The scale is comparable with similar scopes completed. (Score 1)
		N	N	N	
	Summary	The assessment of the Technical Feasibility sub-criterion is as follows: All options are assessed as being Neutral to each other. There are residual concerns regarding the ability to Reverse Reel these lines through existing cover due to uncertain residual integrity however the assessment has remained as Neutral. All options are conducted using largely routine operations. **Overall, all options are equally preferred from a Technical Feasibility perspective.**			
3. Technical	3.2 Ease of Recovery from Excursion	Recovery is achievable with existing in-field equipment. (Score 1)		Recovery is achievable with existing in-field equipment. (Score 1)	Recovery is achievable with existing in-field equipment. (Score 1)
		W	W	N	
	Summary	The assessment of the Ease of Recovery from Excursion sub-criterion is as follows: Option 2B is assessed as being Weaker than both partial removal options due to requirement to locate and connect to the line end for continued recovery by reverse reeling should it be dropped during an unplanned excursion. Option 4A is assessed as being Neutral to Option 5 as recovery is similar in both options. **Overall, Option 4A and Option 5 are equally preferred from an Ease of Recovery from Excursion perspective.**			
3. Technical	3.3 Use of Proven Technology and Equipment	Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)		Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)	Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)
		N	N	N	
	Summary	The assessment of the Use of Proven Technology and Equipment sub-criterion is as follows: All options are assessed as being Neutral to each other as they are delivered using routine operations with equipment that is readily available and has an extensive track record. **Overall, all options are equally preferred from an Use of Proven Technology and Equipment perspective.**			

		O2B - Reverse Installation (Reel) without Deburial (Full Removal)		O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
4. Societal	4.1 Fishing	Short term disruption may occur during operations. Thereafter seabed clear for fishing. (Score 2)		Short term disruption may occur during operations. Thereafter seabed generally clear for fishing, small amount of additional rock profiled to accommodate trawling. (Score 2)	Short term disruption may occur during operations. Thereafter seabed clear for fishing, small amount of rock on pipeline ends, profiled to accommodate trawling. (Score 2)
		S	S	W	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 2B is assessed as being Stronger than both partial removal options as the lines are fully removed whereas, the introduction of rock cover over the line ends in Option 4A presents new rock berms and the lines remain in-situ in both partial removal options. Option 4A is assessed as being Weaker than option 5 as while the lines remain in-situ in both options, the additional of the rock berms in Option 4A results in a preference for Option 5. **Overall, Option 2B is the preferred option from a Societal impact on Fishing perspective.**			
4. Societal	4.2 Socio-economic Impacts on Amenities and Communities	Short term impact on communities, positive from an economic perspective. (Score 2) Materials Returned: Steel: 532 tonnes (recyclable) Copper: 133 tonnes (recyclable) Polymer: 431 tonnes (landfill)		No impact on communities. (Score 1) Materials Returned: Steel: 4 tonnes (recyclable) Copper: 1 tonnes (recyclable) Polymer: 3 tonnes (landfill)	No impact on communities. (Score 1) Materials Returned: Steel: 10 tonnes (recyclable) Copper: 3 tonnes (recyclable) Polymer: 8 tonnes (landfill)
		N	N	N	
	Summary	The assessment of the Socio-economic Impacts on Amenities and Communities sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there is more useful (recyclable) material returned in Option 2B (steel and copper), this is offset by the significant quantity of material that will be likely to be destined for landfill (polymer). Overall the positive and negative societal impacts were considered to be balanced for all options. **Overall, all options are equally preferred from a Socio-economic Impacts on Amenities and Communities perspective.**			
5. Economic	5.1 Short-term Costs	£7.603 Million		£1.036 Million	£2.764 Million
		MW	W	S	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 2B is assessed as being Much Weaker than Option 4A as the cost to execute the option is more than 7 times greater or around £6.6 million more. Option 2B is assessed as Weaker than Option 5 as the execution cost is almost 3 times greater or around £4.8 million more. Option 4A is assessed as being Stronger than Option 5 as the execution cost for option 5 is more than double or around £1.7 million more. **Overall, Option 4A is the preferred option from a Short-term Cost perspective.**			
5. Economic	5.2 Long-term Costs	Surveys: £0.613 Million FLTC: N/A Total Legacy Cost: £0.613 Million		Surveys: £0.804 Million FLTC: N/A Total Legacy Cost: £0.804 Million	Surveys: £0.805 Million FLTC: £225 Total Legacy Cost: £0.805 Million
		N	N	N	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: All options are assessed as being Neutral to each other as, while the legacy costs for surveying & monitoring associated with the partial removal options are greater than the full removal option, there remains the requirement to monitor the under crossings (2 off) remaining in Option 2B. **Overall, all options are equally preferred from a Long-term Cost perspective.**			

Appendix D.2 Group 2 Pairwise Comparison Matrices - Safety

1.1 Operations Personnel	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	MW	W	18.6%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	MS	N	S	50.7%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	W	N	30.7%

1.2 Legacy Risk	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	S	S	42.6%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	W	24.8%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	W	S	N	32.5%

Appendix D.3 Group 2 Pairwise Comparison Matrices - Environment

2.1 Operational Marine Impact	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	W	W	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	37.5%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	N	N	37.5%

2.2 Atmospheric Emissions, Fuel & Energy Consumption	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

2.3 Seabed Disturbance	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	N	N	33.1%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	W	28.9%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	S	N	37.9%

2.4 Legacy Marine Impacts	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	S	S	42.9%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	N	28.6%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	W	N	N	28.6%

Appendix D.4 Group 2 Pairwise Comparison Matrices – Technical

3.1 Technical Feasibility	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

3.2 Ease of Recovery from Excursion	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	W	W	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	37.5%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	N	N	37.5%

3.3 Use of Proven Technology and Equipment	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

Appendix D.5 Group 2 Pairwise Comparison Matrices - Societal

4.1 Fishing	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	S	S	42.6%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	W	24.8%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	W	S	N	32.5%

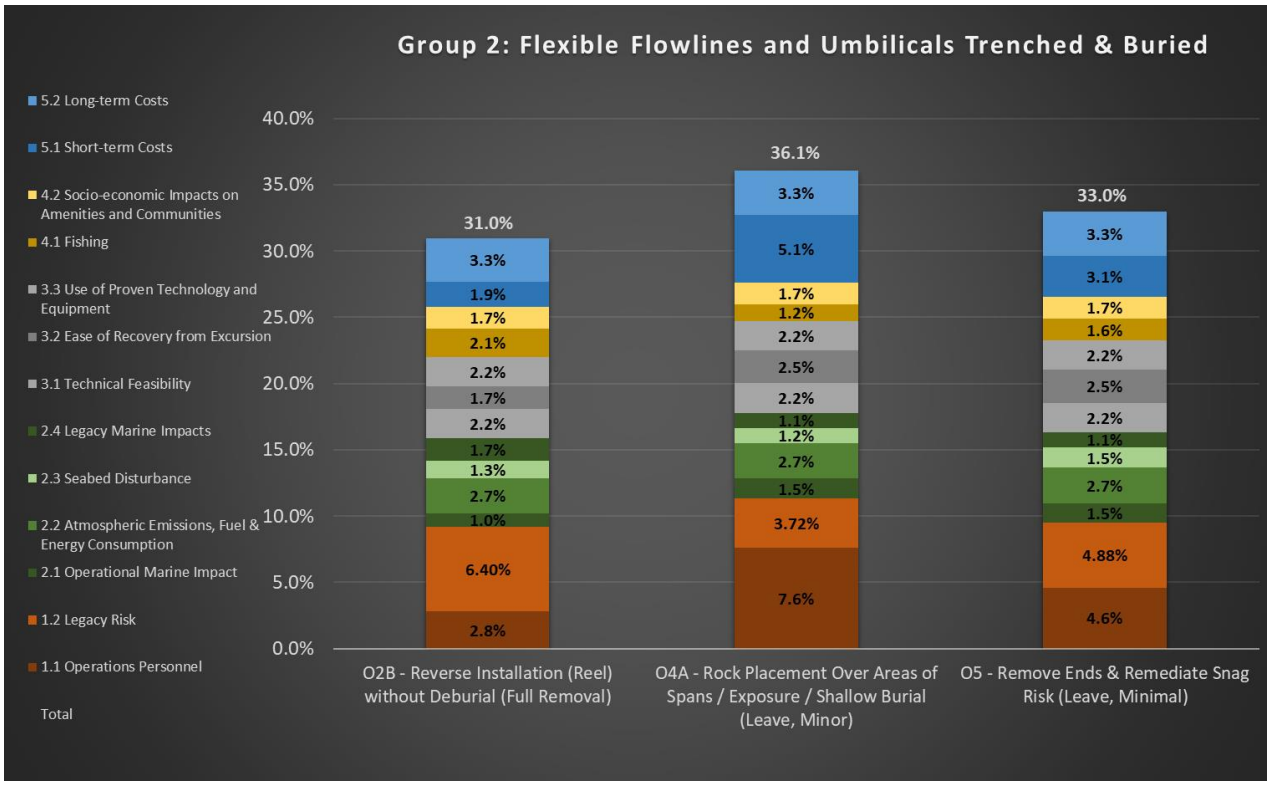
4.2 Socio-economic Impacts on Amenities and Communities	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

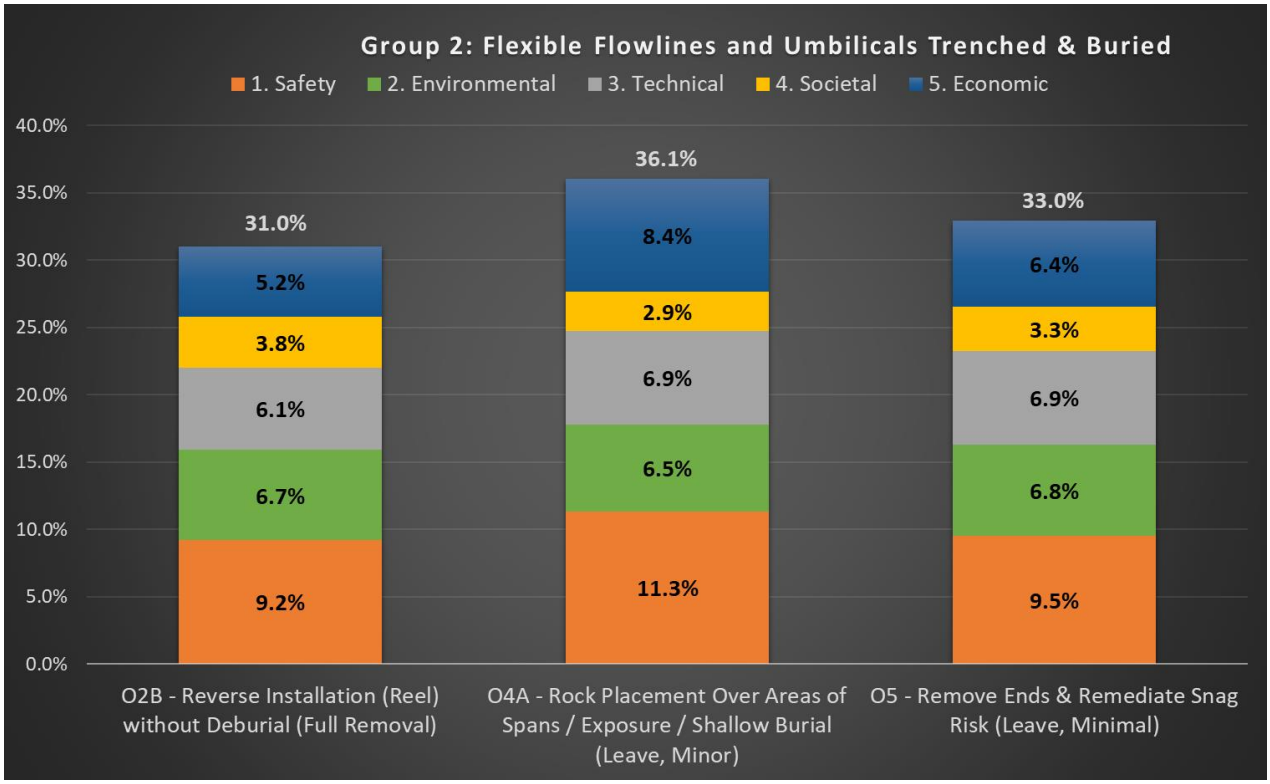
Appendix D.6 Group 2 Pairwise Comparison Matrices - Economic

5.1 Short-term Costs	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	MW	W	18.6%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	MS	N	S	50.7%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	W	N	30.7%

5.2 Long-term Costs	O2B - Reverse Installation (Reel) without Deburial (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2B - Reverse Installation (Reel) without Deburial (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

Appendix D.7 Group 2 Results Charts





APPENDIX E GROUP 4 – DETAILED EVALUATION RESULTS

Appendix E.1 Group 4 Attributes Table

		O2A - Cut and Lift (Full Removal)		O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
		- Lines already cut / disconnected at ends. - Lines will be deburied where required by bucket excavation to access for cutting. - Lines cut into sections using hydraulic shears recovered to vessel and returned to shore for processing.		- Lines already cut / disconnected at ends. - Surface laid sections (out with trench) will be rock covered. - Rock placement at all areas of spans and exposure.	- Lines already cut / disconnected at ends. - Surface laid sections (out with rock cover) cut into sections using hydraulic shears, recovered to vessel and returned to shore for processing. - Rock placement to remediate snag risk from cut ends.
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL DSV: 110 / 9.2 / 12,104 / 9.08E-04 Divers: 18 / 9.2 / 3,961 / 3.84E-03 CSV: 76 / 104.4 / 95,222 / 7.14E-03 Total offshore hours: 111,288 hrs Total offshore PLL: 1.19E-02 Resource Type: Days / Hours / PLL Engineering & Management: 1,527.9 / 12,224 / 4.89E-05 Project Management: 1,484.0 / 11,872 / 4.75E-05 Onshore Operations (includes Cleaning & Disposal): 18.0 / 1,152 / 1.42E-04 Total onshore hours: 25,248 hrs Total onshore PLL: 2.38E-04 Total operational hours: 136,535 hrs Total operational PLL: 1.21E-02		Vessel Type: PoB / Days / Hours / PLL Rockdump Vessel: 20 / 6.7 / 1,610 / 1.21E-04 Total offshore hours: 1,610 hrs Total offshore PLL: 1.21E-04 Resource Type: Days / Hours / PLL Engineering & Management: 48.5 / 388 / 1.55E-06 Project Management: 60.0 / 480 / 1.92E-06 Total onshore hours: 868 hrs Total onshore PLL: 3.47E-06 Total operational hours: 2,479 hrs Total operational PLL: 1.24E-04	Vessel Type: PoB / Days / Hours / PLL CSV: 76 / 9.1 / 8,290 / 6.22E-04 Total offshore hours: 8,290 hrs Total offshore PLL: 6.22E-04 Resource Type: Days / Hours / PLL Engineering & Management: 110.3 / 882 / 3.53E-06 Project Management: 123.0 / 984 / 3.94E-06 Onshore Operations (includes Cleaning & Disposal): 1.0 / 64 / 7.87E-06 Total onshore hours: 1,930 hrs Total onshore PLL: 1.53E-05 Total operational hours: 10,220 hrs Total operational PLL: 6.37E-04
		Largely routine operations. Potential for dropped object from multiple lifts through water column (1102 (184 if bundled) lifts). In addition there is the offloading associated with transferring the pipeline to quayside.		Largely routine operations. No potential for dropped object as no lifting with this option.	Largely routine operations. Potential for dropped object from multiple lifts through water column (20 (4 if bundled) lifts). In addition there is the offloading associated with transferring the pipeline to quayside.
		VMW	**MW**	**S**	
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 2A is assessed as being Very Much Weaker than Option 4A as the risk exposure is much higher due to the extended offshore operations and the use of divers for addressing the under crossing location in Option 2A versus the small offshore scope and no onshore handling of returned material in Option 4A. Option 2A is assessed as being Much Weaker than Option 5 due to the higher risk exposure from the greater offshore scope, the use of divers and the high number of offshore lifts of the lines through the water column to the vessel in Option 2A. Option 4A is assessed as being Stronger than Option 5 as the offshore scope is smaller and impacts fewer personnel due to lower PoB on the Rockdump Vessel versus the CSV. There is also offshore lifts of the lines through the water column to the vessel in Option 5. **Overall, Option 4A is the preferred option from a risk to Operations Personnel perspective.**			
1. Safety	1.2 Legacy Risk	A small legacy risk remains with Option 2A as a single under crossing will remain. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 12.1 / 6,405 / 4.80E-04		The lines remain in-situ with this option although the majority of their length is fully trenched and buried as there are no areas of spans or exposure. Their surface laid line ends will be rock covered to mitigate potential snag hazard. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 13.4 / 7,065 / 5.30E-04	The lines remain in-situ with this option although they are fully trenched and buried as there are no areas of spans or exposure. Their surface laid ends will be removed. The survey & monitoring programme is committed to ensuring that the potential snag hazard from left in-situ infrastructure continues to be managed & mitigated as appropriate. The legacy risk associated with this survey and monitoring programme is: Vessel Type: PoB / Days / Hours / PLL Survey Vessel (Legacy): 44 / 13.4 / 7,054 / 5.29E-04
		S	**S**	**N**	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 2A is assessed as being Stronger than both partial removal options as the potential for future snag risk is reduced as the lines are removed. The crossing that remains in Option 2A shall be left in an overtrawlable condition. Option 4A is assessed as being Neutral to Option 5 as the lines are fully trenched and buried. The introduction of rock berms over the ends of the 2 lines (4 berms) in Option 4A was insufficient to express a preference for Option 5. It is noted that a survey & monitoring programme will be performed to ensure that the as left condition of the partial removal options remains overtrawlable. **Overall, Option 2A is the preferred option from a risk to Other Users perspective.**			
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): 96 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 96 days it is the highest of the options being evaluated.		Vessel Noise (days on-site): 3 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 3 days it is the lowest of the options being evaluated.	Vessel Noise (days on-site): 7 days Tooling noise: 0 days Operational Discharges: Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush and discharges to the marine environment during flushing activities. Cutting of line ends and midline cuts would lead to an elevated discharge of fluids from within the line. However, given the prior cleaning of the line, the concentration and quantity of discharge should still be low overall. Therefore, the related impact is also anticipated to be low. Vessel Discharges: This includes Ballast, Grey and Black Water, this is driven by duration of vessel operations and therefore at 7 days it is similar to Option 4A and much lower than Option 2A.
		W	**W**	**N**	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 2A is assessed as being Weaker than both partial removal options due to a combination of the low impact releases from the cutting of the lines and the noise generated by the extended durations of vessels on site. Option 4A is assessed as being Neutral to Option 5 as the impacts are similar and low for both options. **Overall, Option 4A and Option 5 are equally preferred from an Operational Marine Impact perspective.**			

		O2A - Cut and Lift (Full Removal)		O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
2. Environmental	2.2 Atmospheric Emissions, Fuel & Energy Consumption	Vessel Emissions (in tonnes): Fuel: 3,341 CO2: 10,593 NOx: 198.48 SO2: 13.37 Vessel Energy Use: 143,684 GJ Material Emissions (CO2 in tonnes): Recovered Material: 522 Remaining Material: Total: 522 Energy Use (in GJ): Recovered Material: 6,572 Remaining Material: Rock: N/A		Vessel Emissions (in tonnes): Fuel: 423 CO2: 1,342 NOx: 25.14 SO2: 1.69 Vessel Energy Use: 18,200 GJ Material Emissions (CO2 in tonnes): Recovered Material: Remaining Material: 979 Total: 979 Energy Use (in GJ): Recovered Material: Remaining Material: 12,950 Rock: 2,800 tonnes	Vessel Emissions (in tonnes): Fuel: 555 CO2: 1,761 NOx: 32.99 SO2: 2.22 Vessel Energy Use: 23,881 GJ Material Emissions (CO2 in tonnes): Recovered Material: 10 Remaining Material: 962 Total: 972 Energy Use (in GJ): Recovered Material: 93 Remaining Material: 12,725 Rock: 96 tonnes
		W	**W**	**N**	
	Summary	The assessment of the Atmospheric Emissions, Fuel & Energy Consumptions sub-criterion is as follows: Option 2A is assessed as being Weaker than both partial removal options as the emissions generated and fuel / energy consumed are greater and sufficient to express a small preference for the partial removal options. Option 4A is assessed as being Neutral to Option 5 as the small differences in emissions generated and fuel / energy used were insufficient to express a preference. **Overall, Option 4A and Option 5 are equally preferred from an Atmospheric Emissions, Fuel & Energy Consumptions perspective.**			
2. Environmental	2.3 Seabed Disturbance	Operational Seabed Disturbance: Habitat Loss (Rock Cover): 165,200 m2 Short Term Disturbance (Deburial): 33,040 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Cover): 165,200 m2		Operational Seabed Disturbance: Habitat Loss (Rock Cover): 3,200 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Cover): 3,200 m2	Operational Seabed Disturbance: Habitat Loss (Rock Bags): 85 m2 Short Term Disturbance: 1,400 m2 Legacy Seabed Disturbance: Habitat Loss (Rock Bags): 85 m2
		MW	**MW**	**W**	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Option 2A is assessed as being Much Weaker than both partial removal options due to the impact associated with the deburial operations and the larger area of impact from depositing the existing rock cover along the corridor of the lines. Option 4A is assessed as being Weaker than Option 5 as there is a larger area of habitat loss associated with the rock cover in Option 4A. **Overall, Option 5 is the preferred option from a Seabed Disturbance perspective.**			
2. Environmental	2.4 Legacy Marine Impacts	The legacy marine impact from this full removal option is limited to the impact associated with the survey & monitoring of the single under crossing which remains in-situ. This is expected to be minimal. Vessel Days: Survey Vessel (Legacy): 12.1 Total vessel days: 12.1 days		Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Vessel Days: Survey Vessel (Legacy): 13.4 days	Line cleaning and flushing operations will use Best Environmental Practice (BEP) and the Best Available Techniques (BAT) to minimise as far as possible both residual hydrocarbon and other chemical levels in line post flush. The legacy marine impact from the slow release of these low concentration / quantity discharges is therefore expected to be low overall. Vessel Days: Survey Vessel (Legacy): 13.4 days
		S	**S**	**N**	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 2A is assessed as being Stronger than the partial removal options as removing the lines leaves limited legacy marine impact. The environmental impacts associated with the lines remaining in-situ are expected to be low as any residual contents and degradation products will be released slowly over a long time period. Option 4A is assessed as being Neutral to Option 5 as the environmental impact of the lines remaining in-situ is similar for both options. **Overall, Option 2A is the preferred option from a Legacy Marine Impacts perspective.**			
3. Technical	3.1 Technical Feasibility	Concept is technologically feasible. The scale is considerable and supply chain and assets may require some development to accommodate the option. (Score 2)		Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain and assets may require some development to accommodate the option. (Score 1)	Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain and assets may require some development to accommodate the option. (Score 1)
		W	**W**	**N**	
	Summary	The assessment of the Technical Feasibility sub-criterion is as follows: Option 2A is assessed as being Weaker than both partial removal options as, while the operations conducted for all options are largely routine, there are challenges associated with the deburial of the lines in Option 2A due to the excavation required to gain access to the lines for cutting using hydraulic shears. Option 4A is assessed as being Neutral to Option 5 as the technical challenges are minimal and similar for both options. **Overall, Option 4A and Option 5 are equally preferred from a Technical Feasibility perspective.**			
3. Technical	3.2 Ease of Recovery from Excursion	Recovery is achievable with existing in-field equipment. (Score 1)		Recovery is achievable with existing in-field equipment. (Score 1)	Recovery is achievable with existing in-field equipment. (Score 1)
		N	**N**	**N**	
	Summary	The assessment of the Ease of Recovery from Excursion sub-criterion is as follows: All options are assessed as being Neutral to each other as the ability to recover from an unplanned excursion is considered similar for all options. **Overall, all options are equally preferred from an Ease of Recovery from Excursion perspective.**			
3. Technical	3.3 Use of Proven Technology and Equipment	Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)		Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)	Standard equipment available from multiple suppliers with well documented and proven track record. (Score 1)
		N	**N**	**N**	
	Summary	The assessment of the Use of Proven Technology and Equipment sub-criterion is as follows: All options are assessed as being Neutral to each other as they are delivered using routine operations with equipment that is readily available and has an extensive track record. **Overall, all options are equally preferred from an Use of Proven Technology and Equipment perspective.**			

		O2A - Cut and Lift (Full Removal)		O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)
4. Societal	4.1 Fishing	Short term disruption may occur during operations. Thereafter seabed clear for fishing. (Score 2)		Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock. (Score 2)	Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock. (Score 2)
		N	N	N	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: All options are assessed as being Neutral to each other as, while the lines are removed in Option 2A, the lines are fully trenched and buried under the partial removal options. The introduction of rock berms over the ends of the 2 lines (4 berms) in Option 4A was insufficient to express a preference for the other options. **Overall, all options are equally preferred from a Societal impact on Fishing perspective.**			
4. Societal	4.2 Socio-economic Impacts on Amenities and Communities	Short term impact on communities, positive from an economic perspective. (Score 2) Materials Returned: Steel: 518 tonnes (recyclable) Polymer: 7 tonnes (landfill)		No impact. (Score 1) Materials Returned:	No impact. (Score 1) Materials Returned: Steel: 9 tonnes (recyclable) Polymer: 1 tonnes (landfill)
		N	N	N	
	Summary	The assessment of the Socio-economic Impacts on Amenities and Communities sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there is more useful (recyclable) material returned in Option 2A (steel), this is offset by the significant quantity of material that will be likely to be destined for landfill (polymer). Overall the positive and negative societal impacts were considered to be balanced for all options. **Overall, all options are equally preferred from a Socio-economic Impacts on Amenities and Communities perspective.**			
5. Economic	5.1 Short-term Costs	£14.613 Million		£0.777 Million	£1.389 Million
		MW	MW	N	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 2A is assessed as being Much Weaker than Option 4A as the cost to execute the option is more than 18 times greater or around £14 million more. Option 2A is assessed as Much Weaker than Option 5 as the execution cost is more than 10 times greater or around £13 million more. Option 4A is assessed as being Neutral to Option 5 as while the execution cost for option 5 is around double that of Option 4A, the low cost of both options meant the differential was insufficient to express a preference. **Overall, Option 4A and Option 5 are equally preferred from a Short-term Cost perspective.**			
5. Economic	5.2 Long-term Costs	Surveys: £0.606 Million FLTC: N/A Total Legacy Cost: £0.606 Million		Surveys: £0.669 Million FLTC: N/A Total Legacy Cost: £0.669 Million	Surveys: £0.668 Million FLTC: £0 Million Total Legacy Cost: £0.668 Million
		N	N	N	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there are legacy costs for surveying & monitoring associated with the partial removal options, these are low costs and the differential between these costs and no long-term costs for Option 2A was insufficient to express a preference. **Overall, all options are equally preferred from a Long-term Cost perspective.**			

Appendix E.2 Group 4 Pairwise Comparison Matrices - Safety

1.1 Operations Personnel	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	VMW	MW	8.4%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	VMS	N	S	59.9%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	MS	W	N	31.7%

1.2 Legacy Risk	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	S	S	42.9%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	N	28.6%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	W	N	N	28.6%

Appendix E.3 Group 4 Pairwise Comparison Matrices - Environment

2.1 Operational Marine Impact	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	W	W	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	37.5%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	N	N	37.5%

2.2 Atmospheric Emissions, Fuel & Energy Consumption	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	W	W	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	37.5%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	N	N	37.5%

2.3 Seabed Disturbance	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	MW	MW	14.2%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	MS	N	W	37.1%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	MS	S	N	48.7%

2.4 Legacy Marine Impacts	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	S	S	42.9%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	W	N	N	28.6%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	W	N	N	28.6%

Appendix E.4 Group 4 Pairwise Comparison Matrices – Technical

3.1 Technical Feasibility	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	W	W	25.0%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	S	N	N	37.5%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	S	N	N	37.5%

3.2 Ease of Recovery from Excursion	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

3.3 Use of Proven Technology and Equipment	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

Appendix E.5 Group 4 Pairwise Comparison Matrices - Societal

4.1 Fishing	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

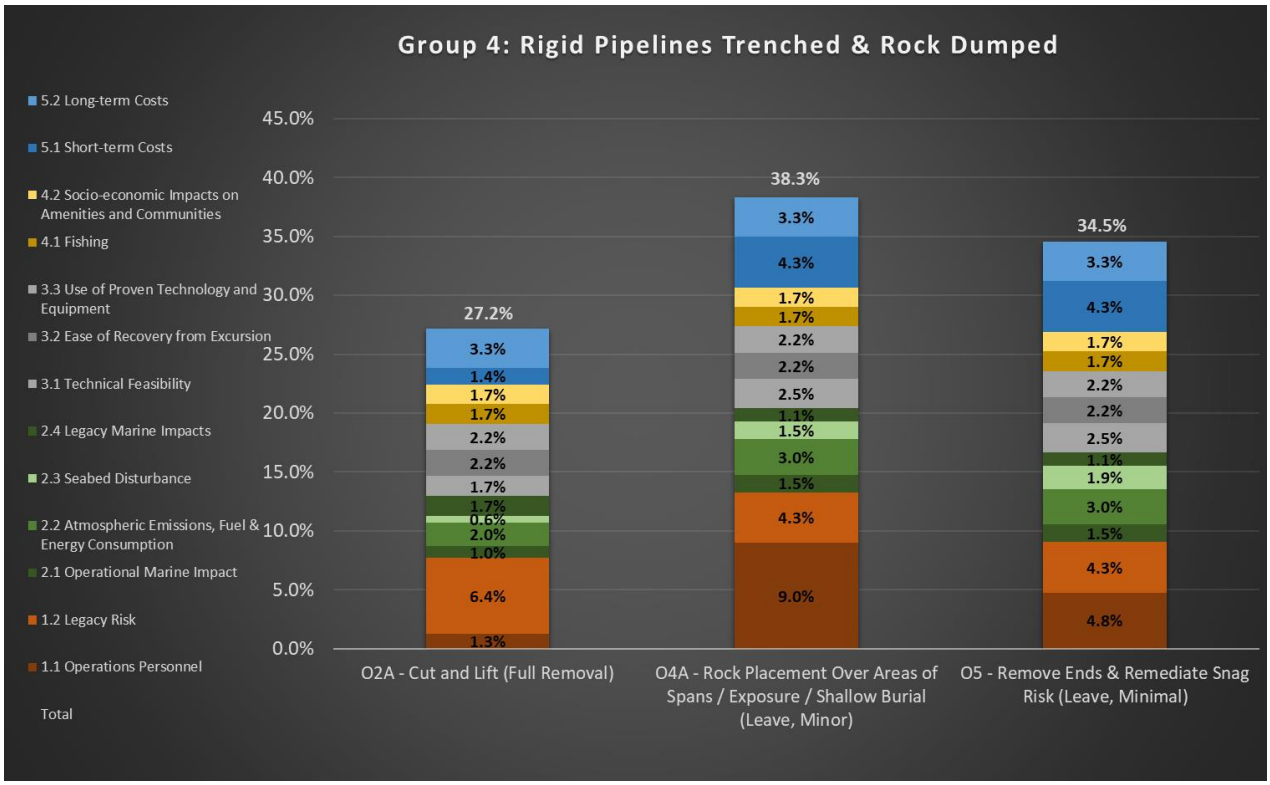
4.2 Socio-economic Impacts on Amenities and Communities	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

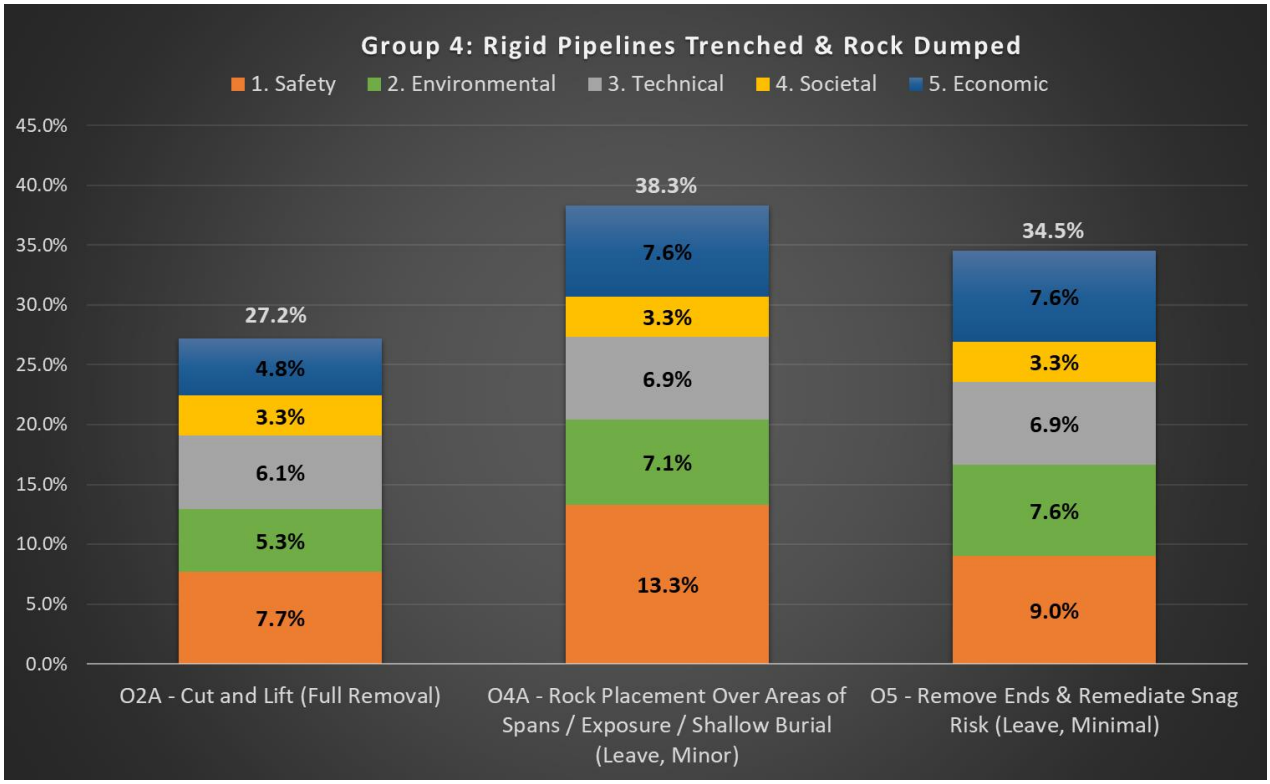
Appendix E.6 Group 4 Pairwise Comparison Matrices - Economic

5.1 Short-term Costs	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	MW	MW	14.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	MS	N	N	42.9%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	MS	N	N	42.9%

5.2 Long-term Costs	O2A - Cut and Lift (Full Removal)	O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	Weighting
O2A - Cut and Lift (Full Removal)	N	N	N	33.3%
O4A - Rock Placement Over Areas of Spans / Exposure / Shallow Burial (Leave, Minor)	N	N	N	33.3%
O5 - Remove Ends & Remediate Snag Risk (Leave, Minimal)	N	N	N	33.3%

Appendix E.7 Group 4 Results Charts





APPENDIX F DECOMMISSIONING METHODOLGIES & DATASHEETS

Appendix F.1 Group 1 – Option 2a

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 1 Option 2A: Full Removal: Cut and Lift with Deburial

	GRAND TOTAL	£33,552,326

	SUB-TOTALS	
100	Offshore Operations	£27,460,096
200	Onshore Operations & Equipment Hire	£551,575
300	Project Services	£4,934,405
400	Long Term Liability	£606,250

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Preparation - Crossings**					
	Mobilise DSV	Day	1.00	DSV	140	140
	Transit to Field (117nm @ 10kts)	Day	0.50	DSV	140	70
	DP Trials	Day	0.17	DSV	140	23
	Dredge Crossings - 200m of 8" Kyle North to Riser Base Prod pipe which crosses over the Fulmar line	Day	1.50	DSV	140	210
	Diver cut of 1 x 200m crossings of the Fulmar lines (28 x 15m sections cut with Diamond Wire Saw - 4hrs/cut)	Day	2.35	DSV	140	329
	Manual rig and recovery of 14 x 15m sections (Bag and tag of NORM positive pipelines & seafastening - 2hrs/pipe)	Day	1.15	DSV	140	161
	Debris Recovery and As Left Surveys	Day	1.00	DSV	140	140
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	DSV	140	70
	Demobilisation of DSV	Day	1.00	DSV	140	140
102	**Pipeline Recovery**					
	Mobilise CSV	Day	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	Day	0.50	CSV	75	38
	DP Trials	Day	0.17	CSV	75	13
	Deburial of 43km of pipeline (273mm to 323mm in diameter) at 30m3/hr using Subsea ROV-Grab (based on 1.5m3/m of pipeline). Note: 200m of 12"Curlew Production line left undisturbed in vicinity where it is crossed by NorthSea Link cables x 2.	Day	90.04	CSV	75	6,753
	Cut 43km of pipeline (273mm to 323mm in diameter) into 15m sections. **Note:** 200m of 12" Curlew Production line left on seabed undisturbed in vicinity where it is crossed by NorthSea Link cables x 2.	Day	60.03	CSV	75	4,502
	Recovery of 15m sections (Bag and tag of NORM positive pipelines & seafastening -45 mins/pipe)	Day	90.04	CSV	75	6,753
	Interim portcalls x 14 for offloading of recovered pipe (2882 lengths of pipe in total at 210 lengths/trip)	Day	28.00	CSV	75	2,100
	Debris Recovery and As Left Surveys	Day	2.00	CSV	75	150
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	CSV	75	38
	Demobilisation of Vessel	Day	1.00	CSV	75	75
						21,779
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	3,185
						3,185
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	2,496
						2,496
SUB-TOTAL Offshore Operations						**27,460**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipe	£k / Te	4,167	-	-0.03	-125
						-125
202	**Equipment Procurement, Hire & Fabrication**					
	Subsea Excavator (ROV-Grab)	Day	93.71	-	5.00	469
	Suction Dredger	Day	11.17		0.95	11
	Hydraulic Shears	Day	5.15		1.50	8
	Pipe Handling Tool	Day	5.15		0.80	4
	Deck Corrals for handling of recovered pipe	£k - LS	1.00	-	75.00	75
	Diamond Wire Cutter	Day	11.17		0.95	11
						577
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**552**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	3,361
						3,361
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	1,373
						1,373
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**4,934**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations - 1 crossings	Day	0.1	Survey Vessel (Legacy)	50	6
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						606
SUB-TOTAL Long Term Liability						**606**

SAFETY				
Offshore Personnel	Number of	186	Man Hours	261,336
Diver Requirement	Number of	18	Man Hours	3,961
Onshore Personnel	Number of	14	Man Hours	180,194
Legacy Risk	Number of	44	Man Hours	6,405
Impact to Other Users of the Sea (operational)	Number of	2	Duration of Operations (Days)	282.5
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	12.13
Operational Risk Offshore	PLL	1.96E-02		
Operational Risk Diver	PLL	3.84E-03		
Operational Risk Onshore	PLL	1.78E-03		
Legacy Risk	PLL	4.80E-04		
Overall Risk	**ΣPLL**	**2.57E-02**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	1	9.2	Dive Ops / Destruct
	CSV	1	273.3	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	12.13	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	8,070	25,581	479	32
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement Ops**
	4,222	0	128,478	0
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	245,020	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	4,168	0	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	0	0	
	Polymer	559	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	2	Concept is technologically feasible. The scale is considerable and supply chain and assets may require some development to accommodate the option.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing.
	Socio-Economic Impacts	2	Short term impact on communities, positive from an economic perspective.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£32.95	M
	Comparative Cost Legacy	£0.61	M
	Comparative Cost Total	£33.55	M

Appendix F.2 Group 1 – Option 4a

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 1: Option 4A - Leave In Situ Rock Cover Exposures

	GRAND TOTAL	£1,797,100

	SUB-TOTALS	
100	Offshore Operations	£367,522
200	Onshore Operations & Equipment Hire	£345,555
300	Project Services	£303,945
400	Long Term Liability	£780,078

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Remedial Rock Placement Over Exposures**					
	Mobilise Vessel	Day	1.00	Rockdump Vessel	45	45
	Transit to Field (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	DP Trials	Day	0.17	Rockdump Vessel	45	8
	As found surveys 1500m/hr	Day	1.20	Rockdump Vessel	45	54
	Rock dump pipeline end transitions, 70m per end	Day	0.47	Rockdump Vessel	45	21
	Rock Placement over exposures - 10 te/m, 23 exposures, 345 m total length	Day	0.14	Rockdump Vessel	45	6
	As Left Surveys	Day	1.00	Rockdump Vessel	45	45
	Transit to Halsvik Quarry (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	Demobilisation of Vessel	Day	1.00	Rockdump Vessel	45	45
						314
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	20
						20
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	33
						33
SUB-TOTAL Offshore Operations						**368**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipe	£k / Te	0.00		-0.03	0
						0
202	**Equipment Procurement, Hire & Fabrication**					
	Rockdump (£k/Te dumped)	£k / Te	14,660		0.02	246
						246
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**346**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	86
						86
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	18
						18
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**304**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	3.6	Survey Vessel (Legacy)	50	180
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						780
SUB-TOTAL Long Term Liability						**780**

SAFETY				
Offshore Personnel	Number of	20	Man Hours	1,675
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	2,976
Legacy Risk	Number of	44	Man Hours	8,242
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	7.0
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	15.61
Operational Risk Offshore	PLL	1.26E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	1.19E-05		
Legacy Risk	PLL	6.18E-04		
Overall Risk	**ΣPLL**	**7.56E-04**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	1	7.0	Rockdump
	DSV	0	0.0	N/A
	CSV	0	0.0	N/A
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	15.61	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	500	1,585	30	2
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement Ops**
	0	7,873	0	104,200
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	14,660	14660 Te	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	0	4,167	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	0	0	
	Polymer	0	559	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	1	Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock.
	Socio-Economic Impacts	1	No impact.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£1.02	M
	Comparative Cost Legacy	£0.78	M
	Comparative Cost Total	£1.80	M

Appendix F.3 Group 1 – Option 4c

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 1: Option 4C - Leave in-situ - Minor Intervention (Remove Areas of Exposures)

	GRAND TOTAL	£4,372,146

	SUB-TOTALS	
100	Offshore Operations	£2,597,826
200	Onshore Operations & Equipment Hire	£293,309
300	Project Services	£676,828
400	Long Term Liability	£804,183

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Cut and Lift Pipelines**					
	Mobilise Vessel	Day	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	Day	0.50	CSV	75	38
	DP Trials	Day	0.17	CSV	75	13
	As found surveys 1500m/hr	Day	1.36	CSV	75	102
	Deburial at product ends/tansitions -16 ends (273mm to 323mm in diameter) at 12hrs/end using					
	Subsea ROV-Grab (based on 1.0m^3/m of pipeline, 70m of pipeline to be deburied and recovered at each end)	Day	8.00	CSV	75	600
	Deburial at exposures using Subsea ROV-Grab 23 exposures - 6hrs each	Day	5.75	CSV	75	431
	Cut product at exposures and recover sections, 110 sections	Day	5.00	CSV	75	375
	As Left Surveys	Day	1.00	CSV	75	75
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	CSV	75	38
	Demobilisation of Vessel	Day	1.00	CSV	75	75
	Spot Rock on Cut Ends					
	Mobilise Vessel	Day	1.00	Rockdump Vessel	45	45
	Transit to Field (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	DP Trials	Day	0.17	Rockdump Vessel	45	8
	As found surveys, 0.5 hours per site	Day	0.48	Rockdump Vessel	45	22
	Rock placement at pipeline cut ends, 24 te/end, 16 ends, 3 hrs/end	Day	2.00	Rockdump Vessel	45	90
	Rock Placement at exposure cut ends - 24 te/end, 46 ends, 3 hrs/end	Day	5.75	Rockdump Vessel	45	259
	As Left Surveys	Day	1.00	Rockdump Vessel	45	45
	Transit to Halsvik Quarry (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	Demobilisation of Vessel	Day	1.00	Rockdump Vessel	45	45
						1,821
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	239
						239
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	236
						236
SUB-TOTAL Offshore Operations						**2,598**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipe	£k / Te	125	-	-0.03	-4
						-4
202	**Equipment Procurement, Hire & Fabrication**					
	Subsea Excavator (ROV-Grab)	Day	26.28	-	5.00	131
	Hydraulic Shears	Day	26.28		1.50	39
	Pipe Grab	Day	26.28		0.05	1
	Rockdump (£k/Te dumped)	£k - LS	1,488		0.02	25
						197
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**293**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	347
						347
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	130
						130
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**677**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	4.1	Survey Vessel (Legacy)	50	204
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						804
SUB-TOTAL Long Term Liability						**804**

SAFETY				
Offshore Personnel	Number of	96	Man Hours	25,359
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	17,025
Legacy Risk	Number of	44	Man Hours	8,496
Impact to Other Users of the Sea (operational)	Number of	2	Duration of Operations (Days)	37.7
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	16.09
Operational Risk Offshore	PLL	1.90E-03		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	1.06E-04		
Legacy Risk	PLL	6.37E-04		
Overall Risk	**ΣPLL**	**2.65E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	1	13.4	Rockdump
	DSV	0	0.0	N/A
	CSV	1	24.3	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	16.09	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**N/A**	**SO2 (Te)**
	1,264	4,007	75	5
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement Ops**
	127	7,637	1375	101,075
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	1,188	168 x 8 Te Tock Bags	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	500	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	125	4,043	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	0	0	
	Polymer	17	543	
	Mattress/Grout Bag	0	0	
	Life Cycle	**Value**		

TECHNICAL			
Technical Considerations	**Use of proven technology and equipment**	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock.
	Socio-Economic Impacts	1	No impact.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£3.57	M
	Comparative Cost Legacy	£0.80	M
	Comparative Cost Total	£4.37	M

Appendix F.4 Group 1 – Option 5

PROJECT	**Banff and Kyle Decommissioning**
CLIENT	**CNRI**
SUBJECT	**Decommissioning Method Statements**
ASSIGNMENT NUMBER	**A400315-S00**
CALCULATION NUMBER	**A-400315-S00-CALC-001**
REVISION	**R02**

Group 1: Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

	GRAND TOTAL	**£4,128,807**

	SUB-TOTALS	
100	**Offshore Operations**	**£2,396,813**
200	**Onshore Operations**	**£311,451**
300	**Project Services**	**£645,132**
400	**Long Term Liability**	**£775,411**

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Pipeline Ends Removal & Rockdump**					
	Mobilise CSV	Day	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	Day	0.50	CSV	75	38
	DP Trials	Day	0.17	CSV	75	13
	Deburial at product ends/tansitions -16 ends (273mm to 323mm in diameter) at 12hrs/end using Subsea ROV-Grab (based on 1.0m^3/m of pipeline, 70m of pipeline to be deburied and recovered at each end)	Day	8.00	CSV	75	600
	Cut 70m of pipeline (273mm to 323mm in diameter) into 15m sections at each of the 16 ends (Each end: 3hrs to deploy/recover shear, 4hrs to make 5 cuts, 2hrs for vessel relocation).	Day	6.00	CSV	75	450
	Recovery of 15m sections (Bag and tag of NORM positive pipelines & seafastening -(45 mins/pipe section)	Day	2.50	CSV	75	188
	Debris Recovery and As Left Surveys	Day	2.00	CSV	75	150
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	CSV	75	38
	Demobilisation of Vessel	Day	1.00	CSV	75	75
102	**Rock Cover Transitions**					
	Mobilise Rock Dump Vessel	Day	1.00	Rockdump Vessel	45	45
	Transit to Field (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	DP Trials	Day	0.17	Rockdump Vessel	45	8
	Rock placement at pipeline cut ends, 24 te/end, 16 ends, 3 hrs/end	Day	2.00	Rockdump Vessel	45	90
	As Left Surveys	Day	1.00	Rockdump Vessel	45	45
	Transit to Halsvik Quarry (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	Demobilisation of Demob of Rock Dump Vessel	Day	1.00	Rockdump Vessel	45	45
						1,948
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	231
						231
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			218
						218
SUB-TOTAL Offshore Operations						**2,397**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipeline	£k / Te	0.00	-	-0.02	0
						0
202	**Equipment Procurement, Hire & Fabrication**					
	Subsea Excavator (ROV-Grab)	Day	23.67	-	5.00	118
	Hydraulic Shears	Day	23.67		1.50	36
	Pipe Grab	Day	23.67		0.05	1
	Deck corrals for handling of recovered pipe	Day	1.00		50.00	50
	Rockdump (£k/Te dumped)	£k - LS	384.00	Rockdump (£k/Te dumped)	0.02	6
						211
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100	100
						100
SUB-TOTAL Onshore Operations						**311**

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	325
						325
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	120
						120
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0.10	-	3.00	0.30
						0
SUB-TOTAL Project Services						**645**

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	3.5	Survey Vessel (Legacy)	50	175
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						775
SUB-TOTAL Long Term Liability						**775**

SAFETY				
Offshore Personnel	Number of	96	Man Hours	21,484
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	15,459
Legacy Risk	Number of	44	Man Hours	8,189
Impact to Other Users of the Sea (operational)	Number of	2	Duration of Operations (Days)	28.8
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	15.51
Operational Risk Offshore	PLL	1.61E-03		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	6.18E-05		
Legacy Risk	PLL	6.14E-04		
Overall Risk	**ΣPLL**	**2.29E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	1	7.2	Rockdump
	DSV	0	0.0	N/A
	CSV	1	21.7	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	15.51	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	1,065	3,375	63	4
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement**
	110	7,669	1188	101,500
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**N/A**	
	Habitat Loss (Rock Cover)	506	384 Te of Rock	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	1,680	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	108.00	4,059.20	
	Aluminium Alloy	0.00	0.00	
	Copper	0.00	0.00	
	Concrete	0.00	0.00	
	Polymer	14.50	544.70	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	1	Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain and assets may require some development to accommodate the option.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock.
	Socio-Economic Impacts	1	No impact.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£3.35	M
	Comparative Cost Legacy	£0.78	M
	Comparative Cost Total	£4.13	M

Appendix F.5 Group 2 – Option 2b

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 2: Option 2B - Full Removal - Reverse Installation (Reel) without Deburial

	GRAND TOTAL	£8,228,369

	SUB-TOTALS	
100	Offshore Operations	£5,539,374
200	Onshore Operations	£823,484
300	Project Services	£1,240,512
400	Long Term Liability	£625,000

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Reverse Reeling Preparation and Execution**					
	Mobilise Vessel	Day	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	Day	0.50	CSV	75	38
	DP Trials	Day	0.17	CSV	75	13
	As found surveys 1500m/hr	Day	1.37	CSV	75	102
	Cut 8" Kyle North to Riser Base Prod line, 4" Banff to Kyle North GL line and Curlew Control Umbilical at either side of crossings (4hrs x 3 - leaving approx 200m x 3 on seabed)	Day	0.50	CSV	75	38
	Initiation of first ends (9 off at 6hrs/end - this includes 3 additional initiations for re-initiating following cut at crossings)	Day	2.25	CSV	75	169
	Recovery of 6 off products totaling 49km at 150m/hr (utilising tensioner and carousel). Note: 200m of Curlew Control Umbilical left undisturbed in vicinity where it is crossed by NorthSea Link cables x 2.	Day	13.61	CSV	75	1,021
	Interim portcalls x 5 for offloading of recovered product (44hrs/portcall, 7.5k of product on carousel)	Day	9.17	CSV	75	688
	Debris Recovery and As Left Surveys to determine requirement for further remediation (any areas of potential snag risk/ berms will be over trawled and remediated at a later date if required- the overtrawl footprint would be within the footprint of the line) excavation activity	days	3.00	CSV	75	225
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	CSV	75	38
	Demobilisation of Vessel	Day	1.00	CSV	75	75
102	**Remove Crossing (at a later date)**					
	Mobilise DSV	Day	1.00	DSV	140	140
	Transit to Field (117nm @ 10kts)	Day	0.50	DSV	140	70
	DP Trials	Day	0.17	DSV	140	23
	Dredge Crossings - 200m of 8" Kyle North to Riser Base Prod pipe and 200m of 4" Banff to Kyle North GL	Day	3.00	DSV	140	420
	Diver cut of 2 x 200m crossings of the Fulmar lines (28 x 15m sections cut with Diamond Wire Saw -	Day	4.70	DSV	140	658
	Manual rig and recovery of 28 x 15m sections (Bag and tag of NORM positive pipelines & seafastening - 2h	Day	2.30	DSV	140	322
	Debris Recovery and As Left Surveys	Day	1.00	DSV	140	140
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	DSV	140	70
	Demobilisation of DSV	Day	1.00	DSV	140	140
						4,463
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	573
						573
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			504
						504
SUB-TOTAL Offshore Operations						**5,539**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Flexibles / Umbilicals / Cables	£k / Te	1093.88	-	0.35	383
						383
202	**Equipment Procurement, Hire & Fabrication**					
	Deck Reel / Reel Drive System / Tensioner	Day	34.06	-	10.00	341
						341
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations						**823**

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	764
						764
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	277
						277
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0.00	-	3	0
						0
SUB-TOTAL Project Services						**1,241**

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	0.5	Survey Vessel (Legacy)	50	25
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						625
SUB-TOTAL Long Term Liability						**625**

SAFETY				
Offshore Personnel	Number of	186	Man Hours	48,864
Diver Requirement	Number of	18	Man Hours	6,121
Onshore Personnel	Number of	14	Man Hours	38,310
Legacy Risk	Number of	44	Man Hours	6,600
Impact to Other Users of the Sea (operational)	Number of	2	Duration of Operations (Days)	47.2
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	12.5
Operational Risk Offshore	PLL	3.66E-03		
Operational Risk Diver	PLL	5.94E-03		
Operational Risk Onshore	PLL	4.35E-04		
Legacy Risk	PLL	4.95E-04		
Overall Risk	**ΣPLL**	**1.05E-02**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	1	14.2	Dive Ops / Destruct
	CSV	1	33.1	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	12.5	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**N/A**	**SO2 (Te)**
	1,453	4,607	86	6
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement Ops (GJ)**
	601	0	11,791	0
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**N/A**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	98,330	Reverse Install	
	Short Term Disturbance	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	531	0	
	Aluminium Alloy	0	0	
	Copper	132	0	
	Concrete	0	0	
	Polymer	430	0	
	Mattress/Grout Bag	0	0	
	Life Cycle	**Value**		
	Disposal Time	43 days		
	Persistence	Hundreds of years		

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	1	Concept is technologically feasible. The scale is comparable with similar scopes completed.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing.
	Socio-Economic Impacts	2	Short term impact on communities, positive from an economic perspective.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£7.60	M
	Comparative Cost Legacy	£0.63	M
	Comparative Cost Total	£8.23	M

Appendix F.6 Group 2 – Option 4a

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 1: Option 4A - Leave In Situ Rock Cover Exposures

	GRAND TOTAL	£1,840,037

	SUB-TOTALS	
100	Offshore Operations	£484,486
200	Onshore Operations & Equipment Hire	£240,700
300	Project Services	£311,247
400	Long Term Liability	£803,604

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Remedial Rock Placement Over Exposures**					
	Mobilise Vessel	Day	1.00	Rockdump Vessel	45	45
	Transit to Field (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	DP Trials	Day	0.17	Rockdump Vessel	45	8
	As found surveys 1500m/hr	Day	1.37	Rockdump Vessel	45	61
	Rock Placement over 12 pipeline ends (70m at each end 5hrs duration - 10Te/m = 6m3/m approx)	Day	2.50	Rockdump Vessel	45	113
	As Left Surveys	Day	1.00	Rockdump Vessel	45	45
	Transit to Halsvik Quarry (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	Demobilisation of Vessel	Day	1.00	Rockdump Vessel	45	45
						406
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	34
						34
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	44
						44
SUB-TOTAL Offshore Operations						**484**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Flexibles / Umbilicals / Cables	£k / Te	0.00	-	0.35	0
						0
202	**Equipment Procurement, Hire & Fabrication**					
	Rockdump (£k/Te dumped)	£k - LS	8400.00		0.02	141
						141
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**241**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	87
						87
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	24
						24
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**311**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	4.1	Survey Vessel (Legacy)	50	204
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						804
SUB-TOTAL Long Term Liability						**804**

SAFETY				
Offshore Personnel	Number of	20	Man Hours	2,170
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	3,526
Legacy Risk	Number of	44	Man Hours	8,490
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	9.0
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	16.08
Operational Risk Offshore	PLL	1.63E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	1.41E-05		
Legacy Risk	PLL	6.37E-04		
Overall Risk	**ΣPLL**	**8.14E-04**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	1	9.0	Rockdump
	DSV	0	0.0	N/A
	CSV	0	0.0	N/A
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	16.08	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	551	1,745	33	2
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement Ops**
	5	1,937	61	26,300
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	8,400	8400 Te	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**N/A**	
	Steel	3	528	
	Aluminium Alloy	0	0	
	Copper	1	131	
	Concrete	0	0	
	Polymer	3	N/A	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	1	Concept is technologically feasible. The scale is comparable with similar scopes completed.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed generally clear for fishing, small amount of additional rock profiled to accommodate trawling.
	Socio-Economic Impacts	1	No impact on communities.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£1.04	M
	Comparative Cost Legacy	£0.80	M
	Comparative Cost Total	£1.84	M

Appendix F.7 Group 2 – Option 5

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 1: Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

	GRAND TOTAL	£3,568,923

	SUB-TOTALS	
100	Offshore Operations	£1,851,618
200	Onshore Operations	£354,867
300	Project Services	£557,584
400	Long Term Liability	£804,854

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Pipeline Ends Removal & Remediation**					
	Mobilise CSV	Day	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	Day	0.50	CSV	75	38
	DP Trials	Day	0.17	CSV	75	13
	As found surveys 1500m/hr	Day	1.37	CSV	75	102
	Deburial at product ends/tansitions -12 ends at 12hrs/end using Subsea ROV-Grab (based on 1.0m^3/m of pipeline, 70m of pipeline to be deburied and recovered at each end)	Day	6.00	CSV	75	450
	Cut 70m of pipeline into 15m sections at each of the 12 ends (Each end: 3hrs to deploy/recover shear, 4hrs to make 5 cuts, 2hrs for vessel relocation).	Day	4.50	CSV	75	338
	Recovery of 15m sections (Bag and tag of NORM positive pipelines & seafastening - 45mins/pipe section)	Day	1.88	CSV	75	141
	Remediate with rock bags pipeline cut ends - 16Te/end at 2hrs/end (2 x 8Te Rock Bags at 10m^3 approx)	Day	1.00	CSV	75	75
	Debris Recovery and As Left Surveys	Day	2.00	CSV	75	150
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	CSV	75	38
	Demobilisation of Vessel	Day	1.00	CSV	75	75
						1,493
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	190
						190
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			168
						168
SUB-TOTAL Offshore Operations						**1,852**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Flexibles / Umbilicals / Cables	£k / Te	18.69	-	0.35	7
						7
202	**Equipment Procurement, Hire & Fabrication**					
	Subsea Excavator (ROV-Grab)	Day	21.91	-	5.00	110
	Hydraulic Shears	Day	21.91		1.50	33
	Pipe Handling Tool	Day	21.91		0.80	18
	Deck corrals for handling recovered pipe	Day	1.00		50.00	50
	Rock Bags (8Te)	£k - LS	24	-	1.60	38
						248
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100	100
						100
SUB-TOTAL Onshore Operations						**355**

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	265
						265
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	93
						93
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0.08	-	3.00	0.23
						0.23
SUB-TOTAL Project Services						**558**

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	4.1	Survey Vessel (Legacy)	50	205
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						805
SUB-TOTAL Long Term Liability						**805**

SAFETY				
Offshore Personnel	Number of	76	Man Hours	18,158
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	1,558
Legacy Risk	Number of	44	Man Hours	8,501
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	19.9
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	16.1
Operational Risk Offshore	PLL	1.36E-03		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	6.35E-06		
Legacy Risk	PLL	6.38E-04		
Overall Risk	**ΣPLL**	**2.01E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	19.9	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	16.1	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	947	3,001	56	4
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement**
	11	1,919	155	26,050
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	254	24 x 8Te rock bags	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	4,200	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	9	522	
	Aluminium Alloy	0	0	
	Copper	2	130	
	Concrete	0	0	
	Polymer	7	423	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	1	Concept is technologically feasible. The scale is comparable with similar scopes completed.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing, small amount of rock on pipeline ends, profiled to accommodate trawling.
	Socio-Economic Impacts	1	No impact on communities.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£2.76	M
	Comparative Cost Legacy	£0.80	M
	Comparative Cost Total	£3.57	M

Appendix F.8 Group 4 – Option 2a

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 4 Option 2A: Full Removal: Cut and Lift with Deburial

	GRAND TOTAL	**£15,218,950**

	SUB-TOTALS	
100	**Offshore Operations**	**£11,422,349**
200	**Onshore Operations & Equipment Hire**	**£936,207**
300	**Project Services**	**£2,254,144**
400	**Long Term Liability**	**£606,250**

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Preparation - Crossings**					
	Mobilise DSV	Day	1.00	DSV	140	140
	Transit to Field (117nm @ 10kts)	Day	0.50	DSV	140	70
	DP Trials	Day	0.17	DSV	140	23
	Dredge Crossings - 200m of 4" Banff to Kyle North Gas pipe which crosses beneath the Fulmar line	Day	1.50	DSV	140	210
	Diver cut of 1 x 200m crossings of the Fulmar lines (28 x 15m sections cut with Diamond Wire Saw - 4hrs/cut)	Day	2.35	DSV	140	329
	Manual rig and recovery of 14 x 15m sections (Bag and tag of NORM positive pipelines & seafastening - 2hrs/pipe)	Day	1.15	DSV	140	161
	Debris Recovery and As Left Surveys	Day	1.00	DSV	140	140
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	DSV	140	70
	Demobilisation of DSV	Day	1.00	DSV	140	140
101	**Cut and Lift Pipelines**					
	Mobilise CSV	Day	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	Day	0.50	CSV	75	38
	DP Trials	Day	0.17	CSV	75	13
	As found surveys 1500m/hr	Day	0.46	CSV	75	34
	Deburial of 16.52 km of pipeline (114.3mm and 168.3mm in diameter) at 30m3/hr using Subsea ROV-Grab (based on 1.5m3/m of pipeline)	Day	34.42	CSV	75	2,581
	Cut 16.52 km of pipeline (114.3mm and 168.3mm in diameter) into 15m sections	Day	22.94	CSV	75	1,721
	Recovery of 15m sections (Bag and tag of NORM positive pipelines & seafastening -45 mins/pipe)	Day	34.42	CSV	75	2,581
	Interim portcalls x 3 for offloading of recovered pipe (634 lengths of pipe in total at ~320 lengths/trip)	Day	6.00	CSV	75	450
	Debris Recovery and As Left Surveys to determine requirement for further remediation (any areas of potential snag risk/ berms will be over trawled and remediated at a later date if required- the overtrawl footprint would be within the footprint of the line) excavation activity	Day	3.00	CSV	75	225
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	CSV	75	38
	Demobilisation of Vessel	Day	1.00	CSV	75	75
						9,114
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	1,270
						1,270
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	1,038
						1,038
SUB-TOTAL Offshore Operations						**11,422**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipe	£k / Te	517.98	-	-0.03	-16
						-16
202	**Equipment Procurement, Hire & Fabrication**					
	Subsea Excavator (ROV-Grab)	Day	106.40	-	5.00	532
	Hydraulic Shears	Day	106.40		1.50	160
	Pipe Handling Tool	Day	106.40		0.80	85
	Deck Corrals for handling of recovered pipe	£k - LS	1.00	-	75.00	75
						852
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**936**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	1,483
						1,483
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	571
						571
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**2,254**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations - 1 crossings	Day	0.1	Survey Vessel (Legacy)	50	6
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						606
SUB-TOTAL Long Term Liability						**606**

SAFETY				
Offshore Personnel	Number of	186	Man Hours	107,326
Diver Requirement	Number of	18	Man Hours	3,961
Onshore Personnel	Number of	14	Man Hours	73,790
Legacy Risk	Number of	44	Man Hours	6,405
Impact to Other Users of the Sea (operational)	Number of	2	Duration of Operations (Days)	113.6
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	12.13
Operational Risk Offshore	PLL	8.05E-03		
Operational Risk Diver	PLL	3.84E-03		
Operational Risk Onshore	PLL	4.32E-04		
Legacy Risk	PLL	4.80E-04		
Overall Risk	**ΣPLL**	**1.28E-02**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	1	9.2	Dive Ops / Destruct
	CSV	1	104.4	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	12.13	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	3,342	10,593	199	13
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement Ops**
	522	0	6,572	0
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	165,200	Existing rock redistributed	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	33,040	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	518	0	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	0	0	
	Polymer	6.5	0	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	2	Concept is technologically feasible. The scale is considerable and supply chain and assets may require some development to accommodate the option.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing.
	Socio-Economic Impacts	2	Short term impact on communities, positive from an economic perspective.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£14.61	M
	Comparative Cost Legacy	£0.61	M
	Comparative Cost Total	£15.22	M

Appendix F.9 Group 4 – Option 4a

PROJECT	**Banff and Kyle Decommissioning**
CLIENT	**CNRI**
SUBJECT	**Decommissioning Method Statements**
ASSIGNMENT NUMBER	**A400315-S00**
CALCULATION NUMBER	**A-400315-S00-CALC-001**
REVISION	**R02**

Group 4: Option 4A - Leave In Situ Rock Cover Exposures

	GRAND TOTAL	**£1,445,439**

	SUB-TOTALS	
100	**Offshore Operations**	**£352,204**
200	**Onshore Operations & Equipment Hire**	**£146,900**
300	**Project Services**	**£277,503**
400	**Long Term Liability**	**£668,833**

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Remedial Rock Placement Over Pipeline Ends**					
	Mobilise Vessel	Day	1.00	Rockdump Vessel	45	45
	Transit to Field (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	DP Trials	Day	0.17	Rockdump Vessel	45	8
	As found surveys 1500m/hr	Day	0.46	Rockdump Vessel	45	21
	Rock Placement over 4 pipeline ends (70m at each end 5hrs duration - 10Te/m = 6m3/m approx)	Day	0.83	Rockdump Vessel	45	37
	3 Relocations (2hr/relocation)	Day	0.25	Rockdump Vessel	45	11
	As Left Surveys	Day	1.00	Rockdump Vessel	45	45
	Transit to Halsvik Quarry (238nm @ 10kts)	Day	1.00	Rockdump Vessel	45	45
	Demobilisation of Vessel	Day	1.00	Rockdump Vessel	45	45
						302
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	18
						18
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	32
						32
SUB-TOTAL Offshore Operations						**352**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipe	£k / Te	0.00		-0.03	0
						0.00
202	**Equipment Procurement, Hire & Fabrication**					
	Rockdump (£k/Te dumped)	£k - LS	2800.00		0.02	47
						47
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**147**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	60
						60
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	18
						18
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0	-	3.00	0
						0
SUB-TOTAL Project Services						**278**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	1.4	Survey Vessel (Legacy)	50	69
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						669
SUB-TOTAL Long Term Liability						**669**

SAFETY				
Offshore Personnel	Number of	20	Man Hours	1,610
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	2,513
Legacy Risk	Number of	44	Man Hours	7,065
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	6.7
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	13.38
Operational Risk Offshore	PLL	1.21E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	1.01E-05		
Legacy Risk	PLL	5.30E-04		
Overall Risk	**ΣPLL**	**6.61E-04**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	1	6.7	Rockdump
	DSV	0	0.0	N/A
	CSV	0	0.0	N/A
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	13.38	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	423	1,342	25	2
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement Ops**
	0	979	0	12,950
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	2,800	2,800 Te Rock	
	Habitat Loss (Rock Bags)	N/A	N/A	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	N/A	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	0	518	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	0	0	
	Polymer	0	6.5	
	Mattress/Grout Bag	0	0	

N/A

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	1	Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain and assets may require some development to accommodate the option.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock.
	Socio-Economic Impacts	1	No impact.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£0.78	M
	Comparative Cost Legacy	£0.67	M
	Comparative Cost Total	£1.45	M

Appendix F.10 Group 4 – Option 5

PROJECT	Banff and Kyle Decommissioning
CLIENT	CNRI
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	A400315-S00
CALCULATION NUMBER	A-400315-S00-CALC-001
REVISION	R02

Group 4: Option 5 - Leave in-situ - Minimal Intervention (Remove Ends & Remediate Snag Risk)

	GRAND TOTAL	£2,056,884

	SUB-TOTALS	
100	Offshore Operations	£824,424
200	Onshore Operations	£200,519
300	Project Services	£364,274
400	Long Term Liability	£667,667

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**Pipeline Ends Removal & Remediation**					
	Mobilise CSV	Day	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	Day	0.50	CSV	75	38
	DP Trials	Day	0.17	CSV	75	13
	As found surveys 1500m/hr	Day	0.46	CSV	75	34
	Deburial at product ends/transitions - 4 ends at 12hrs/end using Subsea ROV-Grab (based on 1.0m^3/m on product, 70m of product to be deburied and recovered at each end)	Day	2.00	CSV	75	150
	Cut 70m of pipeline into 15m sections at each of the 4 ends (Each end: 3hrs to deploy/recover shear, 4hrs to make 5 cuts, 2hrs for vessel relocation).	Day	1.50	CSV	75	113
	Recovery of 15m sections (Bag and tag of NORM positive pipelines & seafastening -45 mins/pipe section)	Day	0.63	CSV	75	47
	Remediate with rock bags pipeline cut ends - 16Te/end at 2hrs/end (2 x 8Te Rock Bags at 10m^3 approx)	Day	0.33	CSV	75	25
	Debris Recovery and As Left Surveys	Day	1.00	CSV	75	75
	Transit to Peterhead (117nm @ 10kts)	Day	0.50	CSV	75	38
	Demobilisation of Vessel	Day	1.00	CSV	75	75
						681
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	68
						68
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%			75
						75
SUB-TOTAL Offshore Operations						824

ITEM	Onshore Operations & Equipment Hire	Unit	QTY		Rate £k	Total £k
201	**Recycling & Disposal**					
	Rigid Steel Pipe	£k / Te	8.78	-	-0.03	0
						0
202	**Equipment Procurement, Hire & Fabrication**					
	Subsea Excavator (ROV-Grab)	Day	11.08	-	5.00	55
	Hydraulic Shears	Day	11.08		1.50	17
	Pipe Handling Tool	Day	11.08		0.80	9
	Deck Winches	Day	22.16		0.20	4
	Subsea Basket	Day	22.16		0.12	3
	Rock Bags (8Te)	£k - LS	8	-	1.60	13
						101
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100	100
						100
SUB-TOTAL Onshore Operations						201

ITEM	Project Services	Unit	QTY		Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	123
						123
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	41
						41
304	**FLTC Legacy Cost**					
	UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	0.02	-	3.00	0.06
						0.06
SUB-TOTAL Project Services						364

ITEM	Long Term Liability	Unit	QTY		Rate £k	Total £k
401	**Long Term Liability Surveys**	**No. Off**	**3**			
	Mob / Demob	Day	6.0	Survey Vessel (Legacy)	50	300
	Transit to Field	Day	3.0	Survey Vessel (Legacy)	50	150
	Survey Operations (1500 m/hr)	Day	1.4	Survey Vessel (Legacy)	50	68
	Transit to Shore	Day	3.0	Survey Vessel (Legacy)	50	150
						668
SUB-TOTAL Long Term Liability						668

SAFETY				
Offshore Personnel	Number of	76	Man Hours	8,290
Diver Requirement	Number of	0	Man Hours	0
Onshore Personnel	Number of	14	Man Hours	5,561
Legacy Risk	Number of	44	Man Hours	7,054
Impact to Other Users of the Sea (operational)	Number of	1	Duration of Operations (Days)	9.1
Impact to Other Users of the Sea (Legacy)	Number of	1	Duration of Operations (Days)	13.36
Operational Risk Offshore	PLL	6.22E-04		
Operational Risk Diver	PLL	0.00E+00		
Operational Risk Onshore	PLL	2.99E-05		
Legacy Risk	PLL	5.29E-04		
Overall Risk	**ΣPLL**	**1.18E-03**		

ENVIRONMENTAL				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel	0	0.0	N/A
	Trenching Vessel	0	0.0	N/A
	Rockdump Vessel	0	0.0	N/A
	DSV	0	0.0	N/A
	CSV	1	9.1	Unburial / Destruct
	Reel Vessel	0	0.0	N/A
	Trawler	0	0.0	N/A
Marine Impact (Vessel Legacy)	**Vessel Type**	**Number off**	**Duration (Days)**	**Activity**
	Survey Vessel (Legacy)	1	13.36	Survey
	Rockdump Vessel (Legacy)	0	0	N/A
Energy Use (Total = Ops + Legacy)	**Fuel (Te)**	**CO2 (Te)**	**Nox (Te)**	**SO2 (Te)**
	555	1,761	33	2
Life Cycle Emissions (Disposal / Replacement of Material)	**CO2 - Disposal Ops (Te)**	**CO2 - Replacement Ops (Te)**	**Energy - Disposal Ops (GJ)**	**Energy - Replacement**
	10	962	93	12,725
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Habitat Loss (Rock Cover)	N/A	N/A	
	Habitat Loss (Rock Bags)	85	12 x 8 Te Rock Bags	
	Short Term Disturbance (Trench and Bury)	N/A	N/A	
	Short Term Disturbance (Reverse Installation w/o Deburial)	N/A	N/A	
	Short Term Disturbance	1,400	N/A	
Materials	**Material**	**Recovered Weight (Te)**	**Remaining Weight (Te)**	
	Steel	9	509	
	Aluminium Alloy	0	0	
	Copper	0	0	
	Concrete	0	0	
	Polymer	0.1	6.3	
	Mattress/Grout Bag	0	0	

TECHNICAL			
	Sub-Criterion	**Scoring**	**Comments**
Technical Considerations	**Technical Feasibility**	1	Concept is technologically feasible. The scale is minimal and easily accommodated by existing supply chain and assets may require some development to accommodate the option.
	Ease of Recovery from Excursion	1	Recovery is achievable with existing in-field equipment.
	Use of proven technology and equipment	1	Standard equipment available from multiple suppliers with well documented and proven track record.

SOCIETAL			
	Sub-Criterion	**Scoring**	**Comments**
Societal Factors	**Fishing**	2	Short term disruption may occur during operations. Thereafter seabed clear for fishing with small amount of additional rock.
	Socio-Economic Impacts	1	No impact.

ECONOMIC			
Economic Considerations	**Comparative Cost Operational**	£1.39	M
	Comparative Cost Legacy	£0.67	M
	Comparative Cost Total	£2.06	M

Appendix F.11 Group 8 – Option 2c

PROJECT	Banff and Kyle Decommissioning
CLIENT	Teekay Petrojarl Floating Production
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	
CALCULATION NUMBER	BFD-P3-TKC-CAL-0001
REVISION	B1

Group 8 Option 2C - Full Removal: Reverse Installation with De-burial

	GRAND TOTAL	£9,236,196

	SUB-TOTALS	
100	Offshore Operations	£4,473,072
200	Onshore Operations & Equipment Hire	£3,395,270
300	Project Services	£1,367,855
400	Long Term Liability	£0

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**STL Pile Decommissioning**					
	Mobilise CSV (Inc. day for additional seafastening / bumper bars required)	days	3.00	CSV	75	225
	Transit to Field (117nm @ 10kts)	days	0.50	CSV	75	38
	DP Trials	days	0.17	CSV	75	13
	Dredge/Excavate to create a 15-20m Radius pit around pile - 25m^3 grab performing 400m^3/hr for ~25,000m^3 per pile using Deep Water Excavator Grab and dredging systems - 4 piles	days	10.00	CSV	75	750
	Lift Clamp/Rigging Arrangement Deployment and Installation - 4 piles at 2hr/pile	days	0.33	CSV	75	25
	Pile lifting, upending and recovery to deck - 4 piles at 4hrs/pile	days	0.66	CSV	75	50
	Interim Port Call x 1 (offload 4 x Recovered Piles)	days	1.50	CSV	75	113
	Dredge/Excavate to create a 15-20m Radius pit around pile - 25m^3 grab performing 400m^3/hr for ~25,000m^3 per pile using Deep Water Excavator Grab and dredging systems - 4 piles	days	10.00	CSV	75	750
	Lift Clamp/Rigging Arrangement Deployment and Installation - 4 piles at 2hr/pile	days	0.33	CSV	75	25
	Pile lifting, upending and recovery to deck - 4 piles at 4hrs/pile	days	0.66	CSV	75	50
	Conduct excavation back-filling operation using the Deep Water Excavator Grab to replace soil.	days	20.00	CSV	75	1,500
						3,536
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	530
						530
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	407
						407
SUB-TOTAL Offshore Operations						**4,473**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Steel	£k / Te	741.00	-	-0.03	-22
						-22
202	**Equipment Procurement, Hire & Fabrication**					
	Pile Recovery Cradle Fabrication	LS	4.00		50.00	200
	Subsea Jetter/Dredging Tool	£k / Day	50.00	-	0.9	43
	Deep Water Excavator Grab	£k / Day	50.00	-	20.00	1,000
	Pile Lifting Clamp	£k / Day	50.00		1.5	75
	Rock Dump	£k / Te	200000.00	-	0.02	4,000
						1,318
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**3,395**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	944
						944
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	224
						224
SUB-TOTAL Project Services						**1,368**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	-	-	-			
						0
SUB-TOTAL Long Term Liability						**0**

Appendix F.12 Group 8 – Option 5

PROJECT	Banff and Kyle Decommissioning
CLIENT	Teekay Petrojarl Floating Production
SUBJECT	Decommissioning Method Statements
ASSIGNMENT NUMBER	
CALCULATION NUMBER	BFD-P3-TKC-CAL-0001
REVISION	B1

Group 8 Option 5 - Partial Removal of the Piles to -3.0m

	GRAND TOTAL	£1,739,162

	SUB-TOTALS	
100	Offshore Operations	£1,003,493
200	Onshore Operations & Equipment Hire	£325,960
300	Project Services	£409,709
400	Long Term Liability	£0

ITEM	Offshore Operations	Unit	QTY	Vessel	Rate £k	Total £k
101	**STL Pile Decommissioning**					
	Mobilise CSV	days	1.00	CSV	75	75
	Transit to Field (117nm @ 10kts)	days	0.50	CSV	75	38
	DP Trials	days	0.17	CSV	75	13
	Dredge out pile internal soil - 8 piles at 12hrs/pile using Subsea Jetter/Dredging tool (based on 2.5m^3/m soil within the pile therefore 3.5m (8.75m^3) required per pile to allow cutting tool access)	days	4.00	CSV	75	300
	Cut each of the 8 piles 3m below seabed (4hrs/end. Cuting: 5.6m circumference @ 50mm/min)	days	1.33	CSV	75	100
	Recovery of the 8 x 3m pile sections to deck (sections to be lifted from seabed with internal clamp and recovered to deck in debris baskets)	days	1.00	CSV	75	75
	Lift and tension remaining 8 pile anchor chain and DWS/shear cut chain links at the seabed. Recover chain to deck	days	1.33	CSV	75	100
	As Left Surveys (all 8 pile locations)	days	0.25	CSV	75	19
	Transit to Peterhead (117nm @ 10kts)	days	0.50	CSV	75	38
	Demobilisation of Vessel	days	0.50	CSV	75	38
						793
110	**Offshore weather allowance**					
	Offshore weather allowance	£k (LS)	15%	-	-	119
						119
120	**Decommissioning Contractors Engineering and Management**					
	Based on 10% of total cost	£k (LS)	10%	-	-	91
						91
SUB-TOTAL Offshore Operations						**1,003**

ITEM	Onshore Operations & Equipment Hire	Unit	QTY	Vessel	Rate £k	Total £k
201	**Recycling & Disposal**					
	Steel	£k / Te	60.00	-	-0.03	-2
						-2
202	**Equipment Procurement, Hire & Fabrication**					
	Subsea Jetter/Dredging Tool	£k / Day	13.00	-	0.85	11
	Abraisive water jet cutter spread (tool, downline, pumps, hose reel, grit storage/return tanks)	£k / Day	13.00	-	15.00	195
	Diamond Wire Saw / Shear Cutter (chains)	£k / Day	13.00	-	0.95	12
	Debris Baskets x 6	£k / Day	13.00	-	0.72	9
						228
203	**Miscellaneous**					
	Misc. Onshore Costs (Port charges, storage etc.)	LS	1	-	100.00	100
						100
SUB-TOTAL Onshore Operations & Equipment Hire						**326**

ITEM	Project Services	Unit	QTY	Vessel	Rate £k	Total £k
301	**Owner Project Management Costs**					
	Project Management / Supervision / Owner Costs	LS	12%	-	-	160
						160
302	**3rd Party Verification**					
	3rd Party Verification	LS	1	-	200.00	200
						200
303	**Insurance**					
	Insurance	LS	5%	-	-	50
						50
SUB-TOTAL Project Services						**410**

ITEM	Long Term Liability	Unit	QTY	Vessel	Rate £k	Total £k
401	-	-	-			
						0
SUB-TOTAL Long Term Liability						**0**

Appendix F.13 Estimate Basis

Vessel Rates	Unit	Rate £k
Survey Vessel	£k/day	50
Trenching Vessel	£k/day	150
Rockdump Vessel	£k/day	45
Rockdump (£k/Te dumped)	£k/Te	0.02
Rock Bags (8Te)	Each	1.60
DSV	£k/day	140
CSV	£k/day	75
Reel Vessel	£k/day	140
Trawler	£k/day	5
Survey Vessel (Legacy)	£k/day	50
Cargo Barge/Pipehaul	£k/day	90
Tug	£k/day	15

Equipment Rates	Unit	Rate £k
Suction Dredger	£k/day	0.95
Mass Flow Excavator (MFE)	£k/day	0.90
Mechanical / Jet Trencher	£k/day	2.50
Hydraulic Shears	£k/day	1.50
Diamond Wire Cutter	£k/day	0.95
Pipe Handling Tool	£k/day	0.80
Speed Loaders Hire	£k/day	0.04
Speed Loader Rigging	Each	0.24
Pipe Grab	£k/day	0.05
Subsea Basket	£k/day	0.12
Deck Corrals for handling of recovered pipe	£k - LS	
Deck Reel / Reel Drive System / Tensioner	£k/day	10.00
Subsea Excavator (ROV-Grab)	£k/day	5.00
Note: Equipment costs do not account for qualified technicians required to operate the equipment.		

Offshore Operations	Unit	Value
All Operations		
Mob / Demob	day	2
Transit to Field	day	1
DP trials	hour	4
Transit to Shore	day	1
Interim trips (inc. transits and mob / demob)	day	3
Trip duration	day	28
Interfield transits	hour	4

Suction Dredger Operations		
Allowance for deburial of pipeline section required to be cut	hour	1
Mass Flow Excavating Operations		
Deburial of trenched and buried line using MFE (whole length)	m / hour	100
Allowance for deburial of pipeline section required to be cut	hour	2
Time required to deploy / retrieve MFE equipment	hour	1
Number of passes required for fully buried / rock covered sections	QTY	3
Number of passes required for partially buried / rock covered sections	QTY	2
Remedial Trenching Operation		
Time required for jet trenching and burying exposure (only applies to trenching and burying exposure spots)	hour	1
Time required to deploy / retrieve and set up jet trenching equipment	hour	2
Time required to reposition jet trenching equipment	hour	1
Time required for jet trenching surface laid lines	m / hour	200
Time required for backfilling surface laid lines	m / hour	225
Length of trench transitions	m	50
Length of trench run in / out	m	30
Cutting and Lifting Operations		
Section length to be cut - Hydraulic Shears	m	15
Section length to be cut - Diamond Wire Saw	m	10
Section length to be cut - Trident Cut and Lift Tool	m	12
No. of hours required to perform one cut - hydraulic shears	hour	0.50
Hydraulic Shear Deployment Time	hour	1
Hydraulic Shears Repositioning Time	hour	0.50
Hydraulic shears retrieval time	hour	0.25
No. of hours required to perform one cut - Diamond Wire Cutter	hour	1
Diamond Wire Saw deployment time	hour	1
Diamond Wire Cutter Repositioning Time	hour	0.50
Diamond Wire Cutter Recovery Time	hour	0.25
Subsea basket deployment time	hour	0.50
Subsea basket retrieval time	hour	0.50
Time required to lift cut section of Pipeline / Spool / Flexible / Umbilical back to vessel - Pipe Grab	hour	0.50
Time required to lift cut section into subsea basket	hour	0.50
Time for combined cut pipe and lift (12m sections / 2 cuts) - Trident	hour	1.50
Time for a dual cut - Trident	hour	1
Time for a single pipe lift - Trident	hour	0.50
Trident deployment time	hour	0.25

Trident relocation time	hour	0.25
Allowance for concrete spalling	%	25%
Time required to recover concrete at each location	hour	0.5
Change out diamond wires every	cuts	6.0
Change out diamond wires	hour	2.0
Survey Operations		
As-found / post-decommissioning pipeline survey	m / hour	1500
As-found / as-left cut end survey - rock cover	hour / end	0.5
Rock Placement		
Rock quantity for pipelines / umbilical	Te / m	10
Time required to rock cover line	Te / hour	1000
Rock quantity for cut ends	Te / end	25
Time required to rock cover section	hour / section	2
No. of rock bag placement per end	QTY	4
No. hours to place rock bags per location	hour	0.33
Reverse Installation Operation		
Time required to lift and attach recovery head and rigging	hour	4
Time required to initiate reverse reel	hour	6
Time required to carry out reverse reeling of flexible / umbilical	m / hour	300
Time required to carry out reverse reeling of rigid pipeline	m / hour	400
Time required to carry out reverse s-lay of rigid pipeline	m / hour	400
Allowance for diver intervention	day	2
Offshore weather allowance	%	15%
Offshore tidal allowance	%	30%
Decommissioning Contractors Engineering and Management	%	10%
Onshore Rates	**Unit**	**Rate £k**
Recycling / Disposal Rates		
Concrete Coated Pipeline	£ / Te	0.02
Rigid Steel Pipe	£ / Te	-0.03
Flexibles / Umbilicals / Cables	£ / Te	0.35
Personnel Rates & Misc. Costs	**Unit**	**Rate £k**
Ops Support Personnel	£k/day	0.68
Assumptions	**Unit**	**Value**
Disturbance		
Rock placement disturbance - length of pipeline	m (width)	10

Rock placement disturbance - pipeline ends	m^2	100
Rock bags (4Te) ~2.4m dia in-place	m^2	25
Rock bags (8Te) ~3.0m dia in-place (3 bags per end)	m2	21
Trench and bury disturbance	m (width)	10
Mass flow excavation disturbance	m (width)	5
Reverse install without deburial disturbance	m (width)	2
Note: Any seabed dredging is considered to be localised and to have a negligible impact on the seabed in comparison to rockdumping, MFE etc and therefore is not included in the estimate for seabed disturbance/impact.		
Vessel Information	**Unit**	**Value**
Vessel Deck Area		
Olympic Ares (CSV)	m^2	1,300
Seven Atlantic (DSV)	m^2	1,200
Seven Arctic (CSV)	m^2	2,600
Seven Pegasus (DSV)	m^2	1,200
Vessel Deck Area Utilisation	%	50%
Maximum Pipe Storage Height	m	1.5
Vessel Deck Weight Capacity		
Olympic Ares (CSV)	Te	7,150
Seven Atalantic (DSV)	Te	12,000
Seven Arctic (CSV)	Te	7,000
Seven Pegasus (DSV)	Te	7,800
Vessel Rock Capacity		
Nordnes (Flexible Fallpipe Vessel)	Te	24,000
Project Services	**Unit**	**Value**
Project Management / Supervision / Owner Costs	%	12%
Insurance	%	5%
Misc. Onshore Costs (Port charges, storage etc.)	£k LS	100
3rd Party Verification	£k LS	200
Fees	**Unit**	**Value**
UK Fisheries Offshore Oil & Gas Legacy Trust Fund (FLTC)	£k / km	3.00

Personnel on Board (PoB) & Fatal Accident Rate (FAR)	PoB	Hours Exposure	FAR
HLV	120	12	5.5
DSV	110	12	7.5
Barge / Pipehaul	20	12	5.5
Tug	7	12	13.2

Divers	18	24	97
Trawler	5	12	7.5
Survey Vessel	44	12	7.5
CSV	76	12	7.5
Light CSV	76	12	5.5
SLV	200	12	5.5
Rockdump Vessel	20	12	7.5
Trenching Vessel	55	12	7.5
Large Deck CSV	76	12	5.5
Reel Vessel	76	12	7.5
Supply Vessel	76	12	18.1
Survey Vessel (Legacy)	44	12	7.5
Rockdump Vessel (Legacy)	20	12	7.5