ENI Petroleum

Hewett CA Support

Hewett Area Subsea Pipelines Comparative Assessment Report

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*ENI has updated information in this document to align with submitted Pipeline Decommissioning Programme

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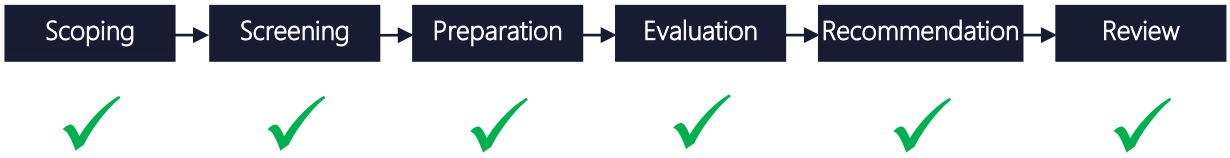
EXECUTIVE SUMMARY

Eni UK have conducted a Comparative Assessment (CA) for the decommissioning of the subsea pipeline infrastructure associated with the Hewett field and associated satellite fields. The following steps from the Oil and Gas UK CA Guidelines have been completed:



This CA report for the Hewett field 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 Hewett field subsea infrastructure has focussed on four decommissioning groups - groups 1, 2, 3 and 4, as described in the table below.

All other decommissioning groups of the Hewett field 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:

GROUP	TITLE	DECOMMISSIONING APPROACH
1	Trunk Lines [1]	Option 3A – Leave In-situ – Trench and Bury Areas of Spans / Exposures • Pipelines will be disconnected • Offshore pipeline ends will be recovered and returned to shore for recycling and disposal (spools addressed in Group 5) • Areas of exposures / spanning shall be buried to a minimum of 0.6m ToP using appropriate techniques in-line with Decommissioning Guidance. Where this requirement cannot be met, the Owners shall endeavour to achieve stable, over-trawlable pipeline cover. • Exposed stabilisation mats recovered. • Protection and stabilisation features associated with these pipelines, buried to a minimum depth of 0.6m will remain in-situ [2]

[1] *While re-use opportunities were explored by Eni UK as part of the CA process, it is recognised that discussions surrounding the re-use opportunities for PL21, a Trunk Line in Group 1, are ongoing. This CA has been conducted on the basis that no viable re-use opportunities will remain for PL21 but shall not be taken to prejudice the outcome of those ongoing discussions between Eni UK and the regulators.*

2 *For protection and stabilisation features (such as concrete mattresses), where they protect a pipeline left in-situ and these protection / stabilisation features become exposed or partially buried, they shall remain in-situ to maintain the pipeline protection / stability. An assessment will be performed to determine if the feature can be recovered on a case-by-case basis, without impacting the pipeline protection / stabilisation. If not OPRED will be consulted where the recovery of exposed / partially buried features is not deemed feasible.*

GROUP	TITLE	DECOMMISSIONING APPROACH
2	Concrete Coated Infield Lines	Option 3A – Leave In-situ – Trench and Bury Areas of Spans / Exposures • Pipelines will be disconnected • Pipeline ends will be recovered and returned to shore for recycling and disposal (spools / jumpers addressed in Group 5) • Areas of exposures / spanning shall be buried to a minimum of 0.6m ToP using appropriate techniques in-line with Decommissioning Guidance. Where this requirement cannot be met, the Owners shall endeavour to achieve stable, over-trawlable pipeline cover. • Exposed stabilisation mats recovered. • Protection and stabilisation features associated with these pipelines, buried to a minimum depth of 0.6m will remain in-situ[2]
3	Non-Concrete Weight Coated Infield Pipelines	Option 3A – Leave In-situ – Trench and Bury Areas of Spans / Exposures • Pipelines will be disconnected • Pipeline ends will be recovered and returned to shore for recycling and disposal (spools / jumpers addressed in Group 5) • Areas of exposures / spanning shall be buried to a minimum of 0.6m ToP using appropriate techniques in-line with Decommissioning Guidance. Where this requirement cannot be met, the Owners shall endeavour to achieve stable, over-trawlable pipeline cover. • Exposed stabilisation mats recovered. • Protection and stabilisation features associated with these pipelines, buried to a minimum depth of 0.6m will remain in-situ[2]
4	Umbilicals[3]	Option 1A – Full Removal – Reeling / Carousel • Umbilicals will be disconnected • De-burial of the lines will be conducted if required. • Each line shall be initiated before recovering to deck with a tensioner and storing on an appropriate reel or carousel • The lines shall be returned to shore for recycling and disposal

[3] All stand-alone umbilicals are included in this group. There are a number of umbilicals across the field that are piggybacked to pipelines. These are included and assessed in the relevant groups (Group 2 and Group 3).

GROUP	TITLE	DECOMMISSIONING APPROACH
5	Flexible Flowlines and Jumpers	Full Removal • Disconnection of jumper ends and recovery of entire line by reverse installation. Utilizing Reel Lay vessel or Cut & Lift. • Returned to shore for recycling or appropriate treatment and disposal
6A	Mattresses (Exposed)	Full Removal • Returned to shore for recycling or appropriate treatment and disposal
6B	Mattresses (Buried)	Leave In-situ as mattresses are buried to a depth of 0.6m
6C	Mattresses (Frond)	Leave In-situ as mattresses are buried to a depth of 0.6m
6D	Mattresses (Special Cases)	Leave In-situ [4]
7A	Exposed Grout Bags	Full removal • Return to shore for recycling or appropriate treatment. • In event of unsafe conditions and practical difficulties in recovery, remain in-situ.
7B	Buried Grout Bags	Leave In-situ

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

[4] *Where there are protection and stabilisation materials that have been applied to pipelines being comparatively assessed, the decommissioning option for the related pipeline shall dictate the approach for these related materials. The rationale is that, should the pipelines be fully removed, the related protection and stabilisation materials shall also be removed. However, should the pipelines be remaining in-situ, then those related protection and stabilisation materials shall also remain in-situ. Additionally, where protection and stabilisation materials are decades old and of poor integrity, an onsite assessment shall be conducted as to the capability to recover mattresses on a case by case basis. Eni shall consult with OPRED where recovery of mattresses is not considered to be feasible.*

1 INTRODUCTION

1.1 Background

Eni UK have engaged Xodus Group to conduct Phase 2 of a comparative assessment (CA) for the decommissioning of the Hewett Field and associated satellite fields (Dawn, Deborah, Delilah, Della, Big Dotty, Little Dotty) subsea infrastructure.

The Hewett Field is located in the southern sector of the North Sea approximately 22 km off the Norfolk coast in blocks 48/28a, 48/30a, 48/29a, 52/4a and 52/5a. Figure 1-1 below gives a schematic representation of the field layout.

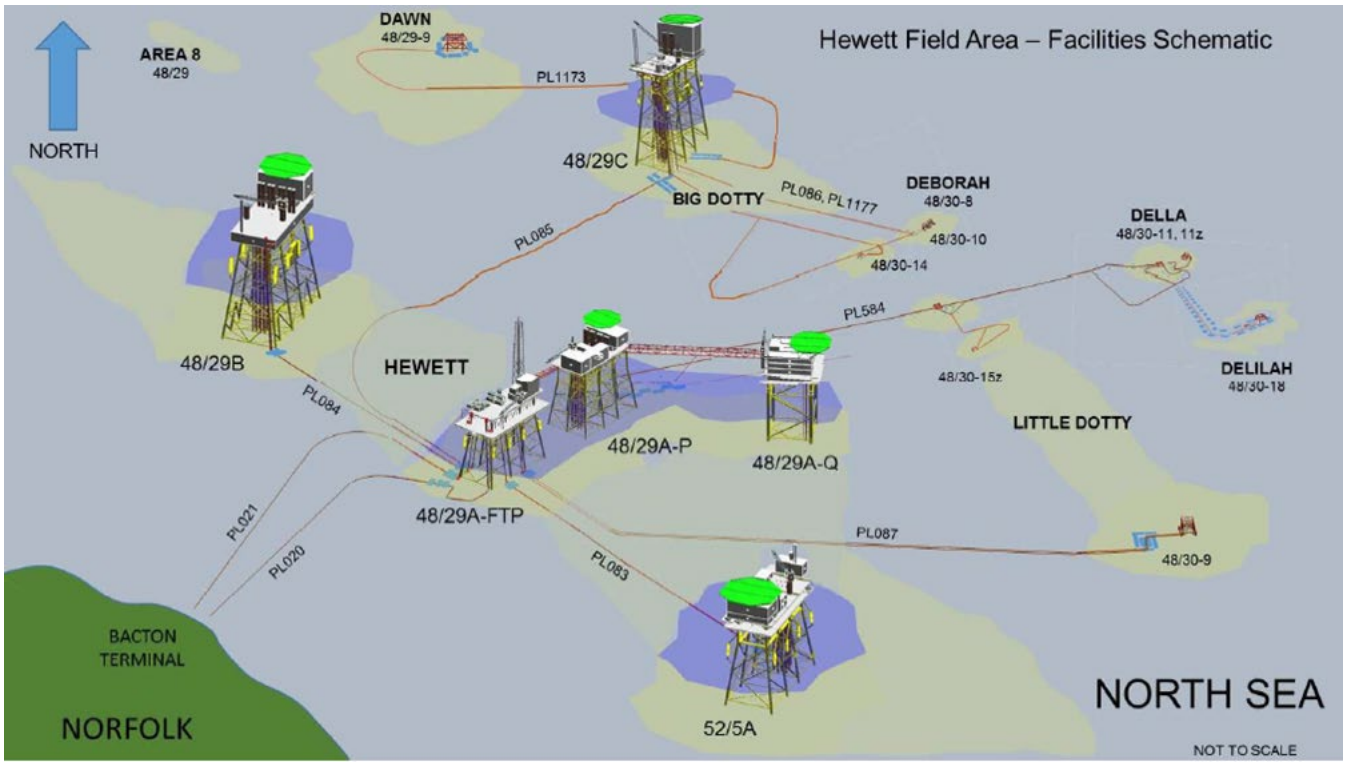


Figure 1.1 - Hewett Field Layout

The field consists of the following infrastructure:

Offshore Platforms:

- 6 off Offshore Platforms (48/29A-FTP, 48/29A-P, 48/29A-Q, 48/29B, 48/29C and 52/5A):
  - 1 off bridge-linked platform complex/Central Complex (48/29A-FTP, 48/29A-P, 48/29A-Q);
  - 3 off Not Permanently Attended Installation (NPAIs), each with temporary accommodation (48/29B, 48/29C and 52/5A);
  - 32 off platform wells.

Subsea Assets:

- 8 off Wellhead Protection Structures WHPSs (Wells 48/29-9, 48/30-8, 48/30-9, 48/30-10, 48/30-11z, 48/30-14, 48/30-15z & 48/30-18):
  - 6 off piled WHPSs (Dawn 48/29-9, Deborah 48/30-8, 48/30-10, 48/30-14, Little Dotty 48/30-9, Della 48/30-11);
  - 2 off non-piled WHPSs (Little Dotty 48/30-15 & Delilah 48/30-18);
- 9 off Subsea Wells (including 1 off Exploration and Appraisal Well 48/30-13 temporary abandoned);
- 2 off piled Tee/Manifold Structures (Della Pipeline End Manifold PLEM and Little Dotty Midline Termination Module MTM).

Pipelines and Umbilicals:

- 2 off 30" Trunk lines (PL20, PL21), for exporting gas from Central Complex to Bacton Gas Terminal, with respective lengths of 17.04 miles (27.43 km) for PL20 and 20.38 miles (32.80km) for PL21;
- 3 off 24" Inter-field Flowlines (PL83, PL84, PL85), linking NPAIs to Central Complex, about 13.66 miles total (21.99 km);
- 5 off 8"/10" Inter-field Flowlines (PL86, PL87, PL584, PL1173, PL1177), linking Subsea Wells to Central Complex/48/29C Platform, about 21.10 miles (33.95 km);
- 4 off 2" Service Pipelines piggybacked to associated Inter-field Flowlines (PL135.1, PL135.2, PL136.1, PL136.2), with total length of 15.14 miles (24.37km) approximately;
- 5 off standalone Control Umbilicals, (PLU4689, U30-8, PLU4743, PLU4690, PL1323),, with total length of 21.77 miles (35.03 km) approximately;
- 5 off Control Umbilicals piggybacked to associated gas flowlines, (PLU4688, PL1174.1, PL1174.2, PL585, PL586),, with total length of 23.12 miles (37.20 km) approximately;
- 4 off short Flexible Jumpers (2", 6" & 8" NB, PL446, PL446.1, PL1325, PL1630)
- 5 off short Control Umbilical Jumpers (Little Dotty and Delilah, PL1324, PL1629.1, PL1629.2, PL1629.3, PL1629.4).

Protection:

- Concrete and frond mattresses, and grout bags deployed across the Hewett area providing protection for subsea installations, stabilisation and support for pipelines.

Current Status:

Export from the field ceased in December 2020. A small amount of gas production remains to fuel gas turbine generators on the central complex. Hewett field CoP was in 2023. A well abandonment campaign is ongoing. Pipelines have been flushed, cleaned and water gapped..

1.2 Purpose

The purpose of this document is to present the Comparative Assessment (CA) process and emerging recommendations for the Hewett Field Subsea Pipelines / Umbilicals infrastructure and associated engineering

features (e.g., mattresses, grout bags and stabilisation features) only (i.e., does not include WHPSs, PLEMs or MTM) in support of the Decommissioning Programme (DP). It is produced in satisfaction of the requirement to perform a CA for any potential leave in-situ proposal for subsea equipment as specified within the BEIS Decommissioning Guidelines ref. [1].

This document describes the field infrastructure addressed, the decommissioning options considered, the CA methodology conducted, and the recommendations concluded 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 – Trunk Lines.
- Section 5 – The CA outcome obtained for Group 2 – Concrete Weight Coated Infield Pipelines.
- Section 6 – The CA outcome obtained for Group 3 – Non-Concrete Weight Coated Infield Pipelines.
- Section 7 – The CA outcome obtained for Group 4 – Umbilicals.
- 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 3 – Detailed Evaluation Results.
- Appendix F – Group 4 – Detailed Evaluation Results.

1.4 Terms, Abbreviations and Acronyms

AHP	Analytical Hierarchy Process
BAT	Best Available Technology
BEP	Best Environmental Practice
BEIS	Department for Business, Energy and Industrial Strategy
CA	Comparative Assessment

CSV	Construction Support Vessel
DP	Decommissioning Programme
DWC	Diamond Wire Cutting
EMT	Environmental Management Team
ENI	Eni UK Limited
FAR	Fatal Accident Rate
HCE	High Consequence Events
HHW	Haisborough, Hammond and Winterton
HSE	Health and Safety Executive
IP	Institute of Petroleum (now the Energy Institute)
JIP	Joint Industry Project
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
MCDA	Multi-Criteria Decision Analysis
MCZ	Marine Conservation Zone
MFE	Mass Flow Excavator
MS	Much Stronger
MSV	Multi-purpose Support Vessel
MTM	Midline Termination Module
MW	Much Weaker
NFFO	National Federation of Fishermen's Organisations
NORM	Naturally Occurring Radioactive Material
NPAI	Not Permanently Attended Installation
O&G	Oil and Gas
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
PLEM	Pipeline End Manifold
PLL	Potential for Loss of Life
POB	Personnel on Board
S	Stronger
SAC	Special Area of Conservation
SNS	Southern North Sea
SPA	Special Protection Area

ToP	Top of Pipe
ToU	Top of Umbilical
UK	United Kingdom
VC	Video Conference
VMS	Very Much Stronger
VMW	Very Much Weaker
W	Weaker
WHPS	Wellhead Protection Structure

1.5 References

1. **BEIS Guidance Notes**	BEIS, Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines, Nov 2018.
2. **OGUK Decommissioning CA Guidelines**	OGUK – Guidelines for Comparative Assessment in Decommissioning Programmes, Dated: October 2015, ISBN: 1 903 004 55 1, Issue: 1.
3. **CA Screening Report**	Eni, Comparative Assessment (Phase 1) Screening Report, 102800PURV87055_PRDE01, 2019
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.
8. **Fisheries Interaction Risk Assessment**	Xodus, Fisheries Interaction Risk Assessment Technical Note, Doc. No.: 102800PLRV88505_PRDE01, Dated: 30/06/21
9. **CA Data Summary**	Xodus, Comparative Assessment Data Summary Technical Note, Doc. No.: 102800PLRV88504_PRDE01, Dated: 18/06/21

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 Eni for the Hewett Decommissioning Project (Subsea Infrastructure).

The OGUK (now known as OEUK) Decommissioning CA Guidelines ref. [2] 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 2019 the screening workshops were attended by members of the Eni project team.
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 Q2 2021 and Stakeholder Workshop on 7th July 2021.
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 8.
Review	Review the recommendation with internal and/or external stakeholders.	✓	The Stakeholder CA Review Workshop was held on 7th July 2021 and the minutes can be found in Appendix B.
Submit	Submit to OPRED in support of Decommissioning Programme.	Q3 2021	Planned Q3 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 six platforms and various subsea wells within the Hewett Field are linked together via the subsea infrastructure including pipelines and subsea installations. Overall production from the field is transported to shore (Bacton Gas Terminal) via two trunk lines, one of which failed in 2017 (PL20). The boundaries of the infrastructure are the mean low water spring mark of the trunk line shore approaches, the platform riser tie-in flanges and the subsea installations tie-in flanges.

The Hewett subsea infrastructure that will be considered under this CA is as follow, with boundary limits:

Pipelines and Spools

- Riser bottom flange to manifold / Xmas tree piping flange.
- Riser bottom flange to low water mark at shore approach (export trunk lines). The onshore Bacton section of pipeline is outside the scope of this document

All umbilicals;

- J-tube hang-off and TUTU to manifold UTA or Xmas tree SUT.

- All control and chemical jumpers;
- Manifold SDU base connector to Xmas tree SUT base connector
- Xmas tree production piping flange to Manifold production piping flange.
- All mattresses and deposits.

Kilometre Point Boundaries

- The following KP boundaries can be assumed: -
  - • Offshore = KP0.000 (FTP) to KP26.949
    - • Nearshore = KP 26.949 to KP 32.300

- • Onshore = KP32.300

The above KPs form the boundary for PL20 and PL21 and the surveys overlap to ensure continuity of data

The starting conditions for the CA are defined below:

- The following will be complete prior to the Eni subsea infrastructure decommissioning scope commencing:
  - All subsea wells will be plugged and abandoned;
  - The pipelines will be flushed, cleaned and cut / disconnected from subsea infrastructure;
  - The umbilical cores containing hazardous fluids (chemical service) will be flushed and cleaned. (Hydraulic lines containing HW540 that is considered to be toxic to the marine environment will be flushed. This has been discussed with OPRED-EMT). Cores containing hydraulic fluid (Aqualink, which is environmentally friendly) will not be flushed and cleaned. All cores will be cut / disconnected from subsea infrastructure.

2.2.2 Physical Attributes of Equipment

All equipment within the scope of the Hewett 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:
  - Materials / diameter / length;
  - Seabed configuration (trenched / buried / surface laid);
  - Details of crossings / mattresses;
  - As-left cleanliness / ability to clean lines / chemicals used;
  - Integrity issues.

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 Hewett 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. [1] 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.

The following scenarios were considered for applicable pipelines as specified in the BEIS Guidance Notes ref. [1] and OGUK North Sea Pipeline Decommissioning Guidelines ref. [6].

- Full Removal:
  - Reverse Installation with de-burial – Recover pipe using reverse s-lay or reverse reeling;
  - Cut and Lift - Cut pipe into small sections and recover;
- Decommissioning In-situ – Partial Removal:
  - Remove mid-line exposed/spanning sections and pipeline ends;
- Decommissioning In-situ – Major Intervention:
  - Trench and bury mid-line exposed/spanning sections and pipeline ends;
- Decommissioning In-situ – Minimum Intervention:
  - Trench and bury pipeline ends only.

At this stage any potential re-use options should be considered. If there are viable in-situ re-use scenarios for any of the infrastructure there is no need to proceed with CA for that infrastructure.

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.

2.3 Screening Phase

The screening phase of the comparative assessment was carried out during a series of workshops held in 2019. 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 Hewett Subsea Infrastructure CA Common Groups for full removal;
- Review proposed decommissioning options for each remaining group;
- Assess decommissioning options against the primary criteria and record assessment and outcome in screening worksheets;
- Primary Criteria:
  - Safety;
  - Environmental;
  - Technical;

  - Societal;
  - Economic;
- Record any actions required to support retained decommissioning options;
- Compile Screening Report.

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

- A maximum of five least onerous decommissioning options are chosen for Evaluation for the pipeline and umbilical infrastructure groups. However, an overarching rule was that at least one full removal option for each assessed infrastructure group shall be retained.
- For similar full removal options, the least onerous option is retained.
- For similar leave in-situ options, a maximum of four least onerous options are retained.

This approach was considered appropriate to ensure that

- The likely least onerous full removal options would be compared to the less onerous leave in-situ options during the Evaluation.
- During the Evaluation phase 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 4.3, Table 5.3, Table 6.3 and Table 7.3.

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 Hewett Subsea CA process were as follows:

- Burial Status Review — Review of historical survey data to understand current and historical burial status of lines.
- Cost Estimate — The methodologies for each option were defined along with necessary resources to execute the option. From this, indicative costs were able to be calculated detailed in the CA Data Summary ref. [9].
- Safety Calculations — Using the methodologies detailed within the Cost Estimate, safety calculations are made for each of the options using the Fatal Accident Rates developed by the JIP conducted by Safetec ref. [4] to calculate cumulative PLL values and detailed in the CA Data Summary ref. [9]. The legacy risk impact is addressed by assessing the spans and exposures, the seabed mobility and the fishing intensity along the lines as detailed in the Fisheries Interaction Risk Assessment ref. [8].
- Emissions Assessment — Fuel consumption and atmospheric emissions assessment performed for each option carried forward based upon activities and resources identified within the cost estimates and the emissions factors from IP 2000 ref. [7] and detailed in the CA Data Summary ref. [9].
- 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 cost estimates. Underwater noise impact was based on a qualitative assessment of the vessels and activities employed as detailed in the CA Data Summary ref. [9].
- Summary Data Sheets — Compiling all necessary data together for evaluation purposes, data sheets were prepared for each option, detailed CA Data Summary ref. [9].

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 Appendices C, D, E and F.

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 CA Guidelines ref. [2] and employs the data obtained during the preparation phase as summarised in the attributes tables, included in Appendices C, D, E and F.

The evaluation phase was performed during several evaluation workshops where the decommissioning project team were represented. This enabled the supporting information for each of the decommissioning groups and associated decommissioning options to be thoroughly interrogated and amended as required.

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 Wednesday 7th July 2021. The attendees were as detailed in Table 2.3.

COMPANY	NAME	ROLE
Natural England	Alexandra Fawcett	Marine Industry Specialist
	Helen Mann	Marine Lead Advisor
JNCC	Tetrienne Kerswell-Box	Offshore Industry Advisor
	Hannah Hood	Offshore Industry Advisor
OPRED ODU	Ruth Ledingham	Senior Decommissioning Manager
	Caitlyn Cox	Decommissioning Manager
	Sam Pattie	Assistant Decommissioning Manager
EniProgetti	Chris Arkless	Pipelines Decommissioning Specialist
	Abigail Harrison-Strong	HSE Advisor
	Andrew Plumb	Project Engineering Manager
	Ryan Phipps	Subsea Decommissioning Engineer
Eni UK	Tarsicio Flores Hernandez	Project Manager
	Donald Smith	HSE Advisor
	Juliana Grando	Environmental Advisor
	John Entwistle	HSE Advisor
	Dhillip Sankoomar	Interface Manager

COMPANY	NAME	ROLE
	Vic Morrell	Marine and Subsea Advisor
Petrofac	Istvan Bartha	Pipelines TA
	Tracey Harrold	HSE Manager
	Billy Sandford	Southern North Sea Team Lead
Xodus Group	Nic Duncan	Project Manager
	John Foreman	Comparative Assessment Lead
	Deborah Morgan	Senior Environmental Consultant
	Will Garston	Decommissioning Consultant
	Andrew Corse	Senior Environmental Consultant (observer)

Table 2.3 - Stakeholder Workshop Attendees & Roles

3 HEWETT DECOMMISSIONING GROUPS

3.1 Decommissioning Scoping Groups

Table 3.1 lists all decommissioning groups identified for the Hewett 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	Trunk Lines	Rigid trunk lines running from the offshore field to the low water mark at shore approach.	Subject to full Comparative Assessment
2	Concrete Weight Coated Infield Pipelines	All infield concrete coated rigid pipelines including associated piggy-backed lines.	Subject to full Comparative Assessment
3	Non-Concrete Weight Coated Infield Pipelines	All infield non-concrete coated rigid pipelines including associated piggy-backed lines.	Subject to full Comparative Assessment
4	Umbilicals	All stand-alone (not piggy-backed) infield umbilicals.	Subject to full Comparative Assessment
5	Flexible Flowlines and Jumpers	All spools associated with the tie-in of pipelines to subsea installations / risers. All jumpers associated with the tie-in of umbilicals to subsea installations.	Full Removal
6A	Mattresses (Exposed)	All protection, support and stabilisation materials such as mattresses that are exposed.	Full Removal
6B	Mattresses (Buried)	All protection, support and stabilisation materials such as mattresses that are buried to a depth greater than 0.6m.	Leave In-situ
6C	Mattresses (Frond)	All frond mattresses that are buried to a depth greater than 0.6m.	Leave In-situ

GRP	TITLE	DESCRIPTION	DECOMMISSIONING APPROACH
6D	Mattresses (Special Cases)	All protection, support and stabilisation materials such as mattresses and grout bags that are an inherent part of stabilisation of pipelines being comparatively assessed. Also includes mattresses and grout bags that are decades old and of poor integrity.	Leave In-situ [5]
7A	Exposed Grout Bags	All protection, support and stabilisation materials such as grout bags that are exposed.	Full Removal
7B	Buried Grout Bags	All protection, support and stabilisation materials such as grout bags that are exposed.	Leave In-situ

Table 3.1 - Decommissioning Groups and Initial Decommissioning Recommendation

3.2 Decommissioning Groups for Evaluation

In summary, the decommissioning groups for the Hewett 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 – Trunk Lines
- Group 2 – Concrete Weight Coated Infield Pipelines
- Group 3 – Non-Concrete Weight Coated Infield Pipelines
- Group 4 – Umbilicals
- Group 6B – Mattresses (Buried)
- Group 6C – Mattresses (Frond)
- Group 6D – Mattresses (Special Cases)
- Group 7B – Buried Grout Bags

[5] *Where there are protection and stabilisation materials that have been applied to pipelines being comparatively assessed, the decommissioning option for the related pipeline shall dictate the approach for these related materials. The rationale is that, should the pipelines be fully removed, the related protection and stabilisation materials shall also be removed. However, should the pipelines be remaining in-situ, then those related protection and stabilisation materials shall also remain in-situ. Additionally, where protection and stabilisation materials are decades old and of poor integrity, an onsite assessment shall be conducted as to the capability to recover mattresses on a case by case basis. Eni shall consult with OPRED where recovery of mattresses is not considered to be feasible. Table 15 in the Decommissioning Programme provides an estimate of the number of mattresses and other stabilisation features.*

Group 5 (Flexible Flowlines & Jumpers, Group 6A (Mattresses Exposed) & Group 7A (Exposed Grout Bags) are all considered for full removal.

4 GROUP 1 – TRUNK LINES

4.1 Group 1 Characteristics

The items that make up Group 1 and their key characteristics are listed in Table 4.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM
PL20	Trunk Line (concrete coated) 48/29A-FTP to Bacton MLWS [6]	30	27.43
PL21	Trunk Line (concrete coated) 48/29A-FTP to Bacton MLWS	30	32.8

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 screening methodology. The assessment performed and the resultant outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 4.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	1A Reverse Installation – Reel-Lay	Disconnection of the pipeline ends and recovery of the entire line by reverse installation utilising Reel Lay vessel or CSV (Reverse Reel). Pipelines would be exposed if buried.	This option is not applicable for concrete coated trunk lines, screened out as a Technical showstopper.
	1B Reverse Installation – S-Lay	Disconnection of the pipeline ends and recovery of the entire line by reverse installation utilising S-Lay vessel (Reverse S-Lay). Pipelines would be exposed if buried.	Assessed as acceptable against the Societal criterion and unattractive against the remaining four criteria. Screened out accordingly.
	1C Cut and Lift	Disconnection of the pipeline ends and removal by cut and lift of the entire pipeline utilising MSV/CSV. Pipelines would be exposed if buried.	Assessed as the least onerous full removal option and retained for Evaluation accordingly.

[6] *PL20 is in two sections after a failed section of the line was removed in 2017.*

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Partial Removal)	2A Partial Cut and Lift, Trench to 0.6m ToP.	Disconnection of the pipeline ends and recovery of all exposed / spanning sections of pipeline by Cut & Lift. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to min. depth of burial of 0.6m ToP.	Assessed as acceptable for the Technical and Societal criteria and unattractive against the remaining three criteria. Screened out accordingly.
	2B Partial Cut and Lift, Trench to 0.6m ToP Cut Ends Only	Disconnection of the pipeline ends and recovery of all exposed/spanning sections of pipeline by Cut & Lift. Cut ends of pipeline / umbilical trenched & back-filled to min. depth of burial of 0.6m ToP.	Assessed as acceptable in four criteria and unattractive against the Economic criterion. Retained as the least onerous partial removal option.
Leave In-situ (Major Intervention)	3A Trench to 0.6m ToP	Disconnection and removal of the pipeline ends. Cut ends within the trench will be left to naturally backfill due to dynamic seabed. Exposed/spanning pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToP if pipeline accessory was put in place during the operational life of the pipeline, eg. anode attached to the pipeline.	Assessed as attractive against the Technical criterion, unattractive against the Environmental criterion and acceptable against the remaining three. Retained for evaluation.
	3B Trench to 0.6m ToP, with FishSafe span removal	Disconnection and removal of the pipeline ends. All potential snagging hazards, i.e. FishSAFE spans, and stabilisation features in the vicinity to be cut and removed by CSV/MSV. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToP.	Assessed as attractive against the Technical criterion, unattractive against the Environmental and Economic criteria and acceptable against the remaining two. Screened out as the most onerous major intervention option.
	3C Trench to suitable depth (>>0.6m) to ToP to avoid future exposure	Disconnection and removal of the pipeline ends. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 3m ToP or more.	Initially assessed as attractive against Safety and Societal, unattractive against Environmental and acceptable against the remaining two. However, latterly screened out as a showstopper as it is considered unfeasible against Technical.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave in situ (minimum intervention)	4A Minimum intervention	Disconnection and removal of the pipeline ends and make safe the remaining cut ends.	Assessed as attractive against Safety, Environmental and Technical, unattractive against Societal and acceptable against Economic. Retained for evaluation.
	4B Minimum intervention with Accelerated Decomposition	Disconnection and removal of the pipeline ends and make safe the remaining cut ends. Introduction of a corrosion accelerant to the pipeline to accelerate the decomposition of the line left *in situ*.	Screened out as a Technical showstopper as the technology is not sufficient mature to be employed.

Table 4.2 - Group 1 Decommissioning Options & Screening Summary

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
  - 1C – Cut and Lift
- Leave In-situ (Partial removal)
  - 2B – Partial Cut and Lift, Trench to 0.6m ToP Cut Ends Only
- Leave In-situ (Major intervention)
  - 3A – Trench to 0.6m ToP
- Leave In-situ (Minimum intervention)
  - 4A – Minimum Intervention – remove ends only

4.4 Group 1 Evaluation Summary

GROUP 1 – TRUNK LINES (See Appendix C for full attributes table and assessment)	
Safety	**Option 4A is assessed as being preferred from a Safety perspective.** For Operations Personnel Option 4A is preferred as this involves the least exposure for personnel due to it having the smallest offshore scope. Option 3A is second with the remaining options considerably less preferred. For Other Users a similar profile is apparent with Option 4A preferred due to it having the fewest days of vessel operations and transits and Option 3A second, with the remaining options least preferred. With respect to High Consequence Events options 3A and 4A are equally preferred as they involve a similar number of lifts and far fewer than the other options thus presenting the lowest potential for dropped object. For Legacy Risk Option 1C is preferred as this involves the full removal of infrastructure and thus no legacy risk exists. Option 4A is the least preferred for Legacy Risk.
Environment	**Option 1C is assessed as being preferred from an Environment perspective.** For Operational Marine Impact options 3A and 4A are equally preferred as these represent the fewest vessel days in field and hence the lowest discharges and noise impact. Options 3A and 4A are also equally preferred from an atmospheric emissions perspective, again due to these options having the fewest vessel days to deliver the scope. From an Other Consumptions perspective Option 1C is preferred as recycling of the recovered material results in lower atmospheric emissions than replacement of the material. For Seabed Disturbance and Legacy Marine Impacts, Option 1C is preferred for similar reasons. Despite there being a greater area of temporary disturbance associated with Option 1C the removal of the infrastructure from the protected areas is preferred to exposed pipe remaining with the potential for future remediation as this is more impactful to the site conservation objectives. The majority of these lines lie inside one or more protected areas.
Technical	**Options 2B, 3A and 4A are assessed as being equally preferred from a Technical perspective.** Options 2B, 3A and 4A are equally preferred from a Technical Risk perspective as, while all options employ routine operations, the much greater scope associated with the full removal in Option 1C presents greater technical risk on a cumulative basis.
Societal	**Options 2B and 3A are assessed as being equally preferred from a Societal perspective.** With respect to impacts on the Fishing industry options 2B and 3A are equally preferred as they strike a balance between minimal disruption during decommissioning operations (primarily to creel fishermen) and a clear seabed left post decommissioning. For Other Users there is no clear preference and all options are found to be equally preferable. The positive aspect of the large quantity of material recovered for recycling (steel) is balanced against the likelihood of the large quantity of the steel reinforced concrete material going to landfill due to saltwater contamination, exacerbated by the nature of the steel reinforcement (chicken wire) due to the age of these lines.
Economic	**Option 4A is assessed as being preferred from an Economic perspective.** From a Short-term Costs perspective Option 4A is preferred as this equates to the lowest cost of all options. It is less than half the cost of the next lowest and is just over 1% of the most expensive option, Option 1C. From a Long-term Costs perspective Option 1C is preferred as there are no long term costs associated with the full removal option with Option 2B being least preferred due to the greater costs associated with future remediation.

GROUP 1 – TRUNK LINES
(See Appendix C for full attributes table and assessment)

Summary

Overall Option 3A is the emerging recommendation.

The results for Option 3A and Option 4A are close across the criteria with Option 4A being preferred from a Safety perspective with Option 3A a close second. From an Environmental perspective, Option 1C is preferred with Option 3A being a close second. With Option 3A being equally preferred against the Technical criterion (with Option 4A) and marginally preferred over Option 4A from a Societal perspective, collectively this presents a small preference for Option 3A overall.

Once the Economics criterion is included (preferred Option 4A), the overall preference changes to Option 4A, however, given the guidance that Economic considerations should not drive the decommissioning outcome, the emerging recommendation for Group 1 remains as Option 3A.

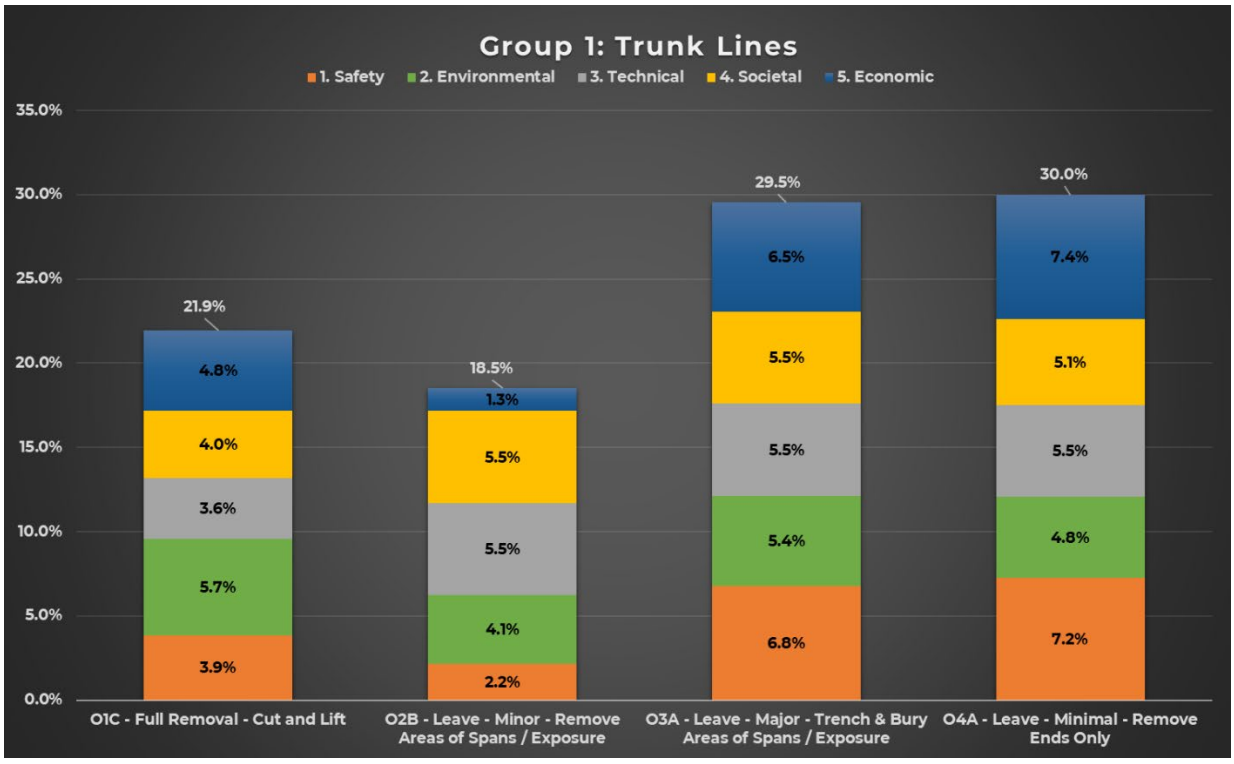


Table 4.3 - Group 1 Evaluation Summary

5 GROUP 2 – CONCRETE WEIGHT COATED INFIELD PIPELINES

5.1 Group 2 Characteristics

The items that make up Group 2 and their key characteristics are listed in Table 5.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM
PL83	Gas Export Pipeline 52/5A to 48/29A-FTP	24	4.00
PL84	Gas Export Pipeline 48/29B to 48/29A-FTP	24	8.55
PL85	Gas Export Pipeline 48/29C to 48/29A-FTP	24	9.44
PL86	Gas Export Pipeline Subsea Wells 48/30-8 and 48/30-10 to 48/29C Note: includes PL135.1 and PL135.2 2.375" service lines piggybacked to PL86)	10	5.80
PL87	Gas Export Pipeline 48/30-9 to 48/29A-FTP Note: includes PL136.1 and PL136.2 2.375" service lines piggybacked to PL87	8	6.10

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 screening methodology. The assessment performed and the resultant outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 5.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	1A Reverse Installation – Reel-Lay	Disconnection of the pipeline ends and recovery of the entire line by reverse installation utilising Reel Lay vessel or CSV (Reverse Reel). Pipelines would be exposed if buried.	This option is not applicable for concrete coated pipelines, screened out as a Technical showstopper accordingly.
	1B Reverse Installation – S-Lay	Disconnection of the pipeline ends and recovery of the entire line by reverse installation utilising S-Lay vessel (Reverse S-Lay). Pipelines would be exposed if buried.	Assessed as attractive against the Societal criterion and unattractive against the remaining four criteria. Screened out accordingly.
	1C Cut and Lift	Disconnection of the pipeline ends and removal by cut and lift of the entire pipeline utilising MSV/CSV. Pipelines would be exposed if buried.	Assessed as the least onerous full removal option and retained for Evaluation accordingly.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Partial Removal)	2A Partial Cut and Lift, Trench to 0.6m ToP.	Disconnection of the pipeline ends and recovery of all exposed / spanning sections of pipeline by Cut & Lift. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to min. depth of burial of 0.6m ToP.	Assessed as attractive against the Technical criterion, unattractive for the Environment criterion and acceptable against the remaining three criteria. Screened out accordingly.
	2B Partial Cut and Lift, Trench to 0.6m ToP Cut Ends Only	Disconnection of the pipeline ends and recovery of all exposed/spanning sections of pipeline by Cut & Lift. Cut ends of pipeline / umbilical trenched & back-filled to min. depth of burial of 0.6m ToP.	Assessed as attractive against the Technical criterion and acceptable against the remaining four criteria. Retained for evaluation.
Leave In-situ (Major Intervention)	3A Trench to 0.6m ToP	Disconnection and removal of the pipeline ends. Cut ends within the trench will be left to naturally backfill due to dynamic seabed. Exposed/spanning pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToP, if pipeline accessory was put in place during the operational life of the pipeline, eg. anode attached to the pipeline.	Assessed as attractive against the Technical criterion, unattractive against the Environmental criterion and acceptable against the remaining three. Retained for evaluation.
	3B Trench to 0.6m ToP, with FishSafe span removal	Disconnection and removal of the pipeline ends. All potential snagging hazards, i.e. FishSAFE spans, and stabilisation features in the vicinity to be cut and removed by CSV/MSV. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToP.	Assessed as attractive against the Technical criterion, unattractive against the Environmental and Economic criteria and acceptable against the remaining two. Screened out accordingly.
	3C Trench to suitable depth (>>0.6m) to ToP to avoid future exposure	Disconnection and removal of the pipeline ends. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 3m ToP or more.	Initially assessed as attractive against Safety, unattractive against Environmental and Economic and acceptable against the remaining two. However, latterly screened out as a Technical showstopper as it is considered an unfeasible option.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (minimum intervention)	4A Minimum intervention	Disconnection and removal of the pipeline ends and make safe the remaining cut ends.	Assessed as attractive against Environmental, Technical and Economics, unattractive against Societal and acceptable against Safety. Retained for evaluation.
	4B Minimum intervention with Accelerated Decomposition	Disconnection and removal of the pipeline ends and make safe the remaining cut ends. Introduction of a corrosion accelerant to the pipeline to accelerate the decomposition of the line left in-situ.	Screened out as a Technical showstopper as the technology is not sufficient mature to be employed.

Table 5.2 - Group 2 Decommissioning Options and Screening Summary

5.3 Group 2 Decommissioning Options for Evaluation

The decommissioning options for Group 2 that remained after screening and which were taken forward to the evaluation phase are therefore:

- Full Removal
  - 1C – Cut and Lift
- Leave In-situ (Partial removal)
  - 2B – Partial Cut and Lift, Trench to 0.6m ToP Cut Ends Only
- Leave In-situ (Major intervention)
  - 3A – Trench to 0.6m ToP
- Leave In-situ (Minimum intervention)
  - 4A – Minimum Intervention – remove ends only

5.4 Group 2 Evaluation Summary

GROUP 2 – CONCRETE WEIGHT COATED INFIELD PIPELINES (See Appendix D for full attributes table and assessment)	
Safety	**Option 3A is assessed as being preferred from a Safety perspective.** For Operations Personnel options 3A and 4A are equally preferred as these options involve the least exposure for personnel due to them having the smallest offshore scope. For Other Users a similar profile is apparent with options 3A and 4A equally preferred due to them having the fewest days of vessel operations and transits. With respect to High Consequence Events options 3A and 4A are equally preferred as they involve a similar number of lifts and far fewer than the other options thus presenting the lowest potential for dropped object. For Legacy Risk Option 1C is the most preferred as this involves the full removal of infrastructure and thus no legacy risk exists. The fishing risk assessment conducted shows that generally the lines within this group have a low risk, with a few discrete medium level areas. Option 4A is the least preferred for Legacy Risk.
Environment	**Option 1C is assessed as being preferred from an Environment perspective.** For Operational Marine Impact options 3A and 4A are equally preferred as these represent the fewest vessel days in field and hence the lowest discharges and noise impact. Options 3A and 4A are also equally preferred from an atmospheric emissions perspective, again due to these options having the fewest vessel days to deliver the scope. From an Other Consumptions perspective all options are equally preferred, as the resultant atmospheric emissions from recycling and material replacement are similar with the differences being insufficient to express a preference. For Seabed Disturbance and Legacy Marine Impacts, Option 1C is preferred for similar reasons. Despite there being a greater area of temporary disturbance associated with Option 1C the removal of the infrastructure from the protected areas is preferred to exposed pipe remaining with the potential for future remediation as this is more impactful to the site conservation objectives. The majority of these lines lie inside one or more protected areas.
Technical	**Options 2B, 3A and 4A are assessed as being equally preferred from a Technical perspective.** Options 2B, 3A and 4A are equally preferred from a Technical Risk perspective as, while all options employ routine operations, the much greater scope associated with the full removal in Option 1C presents greater technical risk on a cumulative basis.
Societal	**Option 1C is assessed as being preferred from a Societal perspective.** With respect to impacts on the Fishing industry Option 1C is preferred as it involves full removal of the lines from the offshore site, where trawling is more prevalent, which is preferable to leaving infrastructure that could potentially snag fishing gear. For Other Users there is no clear preference and all options are found to be equally preferable. The positive aspect of the large quantity of material recovered for recycling (steel) is balanced against the likelihood of large quantity of the steel reinforced concrete material going to landfill due to saltwater contamination, exacerbated by the nature of the steel reinforcement (chicken wire) on PL84 due to the age of the line.

GROUP 2 – CONCRETE WEIGHT COATED INFIELD PIPELINES
(See Appendix D for full attributes table and assessment)

Economic

Options 3A and 4A are assessed as being equally preferred from an Economic perspective.

From a Short-term Costs perspective options 3A and 4A are found to be equally preferred as their respective costs are considerably lower than options 1C and 2B, whereas there is only a small differential between them. They are approximately 20% of the cost of Option 2B and approximately 6% the cost of Option 1C.

From a Long-term Costs perspective Option 1C is preferred as there are no long term costs associated with the full removal option.

Summary

Overall Option 3A is the emerging recommendation.

Option 3A is the preferred option against the Safety criterion, it is a close second (to Option 1C) against the Environment criterion. It is equally preferred against the Technical criterion and second in preference (to Option 1C) against the Societal criterion. This strong showing across all criteria results in a strong preference for Option 3A overall.

Once the Economics criterion is included, this strengthens the preference for Option 3A which is the emerging recommendation for Group 2.

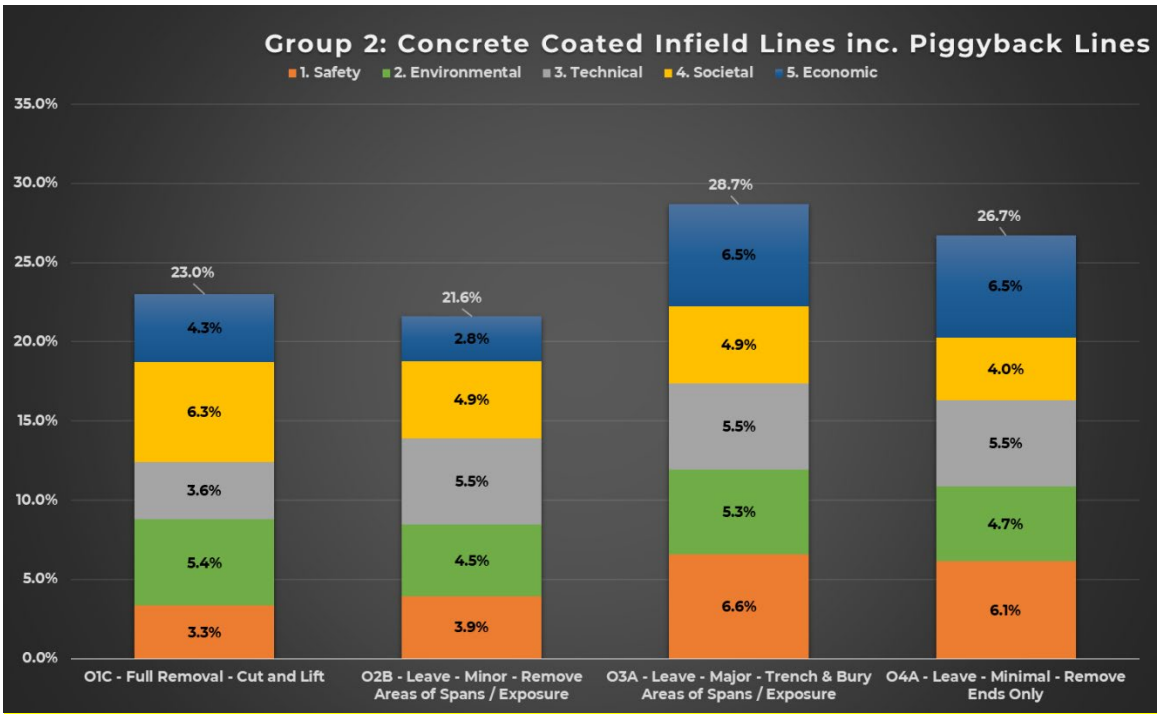


Table 5.3 - Group 2 Evaluation Summary

6 GROUP 3 – NON-CONCRETE WEIGHT COATED INFIELD PIPELINES

6.1 Group 3 Characteristics

The items that make up Group 3 and their key characteristics are listed in Table 6.1.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM
PL584	Gas Export Flowline Well 48/30-11 to 48/29A-P Note: includes PL585 and PL586 3.82" hydraulic-CI umbilical piggybacked to PL584	10	10.05
PL1173	Gas Export Flowline Well 48/29-9 to 48/29C Note: includes PL1174.1 and PL1174.2 4.88" electro-hydraulic-CI umbilical piggybacked to PL1173	8	6.10
PL1177	Gas Export Subsea Wells 48/30-14 to 48/29C Note: includes PLU4688 3.3" control umbilical piggybacked to PL1177	8	5.90

Table 6.1 - Group 3 Items

6.2 Group 3 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 screening methodology. The assessment performed and the resultant outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 6.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	1A Reverse Installation – Reel-Lay	Disconnection of the pipeline ends and recovery of the entire line by reverse installation utilising Reel Lay vessel or CSV (Reverse Reel). Pipelines would be exposed if buried.	Assessed as acceptable against the Societal criterion and unattractive against the remaining four criteria. Screened out accordingly.
	1B Reverse Installation – S-Lay	Disconnection of the pipeline ends and recovery of the entire line by reverse installation utilising S-Lay vessel (Reverse S-Lay). Pipelines would be exposed if buried.	Assessed as acceptable against the Societal criterion and unattractive against the remaining four criteria. Screened out accordingly.
	1C Cut and Lift	Disconnection of the pipeline ends and removal by cut and lift of the entire pipeline utilising MSV/CSV. Pipelines would be exposed if buried.	Assessed as the least onerous full removal option and retained for Evaluation accordingly.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Partial Removal)	2A Partial Cut and Lift, Trench to 0.6m ToP.	Disconnection of the pipeline ends and recovery of all exposed / spanning sections of pipeline by Cut & Lift. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to min. depth of burial of 0.6m ToP.	Assessed as unattractive against the Environmental criterion and acceptable for the remaining four criteria. Screened out accordingly.
	2B Partial Cut and Lift, Trench to 0.6m ToP Cut Ends Only	Disconnection of the pipeline ends and recovery of all exposed/spanning sections of pipeline by Cut & Lift. Cut ends of pipeline / umbilical trenched & back-filled to min. depth of burial of 0.6m ToP.	Assessed as attractive against the Technical criterion and acceptable against the remaining four criteria. Retained for evaluation.
Leave In-situ (Major Intervention)	3A Trench to 0.6m ToP	Disconnection and removal of the pipeline ends. Cut ends within the trench will be left to naturally backfill due to dynamic seabed.Exposed/spanning pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToP, if pipeline accessory was put in place during the operational life of the pipeline, eg. anode attached to the pipeline.	Assessed as attractive against the Technical and Economic criteria, unattractive against the Environmental criterion and acceptable against the remaining two. Retained for evaluation.
	3B Trench to 0.6m ToP, with FishSafe span removal	Disconnection and removal of the pipeline ends. All potential snagging hazards, i.e. FishSAFE spans, and stabilisation features in the vicinity to be cut and removed by CSV/MSV. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToP.	Assessed as attractive against the Technical criterion, unattractive against the Environmental and Economic criteria and acceptable against the remaining two. Screened out accordingly.
	3C Trench to suitable depth (>>0.6m) to ToP to avoid future exposure	Disconnection and removal of the pipeline ends. Remaining pipeline sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 3m ToP or more.	Initially assessed as attractive against Safety and Societal, unattractive against Environmental and acceptable against the remaining two. However, latterly screened out as a Technical showstopper as it is

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
			considered an unfeasible option.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (minimum intervention)	4A Minimum intervention	Disconnection and removal of the pipeline ends and make safe the remaining cut ends.	Assessed as attractive against Environmental and Technical, unattractive against Societal and acceptable against Safety and Economics. Retained for evaluation.
	4B Minimum intervention with Accelerated Decomposition	Disconnection and removal of the pipeline ends and make safe the remaining cut ends. Introduction of a corrosion accelerant to the pipeline to accelerate the decomposition of the line left in-situ.	Screened out as a Technical showstopper as the technology is not sufficient mature to be employed.

Table 6.2 - Group 3 Decommissioning Options and Screening Summary

6.3 Group 3 Decommissioning Options for Evaluation

The decommissioning options for Group 3 remaining after screening and taken forward to evaluation are:

- Full Removal
  - 1C – Cut and Lift
- Leave In-situ (Partial removal)
  - 2B – Partial Cut and Lift, Trench to 0.6m ToP Cut Ends Only
- Leave In-situ (Major intervention)
  - 3A – Trench to 0.6m ToP
- Leave In-situ (Minimum intervention)
  - 4A – Minimum Intervention – remove ends only

6.4 Group 3 Evaluation Summary

GROUP 3 – NON-CONCRETE WEIGHT COATED INFIELD PIPELINES (See Appendix E for full attributes table and assessment)	
Safety	**Option 3A is assessed as being preferred from a Safety perspective.** For Operations Personnel options 3A and 4A are equally preferred as these options involve the least exposure for personnel due to them having the smallest offshore scope. For Other Users a similar profile is apparent with options 3A and 4A equally preferred due to them having the fewest days of vessel operations and transits. With respect to High Consequence Events options 3A and 4A are equally preferred as they involve a similar number of lifts and far fewer than the other options thus presenting the lowest potential for dropped object. For Legacy Risk Option 1C is the most preferred as this involves the full removal of infrastructure and thus no legacy risk exists. The fishing risk assessment conducted shows that generally the lines within this group have a low risk, with a few discrete medium level areas. Option 4A is the least preferred for Legacy Risk.
Environment	**Option 1C is assessed as being preferred from an Environment perspective.** For Operational Marine Impact options 3A and 4A are equally preferred as these represent the fewest vessel days in field and hence the lowest discharges and noise impact. Options 3A and 4A are also equally preferred from an atmospheric emissions perspective, again due to these options having the fewest vessel days to deliver the scope. From an Other Consumptions perspective all options are equally preferred, as the resultant atmospheric emissions from recycling and material replacement are similar with the differences being insufficient to express a preference. For Seabed Disturbance and Legacy Marine Impacts, Option 1C is preferred for similar reasons. Despite there being a greater area of temporary disturbance associated with Option 1C the removal of the infrastructure from the protected areas is preferred to exposed pipe remaining with the potential for future remediation as this is more impactful to the site conservation objectives. The majority of these lines lie inside one or more protected areas.
Technical	**Options 2B, 3A and 4A are assessed as being equally preferred from a Technical perspective.** Options 2B, 3A and 4A are equally preferred from a Technical Risk perspective as, while all options employ routine operations, the much greater scope associated with the full removal in Option 1C presents greater technical risk on a cumulative basis.
Societal	**Option 1C is assessed as being preferred from a Societal perspective.** With respect to impacts on the Fishing industry Option 1C is preferred as it involves full removal of the lines from the offshore site, where trawling is more prevalent, which is preferable to leaving infrastructure that could potentially snag fishing gear. For Other Users there is no clear preference and all options are found to be equally preferable. The positive aspect of the large quantity of material recovered for recycling (steel) is balanced against the likelihood of large quantity of the steel reinforced concrete material going to landfill due to saltwater contamination.

GROUP 3 – NON-CONCRETE WEIGHT COATED INFIELD PIPELINES
(See Appendix E for full attributes table and assessment)

Economic

Option 4A is assessed as being preferred from an Economic perspective.

From a Short-term Costs perspective Option 4A is found to be preferred as its associated costs are considerably lower than options 1C and 2B and sufficiently lower than Option 3A to express a preference for Option 4A. Option 4A costs are 62.5% of Option 3A and 6.5% or Option 1C.

From a Long-term Costs perspective Option 1C is preferred as there are no long term costs associated with the full removal option.

Summary

Overall Option 3A is the emerging recommendation.

Option 3A is the preferred option against the Safety criterion, it is second (to Option 1C) against the Environment criterion. It is equally preferred against the Technical criterion and second in preference (to Option 1C) against the Societal criterion. This strong showing across all criteria results in a strong preference for Option 3A overall.

Once the Economics criterion is included, the preference for Option 3A remains, making it the emerging recommendation for Group 3.

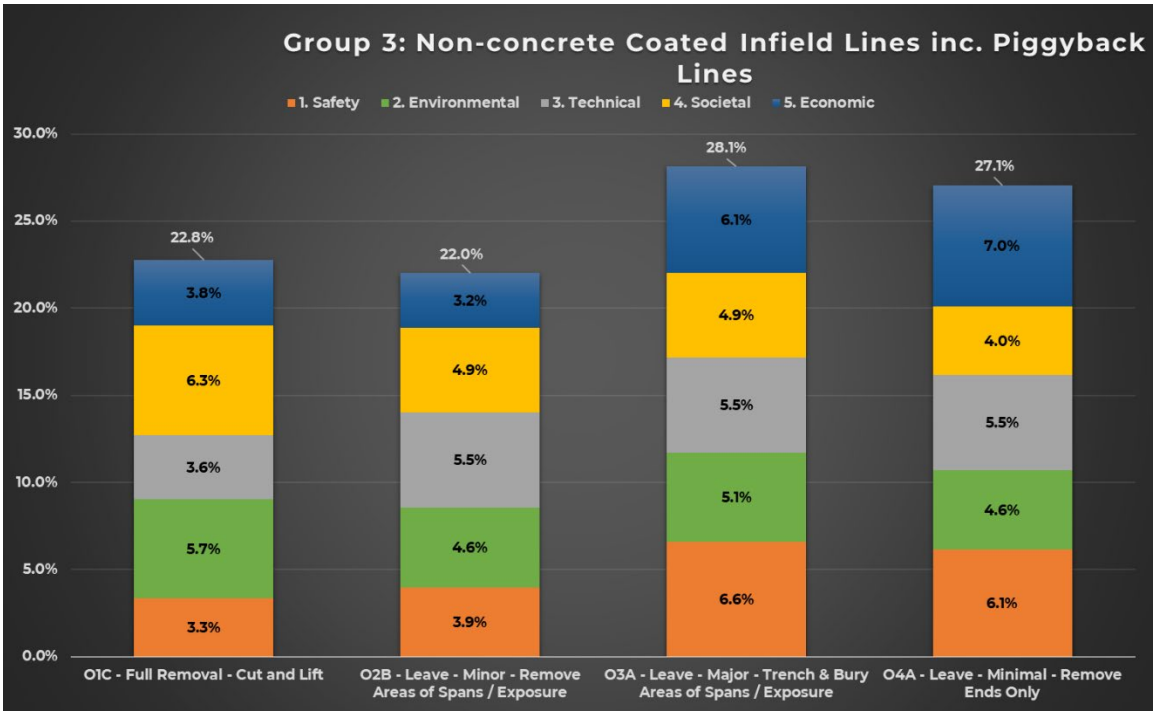


Table 6.3 – Group 3 Evaluation Summary

7 GROUP 4 – UMBILICALS

7.1 Group 4 Characteristics

The items that make up Group 4 and their key characteristics are listed in Table 7.1. There are two stand-alone umbilicals (PLU4690 and PLU4743 that are addressed as part of Group 5 - Flexible Flowlines and Jumpers and shall be fully removed.

ID	DESCRIPTION	OD (INCHES)	LENGTH (KM
PLU4689	Hydraulic Umbilical 48/29C to Subsea Well 48/30-8	2.98	5.90
PL1323	Electro Hydraulic Chem Injection Umbilical Platform 48/29A-P TUTU to Subsea Well 48/30-11	5.16	9.61

Table 7.1 - Group 4 Items

7.2 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 screening methodology. The assessment performed and the resultant outcomes are detailed fully in the CA Screening Report ref. [3] and summarised in Table 7.2 below.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Full Removal	1A Reverse Installation – Reeling / Carousel	Disconnection of the umbilical ends and recovery of the entire line by reverse installation utilising Reel Lay vessel or CSV (Reverse Reel). Umbilical would be exposed if buried.	Assessed as attractive against the Safety and Technical criteria, acceptable against Societal and unattractive against the remaining two. Retained as the least onerous full removal option.
	1B Reverse Installation – S-Lay	Disconnection of the umbilical ends and recovery of the entire line by reverse installation utilising S-Lay vessel (Reverse S-Lay). Umbilicals would be exposed if buried.	Screened out as a Technical showstopper, option is not applicable for umbilicals.
	1C Pull and Cut	Disconnection of the umbilical ends and removal, by cut and lift utilising MSV/CSV, of the entire umbilical.	Assessed as unattractive against the Environmental and Economic criteria, attractive against the Technical criterion and acceptable against the remaining two. Screened out as this is a more onerous full removal option than Option 1A.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (Partial Removal)	2A Partial removal, 0.6m ToU only and then trench to 0.6m ToU.	Disconnection and removal of the umbilical ends and recovery of all exposed sections and <0.6m ToU buried sections by pull and cut. Remaining umbilical, stabilisation features and O&G debris trenched & back-filled to min. depth of burial of 0.6m ToU.	Assessed as attractive against the Technical criterion, unattractive against the Environmental criterion and acceptable against the three remaining criteria. Retained as least onerous partial removal option.
	2B Trench to 0.6m ToU Cut Ends Only	Disconnection and removal of the umbilical ends and recovery of all exposed sections of umbilical by partial Cut & Lift. Cut ends of umbilical trenched & back-filled to min. depth of burial of 0.6m ToU.	Assessed as an approach more suited to rigid pipelines rather than flexible pipelines / umbilicals. Screened out on that basis
Leave In-situ (Major Intervention)	3A Trench to 0.6m ToU	Disconnection and removal of the umbilical ends. Exposed/spanning umbilical sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToU.	Assessed as attractive against the Technical criterion, unattractive against the Environmental criterion and acceptable for the three remaining criteria. Retained for evaluation.
	3B Trench to 0.6m ToU, with FishSafe span removal	Disconnection and removal of the umbilical ends. All potential snagging hazards, i.e. FishSAFE spans, and stabilisation features in the vicinity to be cut and removed by CSV/MSV. Remaining umbilical sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 0.6m ToU.	Assessed as attractive against the Technical criterion, unattractive against the Environmental and Economic criteria and acceptable for the two remaining criteria. Screened out accordingly.
	3C Trench to suitable depth (>>0.6m) to ToU to avoid future exposure	Disconnection and removal of the umbilical ends. Remaining umbilical sections, stabilisation features and O&G debris trenched & back-filled to a minimum depth of burial of 3m ToU or more.	Initially assessed as attractive against the Safety and Societal criteria, unattractive against the Environmental criterion and acceptable for the two remaining criteria. Latterly screened out as a Technical showstopper as considered unfeasible.

CATEGORY	OPTION	DESCRIPTION	DISCUSSION
Leave In-situ (minimum intervention)	4A Minimum intervention	Disconnection and removal of the umbilical ends and make safe the remaining cut ends.	Assessed as attractive against the Technical criterion, unattractive against the Societal criterion and acceptable against the remaining three criteria. Retained for evaluation.
	4B Minimum intervention with Accelerated Decomposition	Disconnection and removal of the umbilical ends and make safe the remaining cut ends. Introduction of a corrosion accelerant to the umbilical to accelerate the decomposition of the line left in-situ.	Screened out as a Technical showstopper, as accelerated decomposition cannot be applied to umbilicals due to their construction.

Table 7.2 - Group 4 Decommissioning Options and Screening Summary

7.3 Group 4 Decommissioning Options for Evaluation

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

- Full Removal
  - 1A – Reverse installation – Reeling / Carousel
- Leave In-situ (partial removal)
  - 2A – Partial removal, remove areas buried to less than 0.6m (ToU) by cut and lift and then trench cut ends to achieve 0.6m burial depth ToU
- Leave In-situ (major intervention)
  - 3A – Trench areas buried to less than 0.6m ToU to achieve 0.6m burial depth ToU
- Leave In-situ (minimal intervention)
  - 4A – Minimum intervention, removal of line ends only and then trench cut ends to achieve 0.6m burial depth ToU

7.4 Group 4 Evaluation Summary

GROUP 4 – UMBILICALS (See Appendix F for full attributes table and assessment)	
Safety	**Options 2A and 3A are assessed as being preferred from a Safety perspective.** For Operations Personnel options 2A, 3A and 4A are equally preferred over the full removal option (Option 1A) as these options involve less exposure for personnel due to smaller offshore scope. For Other Users and High Consequence Events a similar profile is apparent with options 2A, 3A and 4A equally preferred over Option 1A due to fewer days of vessel operations and transits and fewer offshore lifts this presenting a lower potential for dropped object. For Legacy Risk Option 1A is preferred as this involves the full removal of infrastructure and thus no legacy risk exists. The fishing risk assessment conducted shows only low risk for these lines. Option 4A is the least preferred for Legacy Risk.
Environment	**Option 1A is assessed as being preferred from an Environment perspective.** For Operational Marine Impact options 2A, 3A and 4A are all equally preferred as these represent the fewest vessel days in field and hence the lowest discharges and noise impact. All options are equally preferred from an atmospheric emissions perspective as while there are small differences in emissions generated by the options, these differences were insufficient to express a preference. For Other Consumptions all options are equally preferred, with the differences in resultant atmospheric emissions from recycling and material replacement being insufficient to express a preference. For Seabed Disturbance and Legacy Marine Impacts, Option 1A is preferred for similar reasons. Despite there being a greater area of temporary disturbance associated with Option 1A the removal of the infrastructure from the protected areas is preferred to exposed pipe remaining with the potential for future remediation as this is more impactful to the site conservation objectives. The majority of these lines lie inside one or more protected areas.
Technical	**Options 2A, 3A and 4A are assessed as being equally preferred from a Technical perspective.** Options 2A, 3A and 4A are equally preferred from a Technical Risk perspective as, while all options employ routine operations, the greater scope associated with the full removal in Option 1A presents greater technical risk on a cumulative basis.
Societal	**Option 1A is assessed as being preferred from a Societal perspective.** With respect to impacts on the Fishing industry Option 1A is preferred as it involves full removal of the lines from the offshore site, where trawling is more prevalent, which is preferable to leaving infrastructure that could potentially snag fishing gear. For Other Users there is no clear preference and all options are found to be equally preferable. The positive aspect of the large quantity of material recovered for recycling (steel / copper) is balanced against the likelihood of the polymer returned going to landfill. The concrete recovered (mattresses) is the same across all options.

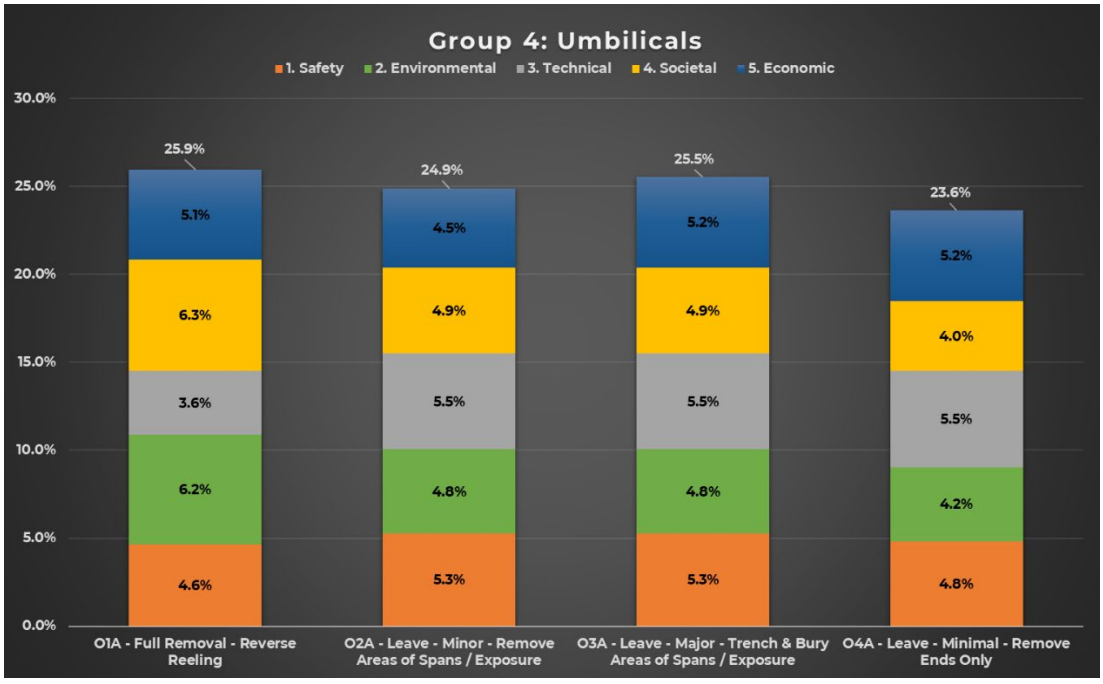
GROUP 4 – UMBILICALS (See Appendix F for full attributes table and assessment)	
Economic	**Options 3A and 4A are assessed as being equally preferred from an Economic perspective.** From a Short-term Costs perspective options 2A, 3A and 4A are found to be equally preferred as their associated costs were similar and relatively lower than Option 1A, being respectively 42%, 32% and 34% of Option 1A. From a Long-term Costs perspective Option 1A was the most preferred as there are no long term costs associated with the full removal option with Option 2A being least preferred due to the greater costs associated with future remediation.
Summary	**Overall Option 1A is the emerging recommendation.** Option 1A is the preferred option against the Environmental and Societal criteria. It is the least preferred option against the Safety and Technical criteria. Collectively, this presents a small preference for Option 1A overall. Once the Economics criterion is included, the preference for Option 1A remains, making it the emerging recommendation for Group 4. 

Table 7.3 - Group 4 Evaluation Summary

8 RECOMMENDATIONS

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

There were several groups where the recommended decommissioning approach was full removal, with no further comparative assessment necessary. These are:

- Group 5 – Flexible Flowlines and Jumpers
- Group 6A – Mattresses (Exposed)
- Group 7A – Exposed Grout Bags

In addition, the recommended decommissioning approach for the following groups was Leave In-situ without the full comparative assessment process being applied. These groups, along with a brief justification are:

- Group 6B – Mattresses (Buried) – as these protection and stabilisation materials are buried to a depth of greater than 0.6m.
- Group 6C – Mattresses (Frond) – as these frond mattresses are buried to a depth of greater than 0.6m.
- Group 6D – Mattresses (Special Cases) – The protection and stabilisation materials that have been applied to pipelines being comparatively assessed shall be decommissioned in the same manner as the associated pipeline. As the decommissioning approach for all pipeline groups (groups 1, 2 and 3) is Option 3A – Leave In-situ – Trench and Bury Areas of Spans / Exposure, the related protection and stabilisation materials shall also remain in-situ. Other protection and stabilisation materials which are decades old and of poor integrity shall have an onsite assessment conducted as to the capability to recover mattresses on a case by case basis. Eni shall consult with OPRED where recovery of mattresses is not considered to be feasible.
- Group 7B – Buried Grout Bags - as these grout bags are buried to a depth of greater than 0.6m.

The full comparative assessment process was applied to the remaining decommissioning groups (1, 2, 3 and 4). The recommended decommissioning options for these groups follow below.

8.1 Group 1 Recommendations

The recommended decommissioning option for Group 1 – Trunk Lines is:

Option 3A – Leave In-situ – Trench and Bury Areas of Spans / Exposures

- Pipelines will be disconnected
- A full pipeline As-Found survey shall be conducted
- Areas of exposures / spanning shall be buried to a minimum of 0.6m ToP using appropriate techniques in-line with Decommissioning Guidance. Where this requirement cannot be met, the Owners shall endeavour to achieve stable, over-trawlable pipeline cover
- Protection and stabilisation features associated with these pipelines, buried to a minimum depth of 0.6m will remain in-situ

- An As-Left survey shall be conducted

The following sections provide a summary of the evaluation of the four most viable Group 1 decommissioning options (Option 1C, Option 2B, Option 3A and Option 4A) against the five criteria and why this recommendation has been made.

8.1.1 Safety

Option 3A has the second lowest risk exposure of the options for operations personnel. This is due to the short offshore durations associated with the scope to disconnect the line ends and re-bury the areas of spans and exposure when compared to the other options, particularly the full removal option. It also has the joint lowest onshore risk exposure with Option 4A as only the pipeline ends are returned for processing. It has the second lowest exposure to other users as there are very few vessel days on-site and very few transits associated with the option, although not as low as Option 4A. It has the equally lowest potential for high consequence events with Option 4A due to there being minimal offshore lifting associated with these options.

The full removal option was preferred from a legacy risk perspective, however while Option 3A leaves the lines in-situ, they will be buried 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 leave in-situ options are preferred to the full removal option from an Operational Marine Impact perspective, however, the partial removal option is only marginally preferred whereas the major and minimal intervention cases are equally significantly preferable. This is due to the increased releases from cutting the lines into sections and the greater noise impact from extended vessel operations on-site in the partial and full removal options. Similarly, the leave in-situ options are preferred to the full removal option from an Atmospheric Emissions and Fuel Use perspective due to the increased emissions from the extended offshore scope in the full removal option, with the major and minimal intervention options being equally preferred to the partial removal option. Regards Other Consumptions, the resultant emissions from recycling are less than those associated with replacement and hence this is preferable to leave in-situ.

From a Seabed Disturbance perspective, the full removal Option is preferred. Although it is associated with a large area of temporary impact caused by the excavation of the lines, leaving the lines in-situ with potential for future remediation is contrary to the site's conservation objectives. The majority of these lines are located within one or more of the following protected areas:

- Haisborough, Hammond and Winterton SAC
- Southern North Sea SAC
- Greater Wash SPA
- Cromer Shoal Chalk Beds MCZ

It is recognised that the full removal option is preferred from a legacy environmental impact perspective.

Overall, there is a preference for Option 1A, Full Removal – Cut and Lift ahead of Option 3A, Trench Exposures / Spans to 0.6m ToP with Option 2B, Partial Removal 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 Risk perspective. While the operations for all options are considered feasible, there are challenges associated with the scale of the operation required to fully remove the lines by cut and lift.

Overall, there is an equal preference for options 2B, 3A and 4A over the full removal option from a Technical perspective.

8.1.4 Societal

Options 2B and 3A were preferred over options 1C and 4A from a Societal – Fishing perspective due to the inshore disruption caused to the creel fishermen from full removal and the offshore impact from leaving infrastructure in-situ.

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 chicken wire reinforced concrete of the lines which would be likely to be destined for limited landfill capacity.

Overall options 2B and 3A 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 less than half the cost of the next lowest cost option with the full removal option being more than 88 times more expensive.

The full removal option is the only case with no associated Long-term Costs and hence it is the preferred case from that perspective.

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

8.2 Group 2 Recommendations

The recommended decommissioning option for Group 2 – Concrete Coated Infield Lines is:

Option 3A – Leave In Situ – Trench and Bury Areas of Spans / Exposures

- Pipelines will be disconnected
- A full pipeline As-Found survey shall be conducted
- Areas of exposures / spanning shall be buried to a minimum of 0.6m ToP using appropriate techniques in-line with Decommissioning Guidance. Where this requirement cannot be met, the Owners shall endeavour to achieve stable, over-trawlable pipeline cover
- Protection and stabilisation features associated with these pipelines, buried to a minimum depth of 0.6m will remain in-situ
- An As-Left survey shall be conducted

The following sections provide a summary of the evaluation of the four most viable Group 2 decommissioning options (Option 1C, Option 2B, Option 3A and Option 4A) against the five criteria and why this recommendation has been made.

8.2.1 Safety

Option 3A has the second lowest risk exposure of the options for operations personnel and is equally preferred along with Option 4A. This is due to the short offshore durations associated with the scope to disconnect the line ends and re-bury the areas of spans and exposure when compared to the other options, particularly the full removal option. It also has the second lowest onshore risk exposure as only the pipeline ends are returned for processing. It has the second lowest exposure to other users as there are very few vessel days on-site and very few transits associated with the option, although not as low as Option 4A. It has the equally lowest potential for high consequence events with Option 4A due to there being minimal offshore lifting associated with these options.

The full removal option was preferred from a legacy risk perspective, however while Option 3A leaves the lines in-situ, they will be buried 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 3A from a Safety perspective.

8.2.2 Environment

All leave in-situ options are preferred to the full removal option from an Operational Marine Impact perspective, however, the partial removal option is only marginally preferred whereas the major and minimal intervention cases are equally significantly preferable. This is due to the increased releases from cutting the lines into sections and the greater noise impact from extended vessel operations on-site in the partial and full removal options. Similarly, the leave in-situ options are preferred to the full removal option from an Atmospheric Emissions and Fuel Use perspective due to the increased emissions from the extended offshore scope in the full removal option, with the major and minimal intervention options being equally preferred to the partial removal option. Regards Other Consumptions, there is insufficient differential between the options to express a preference.

From a Seabed Disturbance perspective, the full removal Option is preferred. Although it is associated with a large area of temporary impact caused by the excavation of the lines, leaving the lines in-situ with potential for future

remediation is contrary to the site's conservation objectives. The majority of these lines are located within one or more of the following protected areas:

- Haisborough, Hammond and Winterton SAC
- Southern North Sea SAC

It is recognised that the full removal option is preferred from a legacy environmental impact perspective.

Overall, there is a preference for Option 1A, Full Removal – Cut and Lift ahead of Option 3A, Trench Exposures / Spans to 0.6m ToP with Option 2B, Partial Removal and Option 4A, Remove Ends Only being equally least preferred from an Environmental perspective.

8.2.3 Technical

All partial removal options were equally preferred over the full removal option from a Technical Risk perspective. While the operations for all options are considered feasible, there are challenges associated with the scale of the operation required to fully remove the lines by cut and lift.

Overall, there is an equal preference for options 2B, 3A and 4A over the full removal option from a Technical perspective.

8.2.4 Societal

Option 1C was preferred over all other options from a Societal – Fishing perspective due to the commercial impact from leaving infrastructure in-situ.

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 reinforced concrete coating, some of which would be likely to be destined for limited landfill capacity.

Overall Option 1C is preferred from a Societal perspective.

8.2.5 Economic

The equally preferred options from a Short-term Costs perspective were options 3A and 4A as the differential between them was insufficient to express a preference. The next most expensive option is over five times more expensive and the least preferred is over 15 times more expensive.

The full removal option is the only case with no associated Long-term Costs and hence it is the preferred case from that perspective.

Overall, options 3A and 4A are equally preferred from an Economic perspective.

8.3 Group 3 Recommendations

The recommended decommissioning option for Group 3 – Non-Concrete Weight Coated Infield Pipelines is:

Option 3A – Leave In Situ – Trench and Bury Areas of Spans / Exposures

- Pipelines will be disconnected
- A full pipeline As-Found survey shall be conducted
- Areas of exposures / spanning shall be buried to a minimum of 0.6m ToP using appropriate techniques in-line with Decommissioning Guidance. Where this requirement cannot be met, the Owners shall endeavour to achieve stable, over-trawlable pipeline cover
- Protection and stabilisation features associated with these pipelines, buried to a minimum depth of 0.6m will remain in-situ
- An As-Left survey shall be conducted

The following sections provide a summary of the evaluation of the four most viable Group 3 decommissioning options (Option 1C, Option 2B, Option 3A and Option 4A) against the five criteria and why this recommendation has been made.

8.3.1 Safety

Option 3A has the second lowest risk exposure of the options for operations personnel and is equally preferred along with Option 4A. This is due to the short offshore durations associated with the scope to disconnect the line ends and re-bury the areas of spans and exposure when compared to the other options, particularly the full removal option. It has the second lowest onshore risk exposure of the options and is equally preferred along with Option 4A as only the pipeline ends are returned for processing. It has the second lowest exposure to other users as there are very few vessel days on-site and very few transits associated with the option, although not as low as Option 4A. It has the equally lowest potential for high consequence events with Option 4A due to there being minimal offshore lifting associated with these options.

The full removal option was preferred from a legacy risk perspective, however while Option 3A leaves the lines in-situ, they will be buried 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 3A from a Safety perspective.

8.3.2 Environment

All leave in-situ options are preferred to the full removal option from an Operational Marine Impact perspective, however, the partial removal option is only marginally preferred whereas the major and minimal intervention cases are equally significantly preferable. This is due to the increased releases from cutting the lines into sections and the greater noise impact from extended vessel operations on-site in the partial and full removal options. Similarly, the

leave in-situ options are preferred to the full removal option from an Atmospheric Emissions and Fuel Use perspective due to the increased emissions from the extended offshore scope in the full removal option, with the major and minimal intervention options being equally preferred to the partial removal option. Regards Other Consumptions, there is insufficient differential between the options to express a preference.

From a Seabed Disturbance perspective, the full removal Option is preferred. Although it is associated with a large area of temporary impact caused by the excavation of the lines, leaving the lines in-situ with potential for future remediation is contrary to the site's conservation objectives. The majority of these lines are located within one or more of the following protected areas:

- Haisborough, Hammond and Winterton SAC
- Southern North Sea SAC

It is recognised that the full removal option is preferred from a legacy environmental impact perspective.

Overall, there is a preference for Option 1A, Full Removal – Cut and Lift ahead of Option 3A, Trench Exposures / Spans to 0.6m ToP with Option 4A, Remove Ends Only 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 Risk perspective. While the operations for all options are considered feasible, there are challenges associated with the scale of the operation required to fully remove the lines by cut and lift.

Overall, there is an equal preference for options 2B, 3A and 4A over the full removal option from a Technical perspective.

8.3.4 Societal

Option 1C was preferred over all other options from a Societal – Fishing perspective due to the commercial impact from leaving infrastructure in-situ.

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 reinforced concrete coating, some of which would be likely to be destined for limited landfill capacity.

Overall Option 1C is preferred from a Societal perspective.

8.3.5 Economic

The preferred option from a Short-term Costs perspective was Option 4A as it is less than two thirds the cost of the next lowest cost option with the full removal option being more than 15 times more expensive.

The full removal option is the only case with no associated Long-term Costs and hence it is the preferred case from that perspective.

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

8.4 Group 4 Recommendations

The recommended decommissioning option for Group 4 – Umbilicals is:

Option 1A – Full Removal – Reeling / Carousel

- Umbilicals will be disconnected
- A full As-Found survey shall be conducted
- De-burial of the lines will be conducted if required.
- Each line shall be initiated before recovering to deck with a tensioner and storing on an appropriate reel or carousel
- An As-Left survey shall be conducted
- The lines shall be returned to shore for recycling and disposal

The following sections provide a summary of the evaluation of the four most viable Group 4 decommissioning options (Option 1A, Option 2A, Option 3A and Option 4A) against the five criteria and why this recommendation has been made.

8.4.1 Safety

The leave in-situ options 2A, 3A and 4A have significantly less exposure to the offshore and onshore operations personnel than the full removal option and as such are equally preferred over it. They also have fewer days in field than the full removal case and are similarly equally preferred.

The number of lifts associated with options 2A, 3A and 4A are similar with the difference being insufficient to express a preference and they are again equally preferred over the full removal case.

The full removal option was preferred from a legacy risk perspective.

Overall, there is a joint preference for options 2A and 3A from a Safety perspective.

8.4.2 Environment

All leave in-situ options are equally preferred to the full removal option from an Operational Marine Impact perspective. This is due to the increased releases from reverse reeling the lines and the greater noise impact from extended vessel operations on-site in the full removal option. There is insufficient difference from an Atmospheric

Emissions and Fuel Use perspective to express a preference and as such they are al equally preferred. Similarly, regards Other Consumptions, there is insufficient difference to express a preference.

From a Seabed Disturbance perspective, the full removal Option is preferred. Although it is associated with a larger area of temporary impact caused by the excavation of the lines, leaving the lines in-situ with potential for future remediation is contrary to the site's conservation objectives. The full length of these lines are located within one or more of the following protected areas:

- Haisborough, Hammond and Winterton SAC
- Southern North Sea SAC

It is recognised that the full removal option is also preferred from a legacy environmental impact perspective.

Overall, there is a preference for Option 1A, Full Removal – Reeling / Carousel ahead of Option 2A, Remove Areas of Exposures / Spans with Option 4A, Remove Ends Only being the least preferred from an Environmental perspective.

8.4.3 Technical

All partial removal options were equally preferred over the full removal option from a Technical Risk perspective. While the operations for all options are considered feasible, there are challenges associated with the scale of the operation required to fully remove the lines by cut and lift.

Overall, there is an equal preference for options 2A, 3A and 4A over the full removal option from a Technical perspective.

8.4.4 Societal

Option 1A was preferred over all other options from a Societal – Fishing perspective due to the commercial impact from leaving infrastructure in-situ.

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 polymers which would be likely to be destined for limited landfill capacity.

Overall Option 1A is preferred from a Societal perspective.

8.4.5 Economic

Options 2A, 3A and 4A are equally the preferred option from a Short-term Costs perspective, they are less than half the cost of full removal.

The full removal option is the only case with no associated Long-term Costs and hence it is the preferred case from that perspective.

Overall, options 3A and 4A are preferred from an Economic perspective.

APPENDIX A EVALUATION METHODOLOGY

A.1 CA Evaluation Methodology

Eni UK 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 The 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 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.

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

A.2 Differentiating Criteria

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 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 Table A.1 below.

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. It should be noted that crew changes are performed via port calls. Any requirement for handling HazMat / NORM shall also be addressed here.	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. The Hours of Exposure is taken from the various studies / cost estimates developed to define the decommissioning options.
	1.2 Other Users	This sub-criterion covers the impact associated with the risk to other users. Considers elements such as collision impact whilst performing activities. Users such as fishing vessels, commercial transport vessels and military vessels are considered. Elements such as duration of vessel operations, number of operational vessel and their locations and number of transits to / from port may be considered.	A quantitative assessment is made based on the number of vessel, durations and port transits associated with each of the decommissioning options. This is considered acceptable as the Safety impact on other users is a function of the operational vessel numbers / durations / movements.
	1.3 High Consequence Events	This sub-criterion relates to 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.	A assessment is conducted to identify activities associated with the decommissioning options that have potential for High Consequence Events. This is a qualitative assessment.

CRITERIA	SUB-CRITERIA	DESCRIPTION	APPROACH TO ASSESSMENT
	1.4 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 remains after performing the decommissioning option. Issues such as residual snag risk, collision risk, etc. may be considered.	An assessment is conducted to identify areas of potential legacy risk associated with the decommissioning options. A risk assessment was conducted on each of the lines across the field with colour coded output to identify specific areas of risk.
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 (m^3) / composition of any releases. Impacts from vessels are qualitative in nature. Marine noise impact is calculated based on the vessel durations, subsea cutting operations and other operations that generate marine noise and is a qualitative measure of cumulative sound energy level. Impact on marine mammals is a key focus.
	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, NOx, SO_2, etc. Fuel and energy consumption are included and are tightly correlated to atmospheric emissions. Not considered: Energy / emissions / resource consumption required to replace materials not recovered for re-use or recycling which is covered in 2.3 Other Consumptions.	Fuel use, emissions and energy consumption are calculated from vessel operations using IP2000 ref. [7] factors for vessel fuel use and emissions. Fuel use, and emissions provided in metric tonnes. Energy provided in joules.

CRITERIA	SUB-CRITERIA	DESCRIPTION	APPROACH TO ASSESSMENT
	2.3 Other Consumptions	This sub-criterion addresses the environmental impact caused by the amount of resource consumption associated with the option. It covers elements such as environmental impact from processing returned materials, the use of quarried rock or other new material and any production of replacement materials for equipment left in-situ.	Other consumptions such as rock / steel / other fabrications are quoted in metric tonnes. Impact of recycling / processing returned material and replacing leave-in-situ material is quoted in CO_2 in metric tonnes. The output CO_2 figures allow a direct, quantitative comparison between options.
	2.4 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 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.
	2.5 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.	Marine impacts are narrative judgement informed by estimates of volumes (m^3) / composition of any releases and the duration these may occur over. Impacts from vessels are qualitative in nature. Marine noise is calculated based on the vessel durations, subsea cutting operations and is a qualitative measure of cumulative sound energy level.
3. Technical	3.1 Technical Risk	This sub-criterion relates to the various technical risks that could result in a major project failure i.e. failure to deliver the decommissioning option broadly within the timescale / budget / endorsed decommissioning programme. Consideration is given to: Technical Novelty / Track Record, Technical Challenges / Consequence of Failure to deliver the decommissioning option as defined.	Assessment based on definition of the decommissioning option provided in the method statements. Qualitative judgement is provided in areas of novelty / track record and risk and consequence of failure.

CRITERIA	SUB-CRITERIA	DESCRIPTION	APPROACH TO ASSESSMENT
4. Societal	4.1 Fishing	This sub-criterion addresses the impact of the decommissioning option on commercial fishing operations. It includes consideration of impacts from both the decommissioning activities themselves and any residual impacts post decommissioning such as reinstatement of access to area.	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.
	4.2 Other Aspects	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.
5. Economic	5.1 Short-term Costs	This sub-criterion addresses the cost of delivering the option as described. An assessment of cost risk or cost uncertainty may also be provided. Not considered: No long-term cost element is considered here.	The cost for delivering the decommissioning option, along with an indication of the cost risk / uncertainty is calculated in the method statements.
	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.	The long-term cost for the monitoring and potential remediation for the decommissioning option, along with an indication of the cost risk / uncertainty is calculated in the method statements.

Table A.1 - Criteria and Sub-criteria Definitions

A.3 Differentiator Weighting

The five differentiating criteria all carry a 20% weighting. That is, all criteria are neutral to each other. The figure below shows the pairwise comparison matrix. Eni UK decided that equal weightings offer the most transparency and a balanced view from all perspectives.

Primary Criteria	1. Safety	2. Environmental	3. Technical	4. Societal	5. Economic	Weighting
1. Safety	N	N	N	N	N	20.0%
2. Environmental	N	N	N	N	N	20.0%
3. Technical	N	N	N	N	N	20.0%
4. Societal	N	N	N	N	N	20.0%
5. Economic	N	N	N	N	N	20.0%

Figure A.1 - Example Pairwise Comparison Matrix (N = Neutral)

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. Appendices C, D, E and F contain the completed Attributes Tables for Groups 1, 2, 3 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.

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, Eni UK 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 below). 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

Figure A.2 - Explanation of Phrasing Adopted for Pairwise Comparison

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 the Figure below.

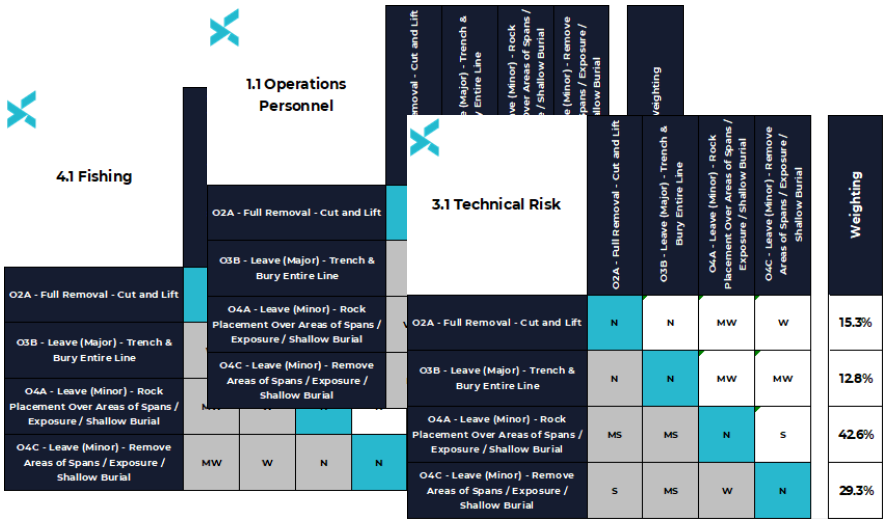


Figure A.3 - Example Option Pairwise Comparison

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 Appendices C, D, E and F. An example of the visual output obtained is shown in the Figure below.

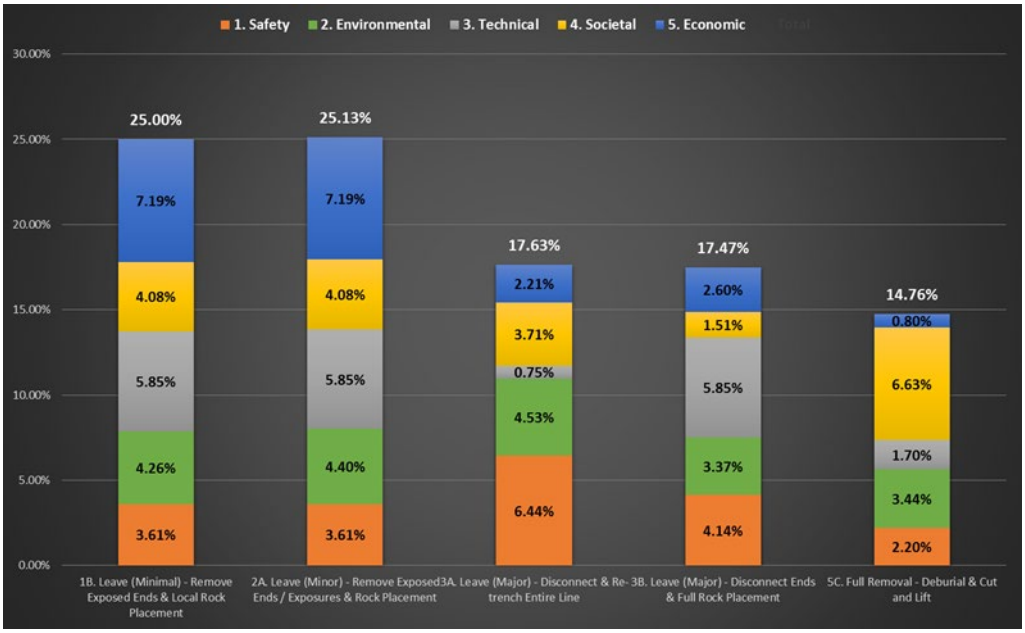


Figure A.4 - Visual Output Example

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 EVALUATION STAKEHOLDER WORKSHOP MINUTES

Subject: Eni Hewett Comparative Assessment Evaluation Workshop

Location: Video Conference

Date: 7th July 2021

Reference: A-302884-S00-MINS-001

Minuted By: Nic Duncan

Issued On: 9th July 2021

Attending:

Alexandra Fawcett	Natural England	Marine Industry Specialist
Helen Mann	Natural England	Marine Lead Advisor
Tetrienne Kerswell-Box	JNCC	Offshore Industry Advisor
Hannah Hood	JNCC	Offshore Industry Advisor
Ruth Ledingham	OPRED ODU	Senior Decommissioning Manager
Caitlyn Cox	OPRED ODU	Decommissioning Manager
Sam Pattie	OPRED ODU	Assistant Decommissioning Manager
Chris Arkless	EniProgetti	Pipelines Decommissioning Specialist
Abigail Harrison-Strong	EniProgetti	HSE Advisor
Andrew Plumb	EniProgetti	Project Engineering Manager
Ryan Phipps	EniProgetti	Subsea Decommissioning Engineer
Tarsicio Flores Hernandez	Eni UK	Project Manager
Donald Smith	Eni UK	HSE Advisor
Juliana Grando	Eni UK	Environmental Advisor
John Entwistle	Eni UK	HSE Advisor
Dhillip Sankoomar	Eni UK	Interface Manager
Vic Morrell	Eni UK	Marine and Subsea Advisor
Istvan Bartha	Petrofac	Pipelines TA
Tracey Harrold	Petrofac	HSE Manager
Billy Sandford	Petrofac	Southern North Sea Team Lead
Nic Duncan	Xodus Group	Project Manager
John Foreman	Xodus Group	Senior Risk Analyst
Deborah Morgan	Xodus Group	Senior Environmental Consultant
Will Garston	Xodus Group	Decommissioning Consultant
Andrew Corse	Xodus Group	Senior Environmental Consultant (observer)

Distribution:

Attendees + Iain Rowe (NFFO), Magdalena Kos (Eni UK), Arnaldo Latas (HSE), Jason Golder (Crown Estates), Tania Tucker (Environment Agency)

ITEM	COMMENT	ACTION
2.0	**Introductions and Background**	
2.1	The session was opened by Nic Duncan, Xodus Project Manager, who thanked the attendees for attending.	Info
2.2	Andrew Plumb, Eni Project Engineering Manager, provided an overview to the Hewett Field history and the decommissioning progress to date.	Info
3.0	**Environmental and Societal Baseline**	
3.1	Dr Deborah Morgan, Xodus Senior Environmental Consultant, provided an overview of the environmental base line against which the decommissioning shall be conducted. Details of the sand banks, sand waves and mega-ripples were described. The various marine protected areas were presented. These are: • Haisborough, Hammond and Winterton SAC • Southern North Sea SAC • Greater Wash SPA • Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ) The extent of shipping in the area was presented showing the proximity to the field infrastructure. An example of the analysis of fishing risk was presented (PL20).	Info
4.0	**Comparative Assessment**	
4.1	Nic Duncan, Xodus Project Manager, provided the background to the CA process conducted to date, including the scoping and screening process, a summary of the data developed within the preparation phase to inform the evaluation and a summary of the options which would be considered within evaluation.	Info
4.2	John Foreman, Xodus Senior Risk Analyst, explained the methodology behind the evaluation process.	Info
4.3	Information provided to inform workshop attendees was as follows: • Terms of Reference (ToR) including the definition of sub-criteria applied within the evaluation; • Evaluation Data Summary Technical Note; • Presentation slides (appended to these minutes).	Info

ITEM	COMMENT	ACTION
5.0	**Group 1: Trunk Lines**	
5.1	Infrastructure details…	

Field / Platform	Description	From	To	Pipeline No.	Pipeline NB / OD (inches)	Length (km)
48/29A-FTP	Concrete Coated Trunk Lines to Bacton Gas Terminal	48/29A-FTP	Bacton GT	PL20	30	27.43
		48/29A-FTP	Bacton GT	PL21	30	32.80

5.2	Four options were evaluated for this group:
	• Full Removal
	  • Option 1C – Cut and Lift with De-burial
	• Leave *In Situ* with Minor Intervention
	  • Option 2B – Remove Areas of Spans / Exposure
	• Leave In Situ with Major Intervention
	  • Option 3A – Trench and Bury Areas of Spans / Exposures
	• Leave In Situ with Minimal Intervention
	  • Option 4A – Remove Ends Only
	Chris Arkless, Eni, explained that there were no re-use opportunities identified at the screening stage for the trunk line PL21, however, Eni were aware that other parties were looking at the possibility of re-use.
	Ruth Ledingham, OPRED, recommended further engagement with the OGA and OPRED regarding the maintenance of the line integrity to ensure that no future re-use opportunities were ruled out.
	Andrew Plumb, Eni, clarified that, for CA purposes, the boundary of the trunk lines was at the low water mark and that the onshore section was not part of this workshop.
	Ruth Ledingham, OPRED, clarified that the Section 29 notice only runs to the low water mark, but pointed out that any decision concerning the onshore section of the pipeline should consider the implications for the offshore section with regard to the potential for re-use.
		Info

5.3	Evaluation	
5.3.1	Safety	
5.3.1.1	Operational Personnel – The assessment conducted was presented with no challenge raised. A query was raised by Alex Fawcett as to whether post decommissioning activities are factored in to the PLLs presented. This is covered under the Legacy Risk sub-criterion.	Info
5.3.1.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
5.3.1.3	High Consequence Events (HCE) – The assessment conducted was presented with no challenge raised.	Info

ITEM	COMMENT	ACTION
5.3.1.4	Legacy Risk – The assessment conducted was presented with no challenge raised. Ruth Ledingham asked if there was any additional consideration given to the integrity of PL20 for recovery from a safety perspective. John Foreman, Xodus, clarified that all options proposed were considered to be safely executable. Istvan Bartha, clarified that the failure of PL20 was related to free spanning not integrity and that the pipeline was considered to be in suitable condition such that no decommissioning options were ruled out. Ruth Ledingham, OPRED, advised that this needs to be made clear within the reported conclusions	Info
5.3.2	Environment	
5.3.2.1	Operational Marine Impacts – The assessment conducted was presented. The initial findings were challenged by Hannah Hood, JNCC, as the noise from vessels and cutting operations would be considered to be background and shouldn't be driving the decision. John Foreman, Xodus, also noted that the release from cutting lines into sections would be minimal as the lines were gas carriers. The judgements relating to Option 1C were reduced from Much Weaker and Very Much Weaker to Weaker and Much Weaker and the judgement relating to Option 3A was changed from Weaker to Neutral. Alexandra Fawcett, Natural England, agreed with Hannah Hood's view with respect to noise and noted that the Red Throated Diver was more sensitive to visual presence of the vessel(s), although this was only applicable in winter.	Info
5.3.2.2	Atmospheric Emissions and Fuel Consumption – The assessment conducted was presented with no challenge raised.	Info
5.3.2.3	Other Consumptions – The assessment conducted was presented with no challenge raised.	Info

ITEM	COMMENT	ACTION
5.3.2.4	Seabed Disturbance – The assessment conducted was presented. Helen Mann, Natural England, questioned whether the differential between temporary and permanent disturbance was sufficiently represented. Alexandra Fawcett, Natural England, noted that within the Haisborough, Hammond and Winterton SAC and the Cromer Shoal MCZ larger areas of temporary disturbance is not necessarily as undesirable as originally depicted. A clear seabed is preferred over exposed pipe remaining and/or future remediation, which would be more impactful to the site conservation objectives. John Foreman, Xodus, asked whether it would be helpful to show where intervention was proposed in relation to the protected sites? This was confirmed. Action Response: Seabed Disturbance impacts within attributes table for Group 1 updated to include impacts specifically within protected areas and assessment adjusted accordingly. Abigail Harrison-Strong, Eni, asked whether removal of areas of spans and exposures would be preferable? This was confirmed by Alexandra Fawcett, Natural England, who explained that stable buried areas could be left *in situ* subject to there being a good level of confidence in the long term burial stability. Helen Mann, Natural England, noted that there was a balance to be struck regarding *Sabellaria Spinulosa* reef in areas adjacent to the pipelines and that disturbance to these was more impactful than any communities on the pipelines themselves. Abigail Harrison-Strong, Eni, advised that an environmental baseline survey would be conducted to provide more information on the site prior to decommissioning activities taking place. Hannah Hood, JNCC, explained that due to the mobile nature of the area an understanding of conditions beyond the immediate site would be helpful. Full removal is considered ideal however partial removal would also be considered a good result. Vic Morrel, Eni, noted that from a fisheries perspective, removal of spans and any problematic area is preferred. It was clarified that fisheries issues are given due consideration under Legacy Risk and Societal – Fishing. The preference was amended to Option 1C being most preferred.	Info Info Eni Info Info Info Info Info Info
5.3.2.5	Legacy Marine Impacts – The assessment conducted was presented with no challenge raised. Hannah Hood, JNCC, asked what length of pipeline was proposed to be removed for Option 2B. Will Garton, Xodus, advised that 10.1 km of pipeline was proposed to be removed under Option 2B. An action was taken to identify the pipeline intervention with respect to the protected areas. Action Response: Legacy impacts within attributes table for Group 1 updated to include impacts specifically within protected areas and assessment adjusted accordingly.	Info Info Eni
5.3.3	Technical	
5.3.3.1	Technical Risk – The assessment conducted was presented with no challenge raised.	Info
5.3.4	Societal	

ITEM	COMMENT	ACTION
5.3.4.1	Fishing – The assessment conducted was presented with no challenge raised. John Foreman, Xodus, noted that with similar in-shore pipeline areas there was a balance to be struck between long-term removal of the pipeline and short-term disturbance to creel fishing activities in the area. Vic Morrel, Eni, agreed that operational surveys do impact in-shore fishing activities but that the assessment should remain as is for consideration by the National Federation of Fisherman's Organisations (NFFO) off-line.	Info
5.3.4.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
5.3.5	Economic	
5.3.5.1	Short Term Costs – The assessment conducted was presented with no challenge raised.	Info
5.3.5.2	Long Term Costs – The assessment conducted was presented with no challenge raised.	Info
5.3.6	Results	
5.3.6.1	Option 3A was identified as the emerging recommendation without economics included by a small margin to Option 4A. The addition of economics moves the preference to Option 4A, however, it was noted that short-term costs may be less significant than have been presented. Option 3A did not receive any particular positive contributions; however, it was equally favourable across a number of sub-criteria; 1.3 – High Consequence Events, 2.1 – Operational Marine Impact, 2.2 – Atmospheric Emissions & Fuel Consumption, 3.1 – Technical Risk, 4.1 – Fishing, 4.2 – Other Users and 5.2 – Long-term Costs. It received negative contributions from 1.1 – Operations Personnel, 1.2 – Other Users, 1.4 – Legacy Risk, 2.3 – Other Consumptions, 2.4 – Seabed Disturbance, 2.5 – Legacy Marine Impacts and 5.1 – Short-term Costs, however this was insufficient to prevent it becoming the emerging recommendation.	Info
5.3.6.2	Alexandra Fawcett, Natural England, stated that from a purely environmental perspective Options 1C and 2B were preferable.	Info
5.3.6.3	There were no sensitivities conducted for this group.	Info

ITEM	COMMENT	ACTION
6.0	**Group 2: Concrete Coated Infield Lines incl. Piggy Backed Lines**	
6.1	Infrastructure details…	

Field / Platform	Description	From	To	Pipeline No.	Pipeline NB / OD (inches)	Length (km)
Hewett / 52/5A	Gas Export Pipeline	52/5A	48/29A-FTP	PL83	24	4.00
Hewett / 48/29B	Gas Export Pipeline	48/29B	48/29A-FTP	PL84	24	8.55
Hewett / 48/29C	Gas Export Pipeline	48/29C	48/29A-FTP	PL85	24	9.44
Hewett / 48/29C	Gas Export Pipeline	48/30-8 & 48/30-10	48/29C	PL86	10	5.80
Hewett / 48/29A-FTP	Gas Export Pipeline	48/30-9	48/29A-FTP	PL87	8	6.10

6.2	Four options were evaluated for this group:
	• Full Removal
	  • Option 1C – Cut and Lift with De-burial
	• Leave *In Situ* with Minor Intervention
	  • Option 2B – Remove Areas of Spans / Exposure
	• Leave In Situ with Major Intervention
	  • Option 3A – Trench and Bury Areas of Spans / Exposures
	• Leave In Situ with Minimal Intervention
	  • Option 4A – Remove Ends Only
		Info

6.3	Evaluation	
6.3.1	Safety	
6.3.1.1	Operational Personnel – The assessment conducted was presented with no challenge raised.	Info
6.3.1.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
6.3.1.3	High Consequence Events – The assessment conducted was presented with no challenge raised.	Info
6.3.1.4	Legacy Risk – The assessment conducted was presented with no challenge raised. A comparison was made with Group 1 to consider whether the judgements made should change. It was determined that no change was necessary due to the lower level of fishing in the area.	Info
6.3.2	Environment	
6.3.2.1	Operational Marine Impacts – The assessment conducted was presented with no challenge raised. Alexandra Fawcett, Natural England, advised that the sensitivity noted for the Red Throated Diver within trunk line area was not relevant for this location.	Info
6.3.2.2	Atmospheric Emissions and Fuel Consumption – The assessment conducted was presented with no challenge raised.	Info
6.3.2.3	Other Consumptions – The assessment conducted was presented with no challenge raised.	Info

ITEM	COMMENT	ACTION
6.3.2.4	Seabed Disturbance – The assessment conducted was presented. Judgements were amended in line with those applied to Group 1, however, the preference for Option 2B is not quite as strong as for Group 1. Judgements are made on the assumption that the majority of disturbance is within protected areas. As per previous, it was recommended that any locations of proposed pipeline removal should be identified with respect to the protected areas and the judgements amended accordingly.	Info
6.3.2.5	Legacy Marine Impacts – The assessment conducted was presented. The judgements were altered in line with those made for Group 1. The preference for Option 1C against all other options was increased from Stronger to Much Stronger and the preference for options 2B and 3A against Option 4A were increased from Neutral to Stronger.	Info
6.3.3	Technical	
6.3.3.1	Technical Risk – The assessment conducted was presented with no challenge raised.	Info
6.3.4	Societal	
6.3.4.1	Fishing – The assessment conducted was presented with no challenge raised.	Info
6.3.4.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
6.3.5	Economic	
6.3.5.1	Short Term Costs – The assessment conducted was presented with no challenge raised.	Info
6.3.5.2	Long Term Costs – The assessment conducted was presented with no challenge raised.	Info
6.3.6	Results	
6.3.6.1	Option 3A was identified as the emerging recommendation. The preference profile was similar to that for Group 1 but with less of a gap between options 1C and 2B as there is no impact on creel fishing at this location. Option 3A did not receive any particular positive contributions; however, it was equally favourable across a number of sub-criteria; 1.1 – Operations Personnel, 1.2 – Other Users, 1.3 – High Consequence Events, 2.1 – Operational Marine Impact, 2.2 – Atmospheric Emissions & Fuel Consumption, 2.3 – Other Consumptions, 3.1 – Technical Risk, 4.2 – Other Users, 5.1 – Short-term Costs and 5.2 – Long-term Costs. It received negative contributions from 1.4 – Legacy Risk, 2.4 – Seabed Disturbance, 2.5 – Legacy Marine Impacts and 4.1 – Fishing, however this was insufficient to prevent it becoming the emerging recommendation.	Info
6.3.6.2	A sensitivity was conducted on the basis that the majority of seabed disturbance was out with protected areas. This reduced the preference for full removal but did not affect the overall hierarchy of preferences.	Info
6.3.6.3	Ruth Ledingham, OPRED, requested details of the data that underpins the Legacy Risk aspect, the number of surveys assumed and the amount of remediation. Five surveys are assumed, one every five years for 25 years. The estimate for remediation has been informed by operational remediation requirements over recent years. Action Response: Underlying data informing the Legacy Risk assessment detailed in the Fisheries Interaction Risk Assessment ref. [8] and considers burial status, seabed mobility and fishing intensity factors.	Eni Info

ITEM	COMMENT	ACTION
7.0	**Group 3: Non- Concrete Coated Infield Lines incl. Piggy Backed Lines**	
7.1	Infrastructure details…	

Field / Platform	Description	From	To	Pipeline No.	Pipeline NB / OD (inches)	Length (km)
48/29A-P	Gas Export Flowline with Piggy Backed Umbilicals PL585 & PL586	48/30-11	48/29A-P	PL584	10	10.05
48/29C	Gas Export Flowline with Pggy Backed Umbilical PL1174	48/29-9	48/29C	PL1173	8	6.10
48/29C	Gas Export Flowline with Piggy Backed Umbilical U30-14	48/30-14	48/29C	PL1177	8	5.90

7.2	Four options were evaluated for this group:
	• Full Removal
	  • Option 1C – Cut and Lift with De-burial
	• Leave *In Situ* with Minor Intervention
	  • Option 2B – Remove Areas of Spans / Exposure
	• Leave In Situ with Major Intervention
	  • Option 3A – Trench and Bury Areas of Spans / Exposures
	• Leave In Situ with Minimal Intervention
	  • Option 4A – Remove Ends Only
		Info

7.3	Evaluation	
7.3.1	Safety	
7.3.1.1	Operational Personnel – The assessment conducted was presented with no challenge raised.	Info
7.3.1.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
7.3.1.3	High Consequence Events – The assessment conducted was presented with no challenge raised.	Info
7.3.1.4	Legacy Risk – The assessment conducted was presented with no challenge raised.	Info
7.3.2	Environment	
7.3.2.1	Operational Marine Impacts – The assessment conducted was presented with no challenge raised.	Info
7.3.2.2	Atmospheric Emissions and Fuel Consumption – The assessment conducted was presented with no challenge raised.	Info
7.3.2.3	Other Consumptions – The assessment conducted was presented with no challenge raised.	Info

ITEM	COMMENT	ACTION
7.3.2.4	Seabed Disturbance – The assessment conducted was presented. Judgements were amended in line with the challenge raised in Group 1, with the preference being for Option 1C followed by Option 2B, then Option 3A. For Option 2B there is 544 m of proposed pipeline removal within the Southern North Sea SAC protected area. Alexandra Fawcett stated that exposures are the key issue, where pipelines are buried and stable, they are of no concern.	Info Info Info
7.3.2.5	Legacy Marine Impacts – The assessment conducted was presented. The preference for Option 1C over options 2B and 3A were strengthened from Stronger to Much Stronger. It was noted that there would be polymer left within the marine environment for the leave *in situ* options for this group. Post meeting note: Group 2 has the largest quantity of polymer in the form of coal line epoxy used as a corrosion coating beneath the concrete weight coating.	Info Info
7.3.3	Technical	
7.3.3.1	Technical Risk – The assessment conducted was presented with no challenge raised.	Info
7.3.4	Societal	
7.3.4.1	Fishing – The assessment conducted was presented with no challenge raised.	Info
7.3.4.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
7.3.5	Economic	
7.3.5.1	Short Term Costs – The assessment conducted was presented with no challenge raised.	Info
7.3.5.2	Long Term Costs – The assessment conducted was presented with no challenge raised.	Info
7.3.6	Results	
7.3.6.1	Option 3A was identified as the emerging recommendation. Option 3A did not receive any particular positive contributions; however, it was equally favourable across a number of sub-criteria; 1.1 – Operations Personnel, 1.2 – Other Users, 1.3 – High Consequence Events, 2.1 – Operational Marine Impact, 2.2 – Atmospheric Emissions & Fuel Consumption, 2.3 – Other Consumptions, 3.1 – Technical Risk and 4.2 – Other Users. It received negative contributions from 1.4 – Legacy Risk, 2.4 – Seabed Disturbance, 2.5 – Legacy Marine Impacts and 4.1 – Fishing, 5.1 – Short-term Costs and 5.2 – Long-term Costs, however this was insufficient to prevent it becoming the emerging recommendation.	Info

ITEM	COMMENT	ACTION
8.0	**Group 4: Umbilicals**	
8.1	Infrastructure details…	

Field / Platform	Description	From	To	Pipeline No.	Pipeline NB / OD (inches)	Length (km)
48/29C 48/29A-P	Hydraulic Umbilical Electro-Hydraulic-Chemical Injection Umbilical	48/29C 48/29A-P	48/30-8 48/30-11	U30-8 PL1323	2.98 5.16	5.90 9.61

8.2	Four options were evaluated for this group:
	• Full Removal
	  • Option 1A – Reverse Reel
	• Leave *In Situ* with Minor Intervention
	  • Option 2B – Remove Areas of Spans / Exposure
	• Leave In Situ with Major Intervention
	  • Option 3A – Trench and Bury Areas of Spans / Exposures
	• Leave In Situ with Minimal Intervention
	  • Option 4A – Remove Ends Only
		Info

8.3	Evaluation	
8.3.1	Safety	
8.3.1.1	Operational Personnel – The assessment conducted was presented with no challenge raised. John Foreman, Xodus, highlighted that the PLLs associated with this group are an order of magnitude lower than for the other groups primarily due to the full removal option being by reverse installation.	Info
8.3.1.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
8.3.1.3	High Consequence Events – The assessment conducted was presented with no challenge raised.	Info
8.3.1.4	Legacy Risk – The assessment conducted was presented with no challenge raised.	Info
8.3.2	Environment	
8.3.2.1	Operational Marine Impacts – The assessment conducted was presented with no challenge raised.	Info
8.3.2.2	Atmospheric Emissions and Fuel Consumption – The assessment conducted was presented with no challenge raised. An action was taken to double check the values presented for fuel and emissions relating to Option 4C as the appeared unduly high. Action Response: adjustment made to correct error in fuel use and emissions for this option. Attributes table updated and assessment checked and remains valid. Judgements were made on the assumption that the correct values will be lower than for the other options.	Xodus Info
8.3.2.3	Other Consumptions – The assessment conducted was presented with no challenge raised.	Info

ITEM	COMMENT	ACTION
8.3.2.4	Seabed Disturbance – The assessment conducted was presented. Judgements were amended in line with the challenge previously raised against Seabed Disturbance for Group 1, with the preference being for Option 1A followed by Option 2B, then Option 3A. Discussion was held regarding the conflicting impacts on overlapping areas. It was concluded that preference should be for the Haisborough, Hammond and Winterton SAC over the Southern North Sea SAC.	Info
8.3.2.5	Legacy Marine Impacts – The assessment conducted was presented with no challenge raised. A question was raised whether the quantity of polymer associated with this group is sufficient to amend the judgement. It was concluded that it was not. Post meeting note: As noted above Group 2 actually has the largest amount of polymer associated with any of the groups.	Info
8.3.3	Technical	
8.3.3.1	Technical Risk – The assessment conducted was presented with no challenge raised.	Info
8.3.4	Societal	
8.3.4.1	Fishing – The assessment conducted was presented with no challenge raised.	Info
8.3.4.2	Other Users – The assessment conducted was presented with no challenge raised.	Info
8.3.5	Economic	
8.3.5.1	Short Term Costs – The assessment conducted was presented with no challenge raised.	Info
8.3.5.2	Long Term Costs – The assessment conducted was presented with no challenge raised.	Info
8.3.6	Results	
8.3.6.1	Option 1A was identified as the emerging recommendation. Option 1A received positive contributions from several sub-criteria judgements, including 1.4 – Legacy Risk, 2.4 – Seabed Disturbance, 2.5 – Legacy Marine Impacts, 4.1 – Fishing and 5.2 – Long-term Costs. It received negative contributions from 1.1 – Operations Personnel, 1.2 – Other Users, 1.3 – High Consequence Events, 2.1 – Operational Marine Impact, 3.1 – Technical Risk and 5.1 – Short-term Costs. For the remaining sub-criteria, 2.2 – Atmospheric Emissions & Fuel Consumption, 2.3 – Other Consumptions and 4.2 – Other Users it was equally preferred.	Info
10.0	**Closing Statements**	
10.1	Alexandra Fawcett, Natural England, questioned whether these are the results that would be carried through to the Environmental Appraisal(s) and Decommissioning Programme(s)? John Foreman, Xodus, demonstrated that significant adjustment of the criteria weightings would be necessary to alter the results from those that have emerged showing that the process is robust. Abigail Harrison-Strong, Eni, advised that a Habitats Regulation Assessment can be performed to address any specific environmental concerns relating to the site and that eventual permitting would also identify any necessary specific actions relating to discrete areas of the site.	Info

ITEM	COMMENT		ACTION
10.2	John Foreman, Xodus, summarised that initial judgements were presented and amended in accordance with the expertise in attendance. Emerging Recommendations were:		Info
	Group 1 Trunk Lines	Option 3A Trench and Bury Areas of Spans / Exposures	
	Group 2 Concrete Coated Pipelines	Option 3A Trench and Bury Areas of Spans / Exposures	
	Group 3 Non-Concrete Coated Pipelines	Option 3A Trench and Bury Areas of Spans / Exposures	
	Group 4 Umbilicals	Option 1A Full Removal by Reverse Installation	

APPENDIX C GROUP 1 – DETAILED EVALUATION RESULTS

C.1 Group 1 Attributes Table

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
		- Disconnection of pipeline ends - De-burial of pipeline where necessary using MFE - Full removal by cut and lift utilising MSV/CSV	- Disconnection of pipeline ends - Expose pipeline around areas of spans / exposures / pipeline ends - Remove spans / exposures / pipeline ends by cut and lift utilising MSV/CSV - Trench and back fill cut ends to minimum 0.6 m ToP	- Disconnection of pipeline ends - Remove pipeline ends by cut and lift utilising MSV/CSV - Trench and back fill spans / exposures to minimum 0.6 m ToP	- Disconnection of pipeline ends - Remove pipeline ends by cut and lift utilising MSV/CSV
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL CSV: 130 / 1,025 / 2,830,330 / 1.62E-01 DSV: 100 / 95 / 192,692 / 7.48E-03 Divers: 25 / 95 / 622,527 / 8.89E-01 Supply Vessel: 18 / 1,509 / 772,335 / 2.20E-02 Total offshore hours: 4,417,884 hrs Total offshore PLL: 1.08E00 Resource Type: Hours / PLL Engineering & Management: 449,091 / 1.80E-03 Project Management: 103,790 / 4.15E-04 Onshore Operations : 171,200 / 2.11E-02 Total onshore hours: 724,081 hrs Total onshore PLL: 2.33E-02 Total operational hours: 5,141,965 hrs Total operational PLL: 1.10E00	Vessel Type: PoB / Days / Hours / PLL CSV: 130 / 273 / 745,861 / 3.78E-02 DSV: 100 / 51 / 103,547 / 4.05E-03 Divers: 25 / 51 / 170,076 / 2.76E-01 Supply Vessel: 18 / 404 / 206,148 / 5.88E-03 Total offshore hours: 1,225,632 hrs Total offshore PLL: 3.23E-01 Resource Type: Hours / PLL Engineering & Management: 128,700 / 5.15E-04 Project Management: 29,744 / 1.19E-04 Onshore Operations : 19,050 / 2.34E-03 Total onshore hours: 177,494 hrs Total onshore PLL: 2.98E-03 Total operational hours: 1,403,126 hrs Total operational PLL: 3.26E-01	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 11 / 22,137 / 1.01E-03 Divers: 25 / 11 / 1,659 / 5.68E-03 Trencher: 75 / 30 / 54,841 / 2.11E-03 Total offshore hours: 78,637 hrs Total offshore PLL: 8.80E-03 Resource Type: Hours / PLL Engineering & Management: 15,420 / 6.17E-05 Project Management: 3,564 / 1.43E-05 Onshore Operations : 5,349 / 6.58E-04 Total onshore hours: 24,333 hrs Total onshore PLL: 7.34E-04 Total operational hours: 102,970 hrs Total operational PLL: 9.54E-03	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 11 / 23,757 / 9.15E-04 Divers: 25 / 11 / 1,959 / 2.80E-03 Total offshore hours: 25,716 hrs Total offshore PLL: 3.71E-03 Resource Type: Hours / PLL Engineering & Management: 4,147 / 1.66E-05 Project Management: 958 / 3.83E-06 Onshore Operations : 5,349 / 6.58E-04 Total onshore hours: 10,454 hrs Total onshore PLL: 6.78E-04 Total operational hours: 36,170 hrs Total operational PLL: 4.39E-03
		MW	**VMW**	**VMW**	**VMW**	**VMW**	**W**
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 1C is assessed as being Much Weaker than Option 2B due to the risk exposure being around three times higher due to the increased offshore scope associated with the full removal of the lines in Option 1C. Option 1C is assessed as being Very Much Weaker than Option 3A due to the risk exposure being around 115 times higher due to the much greater offshore scope associated with the full removal of the lines in Option 1C. Option 1C is assessed as being Very Much Weaker than Option 4A due to the risk exposure being around 250 times higher due to the much greater offshore scope associated with the full removal of the lines in Option 1C. Option 2B is assessed as being Very Much Weaker than Option 3A due to the risk exposure being around 35 times higher due to the increased offshore scope associated with removing the spans and exposures in Option 2B. Option 2B is assessed as being Very Much Weaker than Option 4A due to the risk exposure being around 75 times higher due to the increased offshore scope associated with removing the spans and exposures in Option 2B. Option 3A is assessed as being Weaker than Option 4A due to the risk exposure being around double due to the increased offshore scope associated with trenching the spans and exposures in Option 3A. **Overall, Option 4A is the preferred option from a risk to Operations Personnel perspective.**			
1. Safety	1.2 Other Users	Vessel Days: CSV: 1,005 DSV: 91 Supply Vessel: 1,469 Total vessel days: 2,565 days Transits: 32	Vessel Days: CSV: 265 DSV: 47 Supply Vessel: 388 Total vessel days: 700 days Transits: 14	Vessel Days: DSV: 7 Trencher: 26 Total vessel days: 33 days Transits: 4	Vessel Days: DSV: 7 Total vessel days: 7 days Transits: 2
		W	**MW**	**MW**	**MW**	**MW**	**W**
	Summary	The assessment of the Other Users sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B as there are more days of vessel operations and more transits to and from shore associated with the full removal option. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A as there are many more days of vessel operations and transits associated with the full removal option. Option 2B is assessed as being Much Weaker than Option 3A and Option 4A as there are many more days of vessel operations and transits associated with Option 2B. Option 3A is assessed as being Weaker than Option 4A as there are more days of vessel operations and transits associated with Option 3A. **Overall, Option 4A is the preferred option from a risk to Other Users perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
1. Safety	1.3 High Consequence Events	Number of offshore lifts: 5,830 Lift PLL: 6.41E-02	Number of offshore lifts: 1,093 Lift PLL: 1.20E-02	Number of offshore lifts: 14 Lift PLL: 1.54E-04	Number of offshore lifts: 14 Lift PLL: 1.54E-04
		MW **VMW** **VMW**	**VMW** **VMW**	**N**	
	Summary	The assessment of the High Consequence Events sub-criterion is as follows: Option 1C is assessed as being Much Weaker than Option 2B due to the much greater scope for high consequence events from dropped object from the thousands of offshore lifting operations associated with the full removal option versus the smaller scope for high consequence events from dropped object from around a thousand lifts in Option 2B. Option 1C is assessed as being Very Much Weaker than Option 3A and Option 4A as there are thousands of lifts associated with the full removal option versus a few lifts in Option 3A and Option 4A. Option 2B is assessed as being Very Much Weaker than Option 3A and Option 4A due to the much greater scope for high consequence events from dropped object from around a thousand lifts associated with removing the spans and exposures in Option 2B versus the much smaller scope for dropped object from the few lifts in Option 3A and Option 4A. Option 3A is assessed as being Neutral to Option 4A as the scope for dropped object is similar and low in both cases. **Overall, Option 3A and Option 4A are equally preferred from a High Consequence Events perspective.**			
1. Safety	1.4 Legacy Risk	No legacy risk associated with this full removal option.	The line would remain in-situ with this option. Areas of spans or exposure will be removed with the cut ends being trenched and buried 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 43 / 28,289 / 1.09E-03 OM Survey Vessel: 15 / 44 / 15,746 / 4.49E-04 Total legacy hours: 44,035 hrs Total legacy PLL: 1.54E-03	The line would remain in-situ with this option although areas of spans or exposure would be trenched and buried thus leaving lines trenched and buried along their entire length. 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 43 / 28,289 / 1.09E-03 OM Survey Vessel: 15 / 44 / 15,746 / 4.49E-04 Total legacy hours: 44,035 hrs Total legacy PLL: 1.54E-03	The line would remain in-situ with this option. The line ends would be removed with the cut ends being trenched and buried to mitigate potential snag hazard. Any areas of spans or exposure 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 65 / 44,241 / 1.26E-03 OM Survey Vessel: 15 / 44 / 15,746 / 4.49E-04 Total legacy hours: 59,987 hrs Total legacy PLL: 1.71E-03
		MS **MS** **VMS**	**N** **S**	**S**	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 1C is assessed as being Much Stronger than Option 2B and Option 3A as there is no legacy risk associated with the full removal option versus the lines remaining largely in-situ in Option 2B and Option 3A albeit the as-left status will present a clear seabed. There is also a legacy risk associated with the future remediation / survey scope. Option 1C is assessed as being Very Much Stronger than Option 4A as there is no legacy risk associated with the full removal option versus the lines remaining in-situ with areas of spans and exposure remaining in Option 4A. Again, there is also a legacy risk associated with the future remediation / survey scope. Option 2B is assessed as being Neutral to Option 3A as the legacy risk associated with the as left status of a largely clear seabed and the legacy risk from the future survey / remediation being similar in both cases. Option 2B is assessed as being Stronger than Option 4A as the legacy risk associated with the remaining spans and exposures in Option 4A is greater. Option 3A is assessed as being Stronger than Option 4A as the legacy risk associated with the remaining spans and exposures in Option 4A is greater. **Overall, Option 1C is the preferred option from a Legacy Risk perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): CSV: 1,005 DSV: 91 Supply Vessel: 1,469 Total: 2,565 Tooling Noise (days): MFE Noise (days): 43 Diamond Wire Cutting Noise (days): 547 Operation 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 lines. However, given the prior cleaning of the lines, 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 2,565 days it is the highest of the options being evaluated.	Vessel Noise (days on-site): CSV: 265 DSV: 47 Supply Vessel: 388 Total: 700 Tooling Noise (days): MFE Noise (days): 2 Diamond Wire Cutting Noise (days): 117 Operation 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 lines. However, given the prior cleaning of the lines, 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 700 days it is high but not considered significant.	Vessel Noise (days on-site): DSV: 7 Trencher: 26 Total: 33 Tooling Noise (days): MFE Noise (days): 16 Diamond Wire Cutting Noise (days): 0.25 Operation 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 lines. However, given the prior cleaning of the lines, 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 33 days it is at the lower end of the options being evaluated and considered negligible.	Vessel Noise (days on-site): DSV: 7 Total: 7 Tooling Noise (days): Diamond Wire Cutting Noise (days): 0.25 Operation 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 lines. However, given the prior cleaning of the lines, 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 the lowest of the options being evaluated and considered negligible.
		W / MW / MW	MW / MW	N	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B due to the greater impact from the vessel noise and to a lesser extent the tooling noise associated with the longer offshore durations for the full removal option. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A due to the much greater impact from the vessel noise and tooling noise associated with the longer offshore durations for the full removal option versus the much lower noise impact associated with the smaller offshore scope associated with Option 3A and Option 4A. Option 2B is assessed as being Much Weaker than Option 3A and Option 4A due to the much greater impact from the vessel noise and tooling noise associated with the longer offshore durations for removing the spans and exposures in Option 2B versus the much lower noise impact associated with the smaller offshore scope associated with Option 3A and Option 4A. Option 3A is assessed as being Neutral to Option 4A as the marine environmental impacts are expected to be similar and minimal for both options. Note: all impacts are expected to be low overall but there are sufficient cumulative impacts with the greater scopes in Option 1C and Option 2B to express a preference for the other options. It is also noted that the full removal option is likely to present the greatest impact from a visual disturbance perspective on the Red Throated Diver bird species prevalent within the Greater Wash SPA (present in Winter months (Nov to Mar). **Overall, Option 3A and Option 4A are equally preferred from an Operational Marine Impact perspective.**			
2. Environmental	2.2 Atmospheric Emissions & Fuel Consumption	Vessel Emissions (in tonnes): Fuel: 35,361 CO2: 112,094 Vessel Energy Use: 35,361 GJ	Vessel Emissions (in tonnes): Fuel: 11,093 CO2: 35,165 Vessel Energy Use: 478,108 GJ	Vessel Emissions (in tonnes): Fuel: 1,099 CO2: 3,483 Vessel Energy Use: 24,777 GJ	Vessel Emissions (in tonnes): Fuel: 97 CO2: 307 Vessel Energy Use: 4,181 GJ
		MW / MW / MW	W / W	N	
	Summary	The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows: Option 1C is assessed as being Much Weaker than all other options as the atmospheric emissions and fuel use associated with the greater offshore scope for the full removal option is much greater than the other options. Option 2B is assessed as being Weaker than Option 3A and Option 4A as the atmospheric emissions and fuel use associated with the greater offshore scope for removing the areas of spans and exposure in Option 2B is greater than the other partial removal options. Option 3A is assessed as being Neutral to Option 4A as while there are differences in the atmospheric emissions and fuel use for these options, this was considered insufficient to express a preference. **Overall, Option 3A and Option 4A are equally preferred from an Atmospheric Emissions & Consumptions perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.3 Other Consumptions	Material Emissions (CO2 in tonnes): Recovered Material: 66,423 Remaining Material: Total: 66,423	Material Emissions (CO2 in tonnes): Recovered Material: 7,320 Remaining Material: 85,968 Total: 93,289	Material Emissions (CO2 in tonnes): Recovered Material: 1,987 Remaining Material: 93,555 Total: 95,542	Material Emissions (CO2 in tonnes): Recovered Material: 1,987 Remaining Material: 93,555 Total: 95,542
		S S S	N N	N	
	Summary	The assessment of the Other Consumptions sub-criterion is as follows: Option 1C is assessed as being Stronger than all other options as the impact associated with replacing the material left in-situ is greater than the impact associated with processing the material returned in the full removal option. All other options are assessed as being Neutral to each other as the impact associated with processing returned material / replacing material left in-situ is similar across these options. **Overall, Option 1C is the preferred option from an Other Consumptions perspective.**			
2. Environmental	2.4 Seabed Disturbance	Seabed Disturbance (MFE deburial along entire length of lines during full removal operations): 545,147 m^2 total / 392,524 m^2 (72%) within SACs. The majority of the area disturbed from the trenching operations required to bury areas of spans / exposures is within SACs with approx. 50% in the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise) and approx. 50% in the Greater Wash SPA (impacting Annex I bird species) and the Cromar Shoal Chalk Beds MCZ (impacting Broad Scale Habitats, Features of Conservation Interest and a Geological Feature). The area impacted is small in context of the area of the SACs with the impacts being temporary in the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment) and the Greater Wash SPA (as the visual disturbance to Annex I bird species is expected to be of limited duration). The impacts are expected to be more significant in the Cromar Shoals Chalk Beds MCZ due to the impact of MFE operations within this MCZ. There is no permanent impact associated with this full removal option as the lines are fully removed.	Seabed Disturbance (MFE deburial during areas of spans / exposure removal operations): 67,141 m^2 total / 62,552 m^2 (93%) within SACs. The majority of the area disturbed from the trenching operations required to bury areas of spans / exposures is within SACs with approx. 50% in the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise) and approx. 50% in the Greater Wash SPA (impacting Annex I bird species) and the Cromar Shoal Chalk Beds MCZ (impacting Broad Scale Habitats, Features of Conservation Interest and a Geological Feature). The area impacted is small in context of the area of the SACs with the impacts being temporary in the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment) and the Greater Wash SPA (as the visual disturbance to Annex I bird species is expected to be of limited duration). The impacts are expected to be more significant in the Cromar Shoals Chalk Beds MCZ due to the impact of MFE operations within this MCZ. There is a moderate permanent impact to the seabed from the approx. 22 km of line (approx. 40% of total line length excluding 3.6km of spans and exposure which will be removed) left in-situ in the HHW SAC as their presence impacts the behaviour of the sandbanks which is against the conservation objectives.	Seabed Disturbance (Trenching of areas of spans / exposure operations): 101,595 m^2 total / 91,228 m^2 (90%) within SACs. The majority of the area disturbed from the trenching operations required to bury areas of spans / exposures is within SACs with approx. 50% in the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise) and approx. 50% in the Greater Wash SPA (impacting Annex I bird species) and the Cromar Shoal Chalk Beds MCZ (impacting Broad Scale Habitats, Features of Conservation Interest and a Geological Feature). The area impacted is small in context of the area of the SACs with the impacts being temporary in the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment) and the Greater Wash SPA (as the visual disturbance to Annex I bird species is expected to be of limited duration). The impacts are expected to be more significant in the Cromar Shoals Chalk Beds MCZ due to the impact of trenching operations within this MCZ. There is a moderate permanent impact to the seabed from the approx. 25.6 km of line (approx. 40% of total line length) left in-situ in the HHW SAC as their presence impacts the behaviour of the sandbanks which is against the conservation objectives. The 25.6 km of line left in-situ in the HHW SAC includes approx. 3.6 km of spans and exposures which will be trenched and buried.	Seabed Disturbance (minor disturbance from line end removal): 200 m^2 total / 200 m^2 (100%) within SACs. The area of limited seabed disturbance from the surface laid line end removal operations is within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is negligible in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a moderate permanent impact to the seabed from the approx. 25.6 km of line (approx. 40% of total line length) left in-situ in the HHW SAC as their presence impacts the behaviour of the sandbanks which is against the conservation objectives. The 25.6 km of line left in-situ in the HHW SAC includes approx. 3.6 km of spans and exposures which further influences the sandbank habitat.
		S S MS	N S	S	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Assessment change from S / MS / VMS, MS / MS, S to S / S / MS, N / S, S Option 1C is assessed as being Stronger than Option 2B and Option 3A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ in Option 2B and Option 3A have a permanent influence on the sandbanks within the SAC. Option 1C is assessed as being Much Stronger than Option 4A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ with areas of spans and exposures also remaining in Option 4A have a more significant permanent influence on the sandbanks within the SAC. It is noted that the large area of seabed impact during the operations to remove the lines in Option 1C is less influential in the assessment due to the largely temporary nature of those impacts. Option 2B is assessed as being Neutral to Option 3A as the permanent seabed impact from these lines remaining in-situ is expected to be similar in both options. Option 2B is assessed as being Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the significant length of spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours. Again, the differences in the area of seabed impact during the operations is less influential in the assessment due to the largely temporary nature of those impacts. Option 3A is assessed as being Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours. **Overall, Option 1C is the preferred option from a Seabed Disturbance perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.5 Legacy Marine Impacts	No legacy marine impact from this full removal option.	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. Approx. 63.9 km of lines, 47.7 km of which in SACs with 10.2 km removed (9.1 km removed from SACs).	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. Approx. 63.9 km of lines, 47.7 km of which in SACs with 10.2 km trenched (9.1 km trenched in SACs).	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. Approx. 63.9 km of lines, 47.7 km of which in SACs with 10.2 km of spans and exposures remaining (9.1 km remaining in SACs).
		MS MS MS	N S	S	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Assessment change from MS / MS / MS, S / S, S to MS / MS / MS, N / S, S Option 1C is assessed as being Much Stronger than all other options as there is no legacy marine impact with the full removal option. Option 2B is assessed as being Neutral to Option 3A as while 10.2 km of line (9.1 km within SACs) is removed in Option 2B this length of line is trenched to an acceptable depth in Option 3A with the legacy marine impact being considered largely similar for both options. Option 2B is assessed as being Stronger than Option 4A as the 10.2 km of spans and exposures (9.1 km within SACs) remain exposed to the water column in Option 4A which is assessed as having a greater (but still low) legacy marine impact. Option 3A is assessed as being Stronger than Option 4A as the 10.2 km of spans and exposures (9.1 km within SACs) remain exposed to the water column in Option 4A which is assessed as having a greater (but still low) legacy marine impact. **Overall, Option 1C is the preferred option from a Legacy Marine Impacts perspective.**		
3. Technical	3.1 Technical Risk	Cut and lift techniques are well proven and have broad market availability. Challenges will be in excavating buried lines within the highly mobile and tidal environment. Consequence of failure minor, delay to the schedule only. Score: 2	Cut and lift techniques are well proven and have broad market availability. Trenching to 0.6m depth is proven in the area. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minor, delay to the schedule only.	Trenching to 0.6m depth is proven in the area. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minimal, delay to the schedule only. Score: 3	Cut and lift techniques are well proven and have broad market availability. Consequence of failure minimal, delay to the schedule only. Score: 3
		W W W	N N	N	
	Summary	The assessment of the Technical Risk sub-criterion is as follows: Option 1C is assessed as being Weaker than all other options as, while all options employ routine operations, the scale associated with the deburial and cut and lift operations of the full removal option presents greater technical challenges on a cumulative basis. All other options are assessed as being Neutral to each other as the nature and scale of the operations present a similar, low technical risk profile. **Overall, Option 2B, Option 3A and Option 4A are equally preferred from a Technical Risk perspective.**			
4. Societal	4.1 Fishing	Very significant short term disruption from the removal operations. However, the pipelines are fully removed leaving the site clear for future fishing operations. Score: 2	Significant short term disruption during remedial trenching operations. However, fully remediated pipelines will leave site clear for future fishing operations. Score: 3	Medium short term disruption during remedial trenching operations. However, fully remediated pipelines will leave site clear for future fishing operations. Score: 3	Minimal short term disruption during remedial trenching operations. Mid-line exposures remain, potentially obstructing access for fishing industry to the site. Score: 1
		W W MW	N S	S	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B and Option 3A as while the lines are fully removed in Option 1C, the disruption caused by the removal operations will have a greater impact on creel fishing operations prevalent in this area than the smaller disruption from the partial removal associated with Option 2B and Option 3A. Option 1C is assessed as being Much Weaker than Option 4A due to the much greater disruption caused by the full removal of the lines versus the much smaller disruption associated with removing the line ends in option 4A. Option 2B is assessed as being Neutral to Option 3A as the lines remain in-situ albeit with a largely clear seabed in both options and the disruption to creel fishing operations is similar in both cases. Option 2B is assessed as being Stronger than Option 4A due to the minimal disruption in both cases although the lines left in-situ present a largely clear seabed in Option 2B versus spans and exposures remaining in Option 4A. Option 3A is assessed as being Stronger than Option 4A due to the minimal disruption in both cases although the lines left in-situ present a largely clear seabed in Option 3A versus spans and exposures remaining in Option 4A. . Note: assessment influenced by disruption from removal operations as opposed to as left status as bottom trawling fishing low in area but impact from removing will be significant for creel fishing. **Overall, Option 2B and Option 3A are equally preferred from a Societal impact on Fishing perspective.**		

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
4. Societal	4.2 Other Users	Material Returned (tonnes): Steel: 18,672 Concrete: 58,834 Very large amounty of recyclable material returned. Very large amount of material (concrete) that some of which may require to go to landfill Score: 1 Note: PL20 / 21 employ older style for concrete coating reinforcement i.e. chicken wire, which makes recovery and re-use of any of the concrete more challengeing (max one third concrete re-use).	Material Returned (tonnes): Steel: 1,570 Concrete: 7,204 Large amount of recyclable material returned. Large amount of material (concrete) that some of which may require to go to landfill Score: 2	Material Returned (tonnes): Steel: 7 Concrete: 2,500 Small amount of recyclable material (steel) returned. Large amount of material (concrete) that some of which may require to go to landfill Score: 2	Material Returned (tonnes): Steel: 7 Concrete: 2,501 Small amount of recyclable material (steel) returned. Large amount of material (concrete) that some of which may require to go to landfill Score: 2
		N **N** **N**	**N** **N**	**N**	
	Summary	The assessment of the Societal impact on Other Users sub-criterion is as follows: All options are assessed as being neutral to each other as, while there is a larger tonnage of useful material returned in Option 1C (recyclable steel) the societal benefit from this is offset by the much larger quantity of returned material (concrete), the majority of which is likely to take up limited landfill capacity due to it being contaminated by salt water. This is exacerbated by the design of the concrete re-inforcement being of a 'chicken wire' style due to the age of these trunk lines, making the segregation of the concrete from the steel reinforcement challenging. The societal benefits and impacts were considered largely balanced for all other options. **Overall, all options are equally preferred from a Societal impact on Other Users perspective.**			
5. Economic	5.1 Short-term Costs	£301.6 million	£86.1 million	£7.9 million	£3.4 million
		MW **VMW** **VMW**	**VMW** **VMW**	**W**	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 1C is assessed as being Much Weaker than Option 2B as the costs are more than 3 times higher (£215 million more) for Option 1C. Option 1C is assessed as being Very Much Weaker than Option 3A as the costs are more than 38 times higher (£294 million more) for Option 1C. Option 1C is assessed as being Very Much Weaker than Option 4A as the costs are more than 88 times higher (£298 million more) for Option 1C. Option 2B is assessed as being Very Much Weaker than Option 3A as the costs are more than 10 times higher (£78 million more) for Option 2B. Option 2B is assessed as being Very Much Weaker than Option 4A as the costs are more than 25 times higher (£83 million more) for Option 2B. Option 3A is assessed as being Weaker than Option 4A as the costs more than double (£4.5 million more) for Option 3A. **Overall, Option 4A is the preferred option from a Short-term Cost perspective.**			
5. Economic	5.2 Long-term Costs	No legacy costs with this full removal option.	Survey: £0.7 million Future Remediation: £18.2 million	Survey: £0.7 million Future Remediation: £2.0 million	Survey: £0.7 million Future Remediation: £3.1 million
		VMS **S** **S**	**MW** **MW**	**N**	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: Option 1C is assessed as being Very Much Stronger than Option 2B due to there being no long-term costs versus significant long-term costs associated with the future remediation in Option 2B. Option 1C is assessed as being Stronger than Option 3A due to there being no long-term costs versus moderate long-term costs for survey, monitoring and future remediation in Option 3A. Option 1C is assessed as being Stronger than Option 4A due to there being no long-term costs versus moderate long-term costs for survey, monitoring and future remediation in Option 4A. Option 2B is assessed as being Much Weaker than both Option 3A and Option 4A due to the higher future remediation costs in Option 2B. Option 3A is assessed as being Neutral to Option 4A as while there are differences in the long-term costs, these were considered insufficient to express a preference. **Overall, Option 1C is the preferred option from a Long-term Cost perspective.**			

C.2 Group 1 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	VMW	VMW	3.8%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	VMW	VMW	6.5%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	VMS	VMS	N	W	40.3%
O4A - Leave - Minimal - Remove Ends Only	VMS	VMS	S	N	49.4%

1.2 Other Users

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	11.2%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	MW	MW	13.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	MS	N	W	33.7%
O4A - Leave - Minimal - Remove Ends Only	MS	MS	S	N	41.3%

1.3 High Consequence Events

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	VMW	VMW	3.8%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	VMW	VMW	6.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	VMS	VMS	N	N	44.8%
O4A - Leave - Minimal - Remove Ends Only	VMS	VMS	N	N	44.8%

1.4 Legacy Risk

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MS	MS	VMS	58.2%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MW	N	N	S	16.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MW	N	N	S	16.3%
O4A - Leave - Minimal - Remove Ends Only	VMW	W	W	N	9.1%

C.3 Group 1 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	11.3%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	MW	MW	13.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	MS	N	N	37.5%
O4A - Leave - Minimal - Remove Ends Only	MS	MS	N	N	37.5%

2.2 Atmospheric Emissions & Fuel Consumption

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	MW	MW	9.9%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	W	W	24.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	32.9%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	32.9%

2.3 Other Consumptions	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	S	33.3%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	N	22.2%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	N	22.2%
O4A - Leave - Minimal - Remove Ends Only	W	N	N	N	22.2%

2.4 Seabed Disturbance	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	MS	38.1%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

2.5 Legacy Marine Impacts	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MS	MS	MS	49.8%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MW	N	N	S	18.4%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MW	N	N	S	18.4%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	13.5%

C.4 Group 1 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	W	W	18.2%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

C.5 Group 1 Pairwise Comparison Matrices – Societal

4.1 Fishing	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	W	MW	15.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	S	29.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	S	29.6%
O4A - Leave - Minimal - Remove Ends Only	MS	W	W	N	25.9%

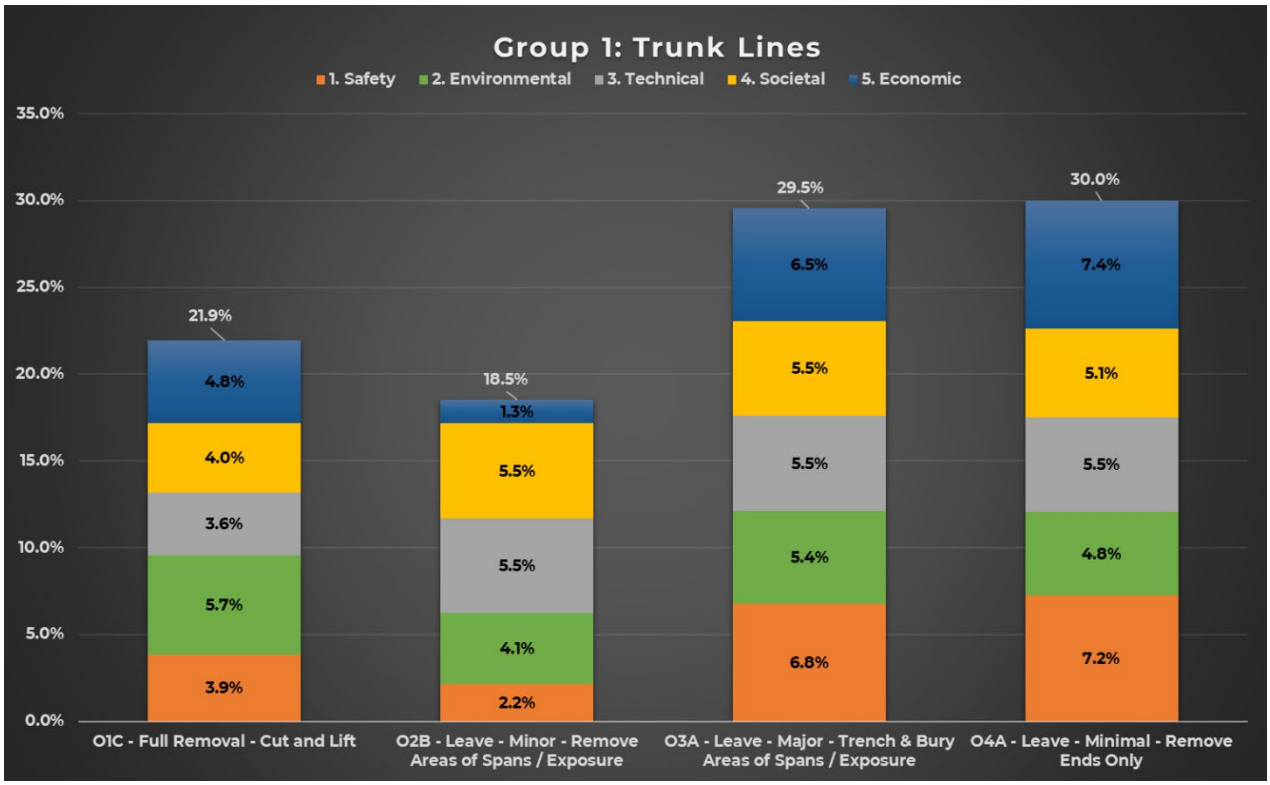
4.2 Other Users	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	N	N	N	25.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

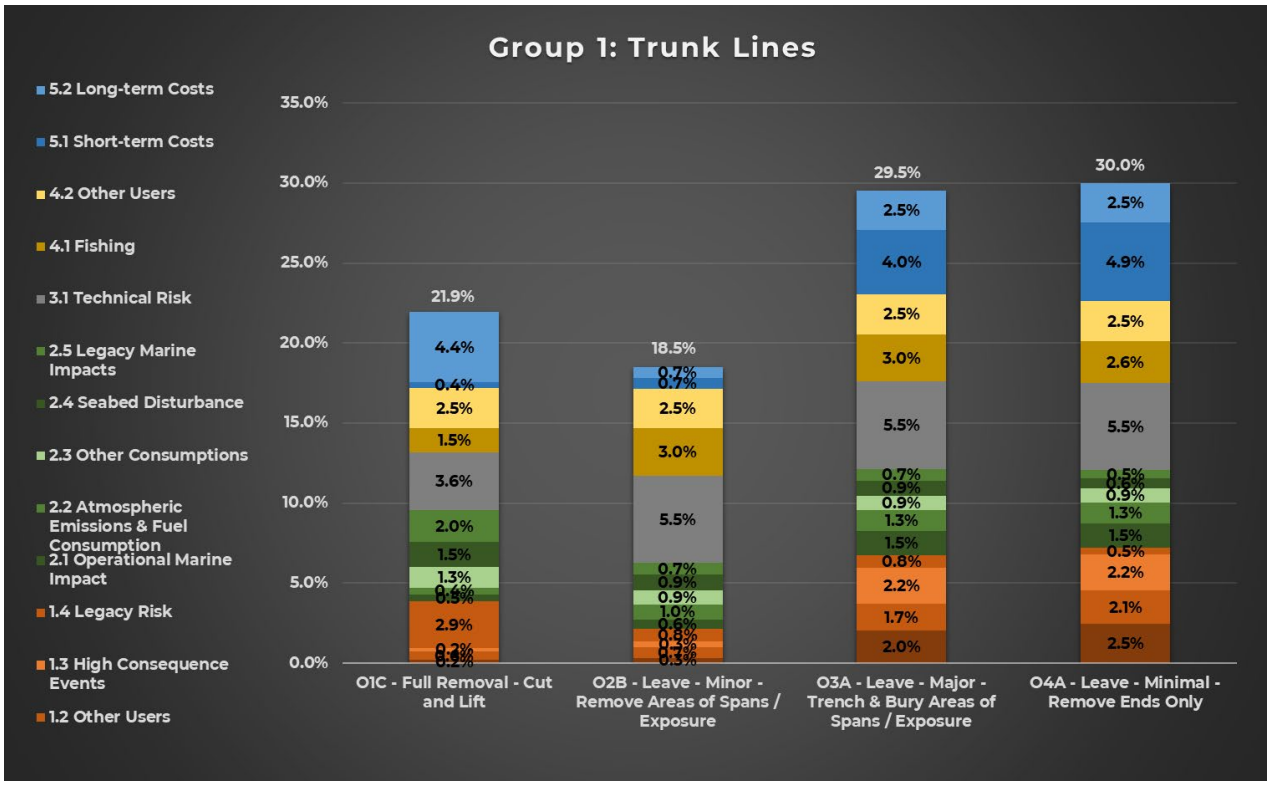
C.6 Group 1 Pairwise Comparison Matrices – Economic

5.1 Short-term Costs	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	VMW	VMW	3.8%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	VMW	VMW	6.5%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	VMS	VMS	N	W	40.3%
O4A - Leave - Minimal - Remove Ends Only	VMS	VMS	S	N	49.4%

5.2 Long-term Costs	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	VMS	S	S	43.9%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	VMW	N	MW	MW	6.9%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	MS	N	N	24.6%
O4A - Leave - Minimal - Remove Ends Only	W	MS	N	N	24.6%

C.7 Group 1 Results Charts





APPENDIX D GROUP 2 – DETAILED EVALUATION RESULTS

D.1 Group 2 Attributes Table

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
		- Disconnection of pipeline ends - De-burial of pipeline where necessary using MFE - Full removal by cut and lift utilising MSV/CSV	- Disconnection of pipeline ends - Expose pipeline around areas of spans / exposures / pipeline ends - Remove spans / exposures / pipeline ends by cut and lift utilising MSV/CSV - Trench and back fill cut ends to minimum 0.6 m ToP	- Disconnection of pipeline ends - Remove pipeline ends by cut and lift utilising MSV/CSV - Trench and back fill spans / exposures to minimum 0.6 m ToP	- Disconnection of pipeline ends - Remove pipeline ends by cut and lift utilising MSV/CSV
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL CSV: 130 / 610 / 1,560,998 / 8.89E-02 DSV: 100 / 69 / 142,830 / 5.83E-03 Divers: 25 / 69 / 352,044 / 5.03E-01 Supply Vessel: 18 / 998 / 431,279 / 1.23E-02 Total offshore hours: 2,487,150 hrs Total offshore PLL: 6.10E-01 Resource Type: Hours / PLL Engineering & Management: 255,306 / 1.02E-03 Project Management: 59,004 / 2.36E-04 Onshore Operations : 44,132 / 5.43E-03 Total onshore hours: 358,442 hrs Total onshore PLL: 6.69E-03 Total operational hours: 2,845,593 hrs Total operational PLL: 6.17E-01	Vessel Type: PoB / Days / Hours / PLL CSV: 130 / 163 / 421,419 / 2.03E-02 DSV: 100 / 66 / 136,335 / 5.58E-03 Divers: 25 / 66 / 110,241 / 1.57E-01 Supply Vessel: 18 / 272 / 117,335 / 3.34E-03 Total offshore hours: 785,330 hrs Total offshore PLL: 1.87E-01 Resource Type: Hours / PLL Engineering & Management: 87,794 / 3.51E-04 Project Management: 20,290 / 8.12E-05 Onshore Operations : 18,573 / 2.28E-03 Total onshore hours: 126,657 hrs Total onshore PLL: 2.72E-03 Total operational hours: 911,987 hrs Total operational PLL: 1.89E-01	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 31 / 64,430 / 3.20E-03 Divers: 25 / 31 / 9,011 / 1.29E-02 Trencher: 75 / 17 / 30,169 / 1.16E-03 Total offshore hours: 103,610 hrs Total offshore PLL: 1.72E-02 Resource Type: Hours / PLL Engineering & Management: 20,531 / 8.21E-05 Project Management: 4,745 / 1.90E-05 Onshore Operations : 5,130 / 6.31E-04 Total onshore hours: 30,406 hrs Total onshore PLL: 7.32E-04 Total operational hours: 134,016 hrs Total operational PLL: 1.80E-02	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 35 / 72,530 / 2.79E-03 Divers: 25 / 35 / 10,511 / 1.50E-02 Total offshore hours: 83,041 hrs Total offshore PLL: 1.78E-02 Resource Type: Hours / PLL Engineering & Management: 13,956 / 5.58E-05 Project Management: 3,225 / 1.29E-05 Onshore Operations : 5,130 / 6.31E-04 Total onshore hours: 22,311 hrs Total onshore PLL: 7.00E-04 Total operational hours: 105,352 hrs Total operational PLL: 1.85E-02
		MW	**VMW**	**VMW**	**MW**	**MW**	**N**
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 1C is assessed as being Much Weaker than Option 2B due to the risk exposure being around three times higher due to the increased offshore scope associated with the full removal of the lines in Option 1C. Option 1C is assessed as being Very Much Weaker than Option 3A and Option 4A due to the risk exposure being around 34 times higher due to the much greater offshore scope associated with the full removal of the lines in Option 1C. Option 2B is assessed as being Much Weaker than Option 3A and Option 4A due to the risk exposure being around 10 times higher due to the increased offshore scope associated with removing the spans and exposures in Option 2B. Option 3A is assessed as being Neutral to Option 4A as the risk exposure is similar for both options. **Overall, Option 3A and Option 4A are equally preferred from a risk to Operations Personnel perspective.**			
1. Safety	1.2 Other Users	Vessel Days: CSV: 598 DSV: 65 Supply Vessel: 974 Total vessel days: 1,637 days Transits: 20	Vessel Days: CSV: 159 DSV: 62 Supply Vessel: 264 Total vessel days: 485 days Transits: 8	Vessel Days: DSV: 27 Trencher: 13 Total vessel days: 39 days Transits: 4	Vessel Days: DSV: 31 Total vessel days: 31 days Transits: 2
		W	**MW**	**MW**	**W**	**W**	**N**
	Summary	The assessment of the Other Users sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B as there are more days of vessel operations and more transits to and from shore associated with the full removal option. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A as there are many more days of vessel operations and transits associated with the full removal option. Option 2B is assessed as being Weaker than Option 3A and Option 4A as there are more days of vessel operations and transits associated with Option 2B. Option 3A is assessed as being Neutral to Option 4A as the vessel days and transits are similar for both options. **Overall, Option 3A and Option 4A are equally preferred from a risk to Other Users perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
1. Safety	1.3 High Consequence Events	Number of offshore lifts: 3,208 Lift PLL: 3.53E-02	Number of offshore lifts: 539 Lift PLL: 5.93E-03	Number of offshore lifts: 65 Lift PLL: 7.15E-04	Number of offshore lifts: 65 Lift PLL: 7.15E-04
		W / **MW** / **MW**	**W** / **W**	**N**	
	Summary	The assessment of the High Consequence Events sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B due to the greater scope for high consequence events from dropped object from the thousands of offshore lifting operations associated with the full removal option versus the smaller scope for high consequence events from dropped object from 539 lifts in Option 2B. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A as there are thousands of lifts associated with the full removal option versus 65 lifts in Option 3A and Option 4A. Option 2B is assessed as being Weaker than Option 3A and Option 4A due to the greater scope for high consequence events from dropped object from 539 lifts associated with removing the spans and exposures in Option 2B versus the smaller scope for dropped object from 65 lifts in Option 3A and Option 4A. Option 3A is assessed as being Neutral to Option 4A as the scope for dropped object is similar and low in both cases. **Overall, Option 3A and Option 4A are equally preferred from a High Consequence Events perspective.**		
1. Safety	1.4 Legacy Risk	No legacy risk associated with this full removal option.	The line would remain in-situ with this option. Areas of spans or exposure will be removed with the cut ends being trenched and buried 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 38 / 25,073 / 9.65E-04 OM Survey Vessel: 15 / 36 / 12,972 / 3.70E-04 Total legacy hours: 38,044 hrs Total legacy PLL: 1.33E-03	The line would remain in-situ with this option although it would be trenched and buried along its entire length to remove areas of spans or exposure. 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 38 / 25,073 / 9.65E-04 OM Survey Vessel: 15 / 36 / 12,972 / 3.70E-04 Total legacy hours: 38,044 hrs Total legacy PLL: 1.33E-03	The line would remain in-situ with this option. The line ends would be removed with the cut ends being trenched and buried to mitigate potential snag hazard. Any areas of spans or exposure 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 44 / 29,240 / 8.33E-04 OM Survey Vessel: 15 / 36 / 12,972 / 3.70E-04 Total legacy hours: 42,212 hrs Total legacy PLL: 1.20E-03
		S / **S** / **MS**	**N** / **S**	**S**	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 1C is assessed as being Stronger than both Option 2B and Option 3A as there is no legacy risk associated with the full removal option versus the lines remaining largely in-situ in Option 2B and Option 3A albeit the as-left status will present a clear seabed. There is also a small legacy risk associated with the future remediation / survey scope. Option 1C is assessed as being Much Stronger than Option 4A as there is no legacy risk associated with the full removal option versus the lines remaining in-situ with areas of spans and exposure remaining in Option 4A. Again, there is also a small legacy risk associated with the future remediation / survey scope. Option 2B is assessed as being Neutral to Option 3A as the legacy risk associated with the as left status of a largely clear seabed and the legacy risk from the future survey / remediation being similar in both cases. Option 2B is assessed as being Stronger than Option 4A as the legacy risk associated with the remaining spans and exposures in Option 4A is greater. Option 3A is assessed as being Stronger than Option 4A as the legacy risk associated with the remaining spans and exposures in Option 4A is greater. **Overall, Option 1C is the preferred option from a Legacy Risk perspective.**		

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): CSV: 598 DSV: 65 Supply Vessel: 974 Total: 1,637 Tooling Noise (days): MFE Noise: 23 Diamond Wire Cutting Noise : 307 Operation 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 lines. However, given the prior cleaning of the lines, 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 1637 days it is the highest of the options being evaluated.	Vessel Noise (days on-site): CSV: 159 DSV: 62 Supply Vessel: 264 Total: 485 Tooling Noise (days): MFE Noise: 1.31 Diamond Wire Cutting Noise : 122 Operation 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 lines. However, given the prior cleaning of the lines, 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 485 days it is high but not considered significant.	Vessel Noise (days on-site): DSV: 27 Trencher: 13 Total: 39 Tooling Noise (days): MFE Noise: 7 Diamond Wire Cutting Noise : 1.75 Operation 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 lines. However, given the prior cleaning of the lines, 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 39 days it is at the lower end of the options being evaluated and considered negligible.	Vessel Noise (days on-site): DSV: 31 Total: 31 Tooling Noise (days): Diamond Wire Cutting Noise : 1.75 Operation 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 lines. However, given the prior cleaning of the lines, 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 the lowest of the options being evaluated and considered negligible.
		W / MW / MW	W / W	N	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B due to the greater impact from the vessel noise and the tooling noise associated with the longer offshore durations for the full removal option. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A due to the much greater impact from the vessel noise and tooling noise associated with the longer offshore durations for the full removal option versus the much lower noise impact associated with the smaller offshore scope associated with Option 3A and Option 4A. Option 2B is assessed as being Weaker than Option 3A and Option 4A due to the greater impact from the vessel noise and tooling noise associated with the longer offshore durations for removing the spans and exposures in Option 2B versus the lower noise impact associated with the smaller offshore scope associated with Option 3A and Option 4A. Option 3A is assessed as being Neutral to Option 4A as the marine environmental impacts are expected to be similar and minimal for both options. Note: all impacts are expected to be low overall but there are sufficient cumulative impacts with the greater scopes in Option 1C and Option 2B to express a preference for the other options. **Overall, Option 3A and Option 4A are equally preferred from an Operational Marine Impact perspective.**			
2. Environmental	2.2 Atmospheric Emissions & Fuel Consumption	Vessel Emissions (in tonnes): Fuel: 19,844 CO2: 62,905 Vessel Energy Use: 855,276 GJ	Vessel Emissions (in tonnes): Fuel: 6,180 CO2: 19,591 Vessel Energy Use: 266,358 GJ	Vessel Emissions (in tonnes): Fuel: 1,416 CO2: 4,488 Vessel Energy Use: 61,024 GJ	Vessel Emissions (in tonnes): Fuel: 1,373 CO2: 4,351 Vessel Energy Use: 59,159 GJ
		W / MW / MW	W / W	N	
	Summary	The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B as the atmospheric emissions and fuel use associated with the greater offshore scope for the full removal option is greater than Option 2B. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A as the atmospheric emissions and fuel use associated with the much greater offshore scope for the full removal option is much greater than the other options. Option 2B is assessed as being Weaker than Option 3A and Option 4A as the atmospheric emissions and fuel use associated with the greater offshore scope for removing the areas of spans and exposure in Option 2B is greater than the other partial removal options. Option 3A is assessed as being Neutral to Option 4A as while there are differences in the atmospheric emissions and fuel use for these options, this was considered insufficient to express a preference. **Overall, Option 3A and Option 4A are equally preferred from an Atmospheric Emissions & Consumptions perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.3 Other Consumptions	Material Emissions (CO_2 in tonnes): Recovered Material: 17,438 Remaining Material: Total: 17,438	Material Emissions (CO_2 in tonnes): Recovered Material: 7,273 Remaining Material: 15,961 Total: 23,234	Material Emissions (CO_2 in tonnes): Recovered Material: 1,905 Remaining Material: 24,447 Total: 26,352	Material Emissions (CO_2 in tonnes): Recovered Material: 1,905 Remaining Material: 24,447 Total: 26,352
		N **N** **N**	**N** **N**	**N**	
	Summary	The assessment of the Other Consumptions sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there are small differences in the impact from material recovered or material left in-situ, these are considered insufficient to express a preference. **Overall, all options are equally preferred from an Other Consumptions perspective.**			
2. Environmental	2.4 Seabed Disturbance	Seabed Disturbance (MFE deburial along entire length of lines during full removal operations): 316,009 m^2 total / 298,653 m^2 (95%) within SACs. The majority of the area disturbed from the MFE deburial operations to allow full line removal is located within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is small in context of the area of the SACs. with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is no permanent impact associated with this full removal option as the lines are fully removed.	Seabed Disturbance (MFE deburial during areas of spans / exposure removal operations): 61,242 m^2 total / 54,533 m^2 (89%) within SACs. The majority of the area disturbed from the MFE deburial operations required to gain access to allow areas of spans / exposures to be removed is all within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is small in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 32.6 km of line (excludes 2400 m of spans and exposures which are removed) left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives.	Seabed Disturbance (Trenching of areas of spans / exposure operations): 34,651 m^2 total / 24,080 m^2 (67%) within SACs. The majority of the area disturbed from the trenching operations required to bury areas of spans / exposures is within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is small in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 35 km of line left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives. The 35 km of line left in-situ includes approx. 2400 m of spans and exposures which will be trenched and buried.	Seabed Disturbance (minor disturbance from line end removal): 1000 m^2 total / 900 m^2 (90%) within SACs. The majority of the area of limited seabed disturbance from the surface laid line end removal operations is within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise) with the exception of the end of PL84 at the 48/29B platform. The area impacted is negligible in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 35 km of line left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives. The 35 km of line left in-situ includes approx. 2400 m of spans and exposures which further influences the sandbank habitat.
		S **S** **MS**	**N** **MS**	**S**	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Assessment change from S / MS / VMS, S / MS, S to S / S / MS, N / MS, S Option 1C is assessed as being Stronger than Option 2B and Option 3A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ in Option 2B and Option 3A have a permanent influence on the sandbanks within the SAC. Option 1C is assessed as being Much Stronger than Option 4A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ with areas of spans and exposures also remaining in Option 4A have a more significant permanent influence on the sandbanks within the SAC. It is noted that the large area of seabed impact during the operations to remove the lines in Option 1C is less influential in the assessment due to the temporary nature of those impacts. Option 2B is assessed as being Neutral to Option 3A as the permanent seabed impact from these lines remaining in-situ is expected to be similar in both options. Option 2B is assessed as being Much Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the significant length of spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours. Again, the differences in the area of seabed impact during the operations is less influential in the assessment due to the temporary nature of those impacts. Option 3A is assessed as being Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours.			

Criterion	Sub-criterion	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	**2.5 Legacy Marine Impacts**	No legacy marine impact from this full removal option.	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.	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.	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.
		MS | **MS** | **MS**	**N** | **S**	**S**	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 1C is assessed as being Much Stronger than all other options as there is no legacy environmental impact associated with the full removal option versus the impact from lines and contents being left in-situ in all other options. Option 2B is assessed as being Neutral to Option 3A as the lines left in-situ are fully buried and the quantity of material left in-situ is similar in both cases. Option 2B is assessed as being Stronger than Option 4A as the lines left in-situ are fully buried versus spans and exposures remain in Option 4A where the lines will be exposed to the water column which is considered to have a greater (but still low) environmental impact.. Option 3A is assessed as being Stronger than Option 4A as the lines left in-situ are fully buried versus spans and exposures remain in Option 4A where the lines will be exposed to the water column which is considered to have a greater (but still low) environmental impact. **Overall, Option 1C is the preferred option from a Legacy Marine Impacts perspective.**			
3. Technical	**3.1 Technical Risk**	Cut and lift techniques are well proven and have broad market availability. Challenges will be in excavating buried lines within the highly mobile and tidal environment. Consequence of failure minor, delay to the schedule only. Score: 2	Cut and lift techniques are well proven and have broad market availability. Trenching to 0.6m depth is proven in the area. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minor, delay to the schedule only. Score: 3	Trenching to 0.6m depth is proven in the area. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minimal, delay to the schedule only. Score: 3	Cut and lift techniques are well proven and have broad market availability. Consequence of failure minimal, delay to the schedule only. Score: 3
		W | **W** | **W**	**N** | **N**	**N**	
	Summary	The assessment of the Technical Risk sub-criterion is as follows: Option 1C is assessed as being Weaker than all other options as, while all options employ routine operations, the scale associated with the deburial and cut and lift operations of the full removal option presents greater technical challenges on a cumulative basis. All other options are assessed as being Neutral to each other as the nature and scale of the operations present a similar, low technical risk profile. **Overall, Option 2B, Option 3A and Option 4A are equally preferred from a Technical Risk perspective.**			
4. Societal	**4.1 Fishing**	Significant short term disruption from the removal operations. However, the pipelines are fully removed leaving the site clear for future fishing operations. Score: 2	Significant short term disruption during remedial trenching operations. However, fully remediated pipelines will leave site clear for future fishing operations. Score: 3	Medium short term disruption during remedial trenching operations. However, fully remediated pipelines will leave site clear for future fishing operations. Score: 3	Medium short term disruption during remedial trenching operations. Mid-line exposures remain, potentially obstructing access for fishing industry to the site. Score: 1
		S | **S** | **MS**	**N** | **S**	**S**	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 1C is assessed as being Stronger than Option 2B and Option 3A as while all 3 options present a clear seabed, the lines are fully removed in Option 1C. Option 1C is assessed as being Much Stronger than Option 4A as the lines will remain with spans and exposures in Option 4A. Option 2B is assessed as being Neutral to Option 3A as both options present a clear seabed for fishing operations. Option 2B is assessed as being Stronger than Option 4A as it presents a clear seabed while spans and exposures will remain with Option 4A. Option 3A is assessed as being Stronger than Option 4A as it presents a clear seabed while spans and exposures will remain with Option 4A. **Overall, Option 1C is the preferred option from a Societal impact on Fishing perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
4. Societal	4.2 Other Users	Material Returned (tonnes): Steel: 6,757 Concrete: 13,202 Polymer: 714 Large amount of recyclable material (steel) returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2 Note: PL84 employs older style for concrete coating reinforcement i.e. chicken wire, which makes recovery and re-use of any of the concrete more challenging (estimate max. one third concrete re-use). PL86 / 87 uses rebar for concrete reinforcement so proportion of concrete re-used should be greater.	Material Returned (tonnes): Steel: 2,404 Concrete: 6,040 Polymer: 262 Large amount of recyclable material returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2	Material Returned (tonnes): Steel: 21 Concrete: 2,355 Polymer: 29 Small amount of recyclable material (steel) returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2	Material Returned (tonnes): Steel: 21 Concrete: 2,355 Polymer: 29 Small amount of recyclable material (steel) returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2
		N **N** **N**	**N** **N**	**N**	
	Summary	The assessment of the Societal impact on Other Users sub-criterion is as follows: All options are assessed as being neutral to each other as, while there is a larger tonnage of useful material returned in Option 1C (recyclable steel) the societal benefit from this is offset by the much larger quantity of returned material (concrete), the majority of which is likely to take up limited landfill capacity due to it being contaminated by salt water. This is exacerbated by the design of the concrete re-inforcement on PL84 being of a 'chicken wire' style due to the age of this line, making the segregation of the concrete from the steel reinforcement challenging (concrete on other lines ais rebar steel reinforced). The societal benefits and impacts were considered largely balanced for all other options. **Overall, all options are equally preferred from a Societal impact on Other Users perspective.**			
5. Economic	5.1 Short-term Costs	£171.3 million	£58.6 million	£11.3 million	£9.5 million
		MW **VMW** **VMW**	**MW** **MW**	**N**	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 1C is assessed as being Much Weaker than Option 2B as the costs are around 3 times higher (£113 million more) for Option 1C. Option 1C is assessed as being Very Much Weaker than Option 3A as the costs are around 15 times higher (£160 million more) for Option 1C. Option 1C is assessed as being Very Much Weaker than Option 4A as the costs are around 18 times higher (£162 million more) for Option 1C. Option 2B is assessed as being Much Weaker than Option 3A as the costs are around 5 times higher (£47 million more) for Option 2B. Option 2B is assessed as being Much Weaker than Option 4A as the costs are around 5 times higher (£49 million more) for Option 2B. Option 3A is assessed as being Neutral to Option 4A as the costs are similar for both options. **Overall, Option 3A and Option 4A are equally preferred from a Short-term Cost perspective.**			
5. Economic	5.2 Long-term Costs	No legacy costs with this full removal option.	Survey: £0.5 million Future Remediation: £9.2 million	Survey: £0.5 million Future Remediation: £1.8 million	Survey: £0.5 million Future Remediation: £2.1 million
		MS **S** **S**	**W** **W**	**N**	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: Option 1C is assessed as being Much Stronger than Option 2B due to there being no long-term costs versus significant long-term costs associated with the future remediation in Option 2B. Option 1C is assessed as being Stronger than Option 3A and Option 4A due to there being no long-term costs versus moderate long-term costs for survey, monitoring and future remediation in Option 3A and Option 4A. Option 2B is assessed as being Weaker than both Option 3A and Option 4A due to the higher future remediation costs in Option 2B. Option 3A is assessed as being Neutral to Option 4A as while there are differences in the long-term costs, these were considered insufficient to express a preference. **Overall, Option 1C is the preferred option from a Long-term Cost perspective.**			

D.2 Group 2 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	VMW	VMW	4.5%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	MW	MW	13.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	VMS	MS	N	N	40.9%
O4A - Leave - Minimal - Remove Ends Only	VMS	MS	N	N	40.9%

1.2 Other Users

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	12.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	W	W	20.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	33.6%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	33.6%

1.3 High Consequence Events

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	12.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	W	W	20.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	33.6%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	33.6%

1.4 Legacy Risk

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	MS	38.1%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

D.3 Group 2 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	12.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	W	W	20.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	33.6%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	33.6%

2.2 Atmospheric Emissions & Fuel Consumption

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	12.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	W	W	20.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	33.6%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	33.6%

2.3 Other Consumptions	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	N	N	N	25.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

2.4 Seabed Disturbance	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	MS	37.3%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	MS	27.5%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.1%
O4A - Leave - Minimal - Remove Ends Only	MW	MW	W	N	12.1%

2.5 Legacy Marine Impacts	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MS	MS	MS	49.8%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MW	N	N	S	18.4%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MW	N	N	S	18.4%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	13.5%

D.4 Group 2 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	W	W	18.2%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

D.5 Group 2 Pairwise Comparison Matrices – Societal

4.1 Fishing

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	MS	38.1%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

4.2 Other Users

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	N	N	N	25.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

D.6 Group 2 Pairwise Comparison Matrices – Economic

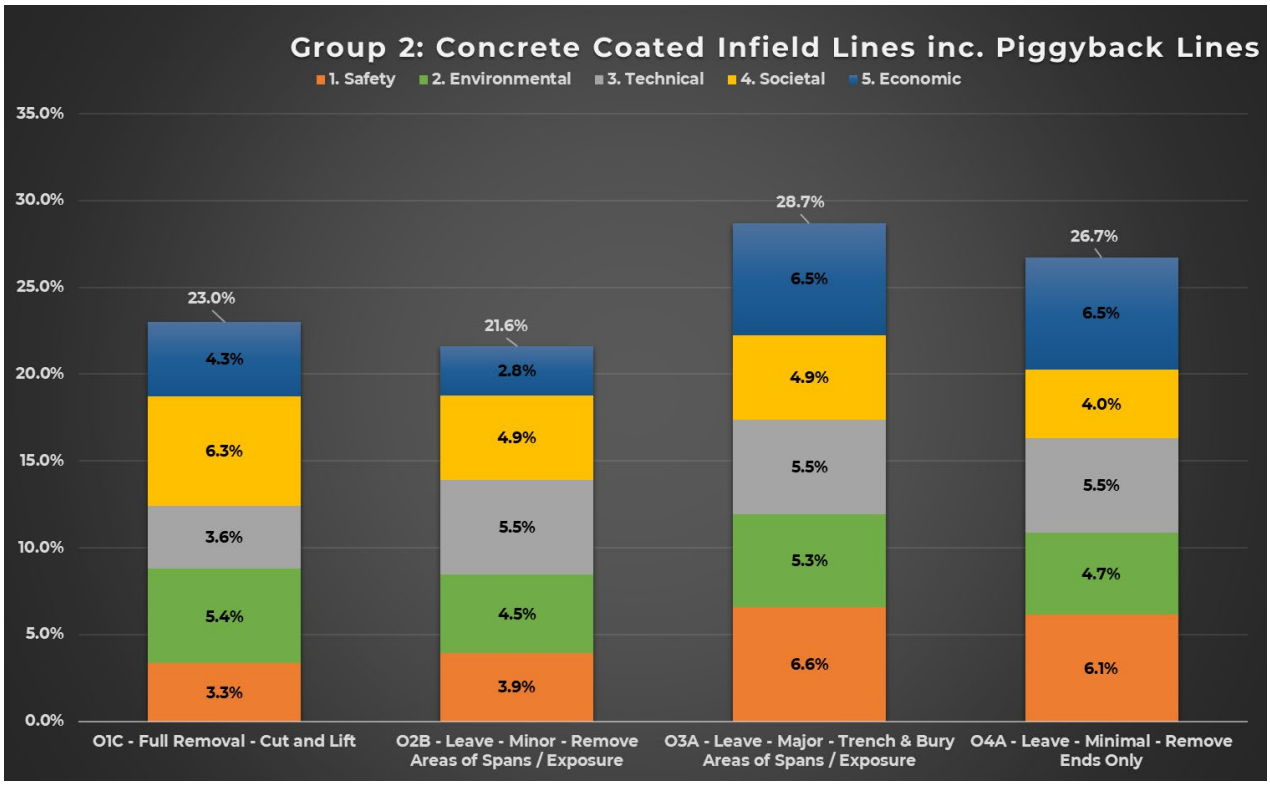
5.1 Short-term Costs

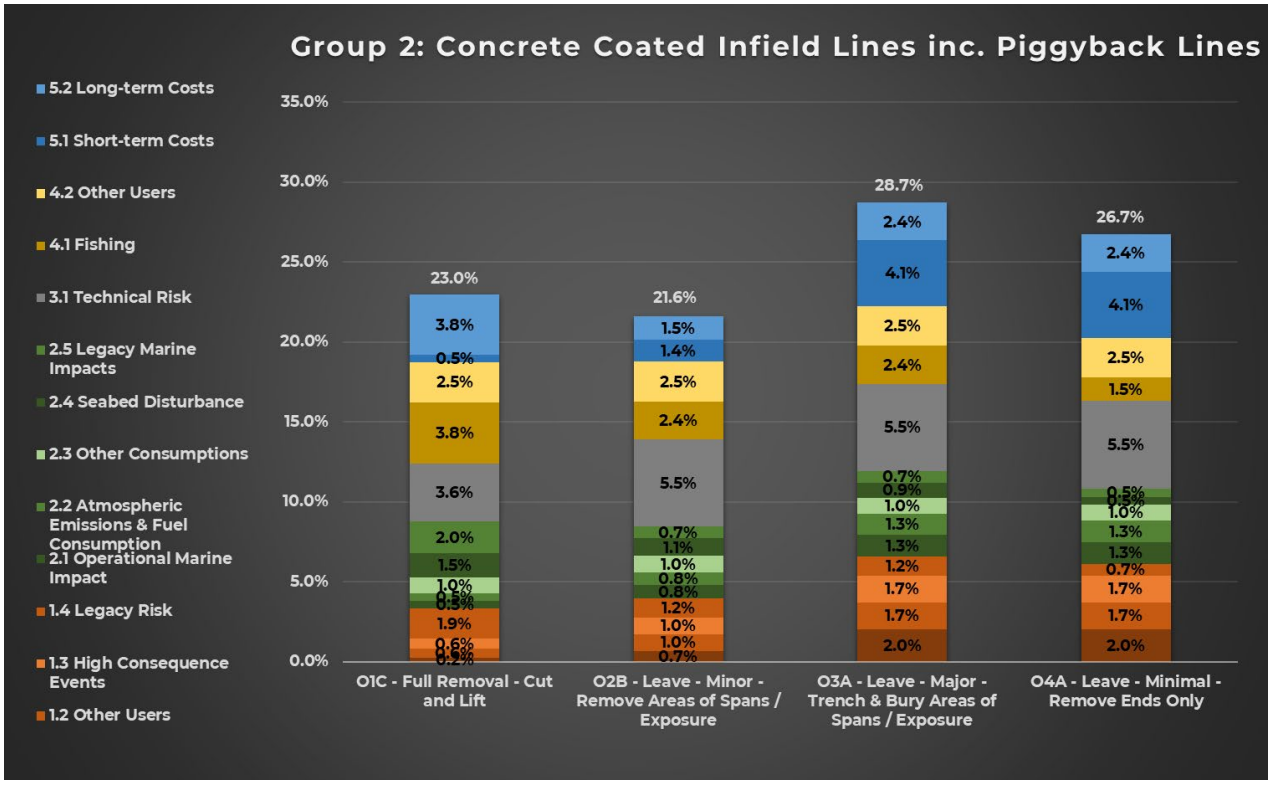
	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	VMW	VMW	4.5%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	MW	MW	13.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	VMS	MS	N	N	40.9%
O4A - Leave - Minimal - Remove Ends Only	VMS	MS	N	N	40.9%

5.2 Long-term Costs

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MS	S	S	38.1%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MW	N	W	W	14.7%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	S	N	N	23.6%
O4A - Leave - Minimal - Remove Ends Only	W	S	N	N	23.6%

D.7 Group 2 Results Charts





APPENDIX E GROUP 3 – DETAILED EVALUATION RESULTS

E.1 Group 3 Attributes Table

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
		- Disconnection of pipeline ends - De-burial of pipeline where necessary using MFE - Full removal by cut and lift utilising MSV/CSV	- Disconnection of pipeline ends - Expose pipeline around areas of spans / exposures / pipeline ends - Remove spans / exposures / pipeline ends by cut and lift utilising MSV/CSV - Trench and back fill cut ends to minimum 0.6 m ToP	- Disconnection of pipeline ends - Remove pipeline ends by cut and lift utilising MSV/CSV - Trench and back fill spans / exposures to minimum 0.6 m ToP	- Disconnection of pipeline ends - Remove pipeline ends by cut and lift utilising MSV/CSV
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL CSV: 130 / 271 / 691,276 / 5.01E-02 DSV: 100 / 117 / 239,449 / 9.55E-03 Divers: 25 / 117 / 184,575 / 2.64E-01 Supply Vessel: 18 / 480 / 209,402 / 5.91E-03 Total offshore hours: 1,324,703 hrs Total offshore PLL: 3.29E-01 Resource Type: Hours / PLL Engineering & Management: 153,222 / 6.13E-04 Project Management: 35,411 / 1.42E-04 Onshore Operations : 16,396 / 2.02E-03 Total onshore hours: 205,029 hrs Total onshore PLL: 2.77E-03 Total operational hours: 1,529,731 hrs Total operational PLL: 3.32E-01	Vessel Type: PoB / Days / Hours / PLL CSV: 130 / 55 / 143,083 / 8.94E-03 DSV: 100 / 70 / 144,210 / 5.88E-03 Divers: 25 / 70 / 51,309 / 7.33E-02 Supply Vessel: 18 / 99 / 42,675 / 1.22E-03 Total offshore hours: 381,277 hrs Total offshore PLL: 8.93E-02 Resource Type: Hours / PLL Engineering & Management: 49,629 / 1.99E-04 Project Management: 11,470 / 4.59E-05 Onshore Operations : 12,772 / 1.57E-03 Total onshore hours: 73,871 hrs Total onshore PLL: 1.82E-03 Total operational hours: 455,148 hrs Total operational PLL: 9.12E-02	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 21 / 43,839 / 2.28E-03 Divers: 25 / 21 / 5,486 / 7.84E-03 Trencher: 75 / 11 / 19,990 / 7.70E-04 Total offshore hours: 69,315 hrs Total offshore PLL: 1.09E-02 Resource Type: Hours / PLL Engineering & Management: 13,562 / 5.42E-05 Project Management: 3,134 / 1.25E-05 Onshore Operations : 11,952 / 1.47E-03 Total onshore hours: 28,648 hrs Total onshore PLL: 1.54E-03 Total operational hours: 97,963 hrs Total operational PLL: 1.24E-02	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 23 / 48,699 / 1.87E-03 Divers: 25 / 23 / 6,386 / 9.12E-03 Total offshore hours: 55,086 hrs Total offshore PLL: 1.10E-02 Resource Type: Hours / PLL Engineering & Management: 9,429 / 3.77E-05 Project Management: 2,179 / 8.72E-06 Onshore Operations : 11,952 / 1.47E-03 Total onshore hours: 23,560 hrs Total onshore PLL: 1.52E-03 Total operational hours: 78,645 hrs Total operational PLL: 1.25E-02
		MW	**VMW**	**VMW**	**MW**	**MW**	**N**
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 1C is assessed as being Much Weaker than Option 2B due to the risk exposure being around three times higher due to the increased offshore scope associated with the full removal of the lines in Option 1C. Option 1C is assessed as being Very Much Weaker than Option 3A and Option 4A due to the risk exposure being around 26 times higher due to the much greater offshore scope associated with the full removal of the lines in Option 1C. Option 2B is assessed as being Much Weaker than Option 3A and Option 4A due to the risk exposure being around 7 times higher due to the increased offshore scope associated with removing the spans and exposures in Option 2B. Option 3A is assessed as being Neutral to Option 4A as the risk exposure is similar for both options. **Overall, Option 3A and Option 4A are equally preferred from a risk to Operations Personnel perspective.**					
1. Safety	1.2 Other Users	Vessel Days: CSV: 263 DSV: 113 Supply Vessel: 464 Total vessel days: 840 days Transits: 14	Vessel Days: CSV: 51 DSV: 66 Supply Vessel: 91 Total vessel days: 208 days Transits: 8	Vessel Days: DSV: 17 Trencher: 7 Total vessel days: 24 days Transits: 4	Vessel Days: DSV: 19 Total vessel days: 19 days Transits: 2
		W	**MW**	**MW**	**W**	**W**	**N**
	Summary	The assessment of the Other Users sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B as there are more days of vessel operations and more transits to and from shore associated with the full removal option. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A as there are many more days of vessel operations and transits associated with the full removal option. Option 2B is assessed as being Weaker than Option 3A and Option 4A as there are more days of vessel operations and transits associated with Option 2B. Option 3A is assessed as being Neutral to Option 4A as the vessel days and transits are similar for both options. **Overall, Option 3A and Option 4A are equally preferred from a risk to Other Users perspective.**					

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
1. Safety	1.3 High Consequence Events	Number of offshore lifts: 2,419 Lift PLL: 2.66E-02	Number of offshore lifts: 396 Lift PLL: 4.36E-03	Number of offshore lifts: 54 Lift PLL: 5.94E-04	Number of offshore lifts: 54 Lift PLL: 5.94E-04
		W **MW** **MW**	**W** **W**	**N**	
	Summary	The assessment of the High Consequence Events sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B due to the greater scope for high consequence events from dropped object from the thousands of offshore lifting operations associated with the full removal option versus the smaller scope for high consequence events from dropped object from 396 lifts in Option 2B. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A as there are thousands of lifts associated with the full removal option versus 54 lifts in Option 3A and Option 4A. Option 2B is assessed as being Weaker than Option 3A and Option 4A due to the greater scope for high consequence events from dropped object from 396 lifts associated with removing the spans and exposures in Option 2B versus the smaller scope for dropped object from 54 lifts in Option 3A and Option 4A. Option 3A is assessed as being Neutral to Option 4A as the scope for dropped object is similar and low in both cases. **Overall, Option 3A and Option 4A are equally preferred from a High Consequence Events perspective.**			
1. Safety	1.4 Legacy Risk	No legacy risk associated with this full removal option.	The line would remain in-situ with this option. Areas of spans or exposure will be removed with the cut ends being trenched and buried 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 37 / 23,789 / 9.16E-04 OM Survey Vessel: 15 / 33 / 11,676 / 3.33E-04 Total legacy hours: 35,464 hrs Total legacy PLL: 1.25E-03	The line would remain in-situ with this option although it would be trenched and buried along its entire length to remove areas of spans or exposure. 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 37 / 23,789 / 9.16E-04 OM Survey Vessel: 15 / 33 / 11,676 / 3.33E-04 Total legacy hours: 35,464 hrs Total legacy PLL: 1.25E-03	The line would remain in-situ with this option. The line ends would be removed with the cut ends being trenched and buried to mitigate potential snag hazard. Any areas of spans or exposure 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 34 / 22,100 / 6.30E-04 OM Survey Vessel: 15 / 33 / 11,676 / 3.33E-04 Total legacy hours: 33,776 hrs Total legacy PLL: 9.63E-04
		S **S** **MS**	**N** **S**	**S**	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 1C is assessed as being Stronger than both Option 2B and Option 3A as there is no legacy risk associated with the full removal option versus the lines remaining largely in-situ in Option 2B and Option 3A albeit the as-left status will present a clear seabed. There is also a small legacy risk associated with the future remediation / survey scope. Option 1C is assessed as being Much Stronger than Option 4A as there is no legacy risk associated with the full removal option versus the lines remaining in-situ with areas of spans and exposure remaining in Option 4A. Again, there is also a small legacy risk associated with the future remediation / survey scope. Option 2B is assessed as being Neutral to Option 3A as the legacy risk associated with the as left status of a largely clear seabed and the legacy risk from the future survey / remediation being similar in both cases. Option 2B is assessed as being Stronger than Option 4A as the legacy risk associated with the remaining spans and exposures in Option 4A is greater. Option 3A is assessed as being Stronger than Option 4A as the legacy risk associated with the remaining spans and exposures in Option 4A is greater. **Overall, Option 1C is the preferred option from a Legacy Risk perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): CSV: 263 DSV: 113 Supply Vessel: 464 Total: 840 Tooling Noise (days): MFE Noise (days): 14 Diamond Wire Cutting Noise (days): 132 Operation 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 lines. However, given the prior cleaning of the lines, 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 840 days it is the highest of the options being evaluated but still negligible.	Vessel Noise (days on-site): CSV: 51 DSV: 66 Supply Vessel: 91 Total: 208 Tooling Noise (days): MFE Noise (days): 2 Diamond Wire Cutting Noise (days): 20 Operation 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 lines. However, given the prior cleaning of the lines, 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 208 days it is high but not considered significant.	Vessel Noise (days on-site): DSV: 17 Trencher: 7 Total: 24 Tooling Noise (days): MFE Noise (days): 3 Diamond Wire Cutting Noise (days): 1.85 Operation 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 lines. However, given the prior cleaning of the lines, 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 24 days it is at the lower end of the options being evaluated and considered negligible.	Vessel Noise (days on-site): DSV: 19 Total: 19 Tooling Noise (days): MFE Noise (days): 2 Diamond Wire Cutting Noise (days): 1.85 Operation 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 lines. However, given the prior cleaning of the lines, 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 19 days it is the lowest of the options being evaluated and considered negligible.
		W | **MW** | **MW**	**W** | **W**	**N**	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 1C is assessed as being Weaker than Option 2B due to the greater impact from the vessel noise and the tooling noise associated with the longer offshore durations for the full removal option. Option 1C is assessed as being Much Weaker than Option 3A and Option 4A due to the much greater impact from the vessel noise and tooling noise associated with the longer offshore durations for the full removal option versus the much lower noise impact associated with the smaller offshore scope associated with Option 3A and Option 4A. Option 2B is assessed as being Weaker than Option 3A and Option 4A due to the greater impact from the vessel noise and tooling noise associated with the longer offshore durations for removing the spans and exposures in Option 2B versus the lower noise impact associated with the smaller offshore scope associated with Option 3A and Option 4A. Option 3A is assessed as being Neutral to Option 4A as the marine environmental impacts are expected to be similar and minimal for both options. Note: all impacts are expected to be low overall but there are sufficient cumulative impacts with the greater scopes in Option 1C and Option 2B to express a preference for the other options. **Overall, Option 3A and Option 4A are equally preferred from an Operational Marine Impact perspective.**			
2. Environmental	2.2 Atmospheric Emissions & Fuel Consumption	Vessel Emissions (in tonnes): Fuel: 10,212 CO2: 32,372 Vessel Energy Use: 440,137 GJ	Vessel Emissions (in tonnes): Fuel: 2,756 CO2: 8,737 Vessel Energy Use: 118,784 GJ	Vessel Emissions (in tonnes): Fuel: 1,075 CO2: 3,406 Vessel Energy Use: 46,314 GJ	Vessel Emissions (in tonnes): Fuel: 908 CO2: 2,878 Vessel Energy Use: 39,135 GJ
		W | **W** | **W**	**N** | **N**	**N**	
	Summary	The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows: Option 1C is assessed as being Weaker than all other options as the atmospheric emissions and fuel use associated with the greater offshore scope for the full removal option is greater than the other options. All other options are assessed as being Neutral to each other as, while there are differences in the atmospheric emissions and fuel use across these options, these differences were considered insufficient to express a preference. **Overall, Option 2B, Option 3A and Option 4A are equally preferred from an Atmospheric Emissions & Consumptions perspective.**			

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.3 Other Consumptions	Material Emissions (CO_2 in tonnes): Recovered Material: 6,406 Remaining Material: Total: 6,406	Material Emissions (CO_2 in tonnes): Recovered Material: 4,801 Remaining Material: 3,305 Total: 8,106	Material Emissions (CO_2 in tonnes): Recovered Material: 4,438 Remaining Material: 4,062 Total: 8,500	Material Emissions (CO_2 in tonnes): Recovered Material: 4,438 Remaining Material: 4,056 Total: 8,494
		N **N** **N**	**N** **N**	**N**	
	Summary	The assessment of the Other Consumptions sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there are small differences in the impact from material recovered or material left in-situ, these are considered insufficient to express a preference. **Overall, all options are equally preferred from an Other Consumptions perspective.**			
2. Environmental	2.4 Seabed Disturbance	Seabed Disturbance (MFE deburial along entire length of lines during full removal operations): 218,320 m^2 total / 172,586 m^2 (79%) within SACs. The majority of the area disturbed from the MFE deburial operations to allow full line removal is located within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is small in context of the area of the SACs. with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is no permanent impact associated with this full removal option as the lines are fully removed.	Seabed Disturbance (MFE deburial during areas of spans / exposure removal operations): 24,122 m^2 total / 17,073 m^2 (71%) within SACs. The majority of the area disturbed from the MFE deburial operations required to gain access to allow areas of spans / exposures to be removed is all within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is small in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 22.1 km of line (excludes approx. 630 m of spans and exposures which are removed) left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives.	Seabed Disturbance (Trenching of areas of spans / exposure operations): 8,801 m^2 total / 6,287 m^2 (71%) within SACs. The majority of the area disturbed from the trenching operations required to bury areas of spans / exposures is within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is very small in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 22.7 km of line left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives. The 22.7 km of line left in-situ includes approx. 630 m of spans and exposures which will be trenched and buried.	Seabed Disturbance (minor disturbance from line end removal): 600 m^2 total / 500 m^2 (83%) within SACs. The majority of the area of limited seabed disturbance from the surface laid line end removal operations is within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise) with the exception of the end of PL1173 at the 48/29C platform. The area impacted is negligible in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 22.7 km of line left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives. The 22.7 km of line left in-situ includes approx. 630 m of spans and exposures which further influences the sandbank habitat.
		S **S** **MS**	**N** **S**	**S**	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Assessment change from S / MS / MS, S / S, S to S / S / MS, N / S, S Option 1C is assessed as being Stronger than Option 2B and Option 3A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ in Option 2B and Option 3A have a permanent influence on the sandbanks within the SAC. Option 1C is assessed as being Much Stronger than Option 4A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ with areas of spans and exposures also remaining in Option 4A have a more significant permanent influence on the sandbanks within the SAC. It is noted that the large area of seabed impact during the operations to remove the lines in Option 1C is less influential in the assessment due to the temporary nature of those impacts. Option 2B is assessed as being Neutral to Option 3A as the permanent seabed impact from these lines remaining in-situ is expected to be similar in both options. Option 2B is assessed as being Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours. Again, the differences in the area of seabed impact during the operations is less influential in the assessment due to the temporary nature of those impacts. Option 3A is assessed as being Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours. **Overall, Option 1C is the preferred option from a Seabed Disturbance perspective.**		

		O1C - Full Removal - Cut and Lift			O2B - Leave - Minor - Remove Areas of Spans / Exposure		O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.5 Legacy Marine Impacts	No legacy marine impact from this full removal option.			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.		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.	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.
		MS	MS	MS	N	S	S	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 1C is assessed as being Much Stronger than all other options as there is no legacy environmental impact associated with the full removal option versus the impact from lines and contents being left in-situ in all other options. Option 2B is assessed as being Neutral to Option 3A as the lines left in-situ are fully buried and the quantity of material left in-situ is similar in both cases. Option 2B is assessed as being Stronger than Option 4A as the lines left in-situ are fully buried versus spans and exposures remain in Option 4A where the lines will be exposed to the water column which is considered to have a greater (but still low) environmental impact.. Option 3A is assessed as being Stronger than Option 4A as the lines left in-situ are fully buried versus spans and exposures remain in Option 4A where the lines will be exposed to the water column which is considered to have a greater (but still low) environmental impact. **Overall, Option 1C is the preferred option from a Legacy Marine Impacts perspective.**						
3. Technical	3.1 Technical Risk	Cut and lift techniques are well proven and have broad market availability. Challenges will be in excavating buried lines within the highly mobile and tidal environment. Consequence of failure minor, delay to the schedule only. Score: 2			Cut and lift techniques are well proven and have broad market availability. Trenching to 0.6m depth is proven in the area. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minor, delay to the schedule only.		Trenching to 0.6m depth is proven in the area. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minimal, delay to the schedule only. Score: 3	Cut and lift techniques are well proven and have broad market availability. Consequence of failure minimal, delay to the schedule only. Score: 3
		W	W	W	N	N	N	
	Summary	The assessment of the Technical Risk sub-criterion is as follows: Option 1C is assessed as being Weaker than all other options as, while all options employ routine operations, the scale associated with the deburial and cut and lift operations of the full removal option presents greater technical challenges on a cumulative basis. All other options are assessed as being Neutral to each other as the nature and scale of the operations present a similar, low technical risk profile. **Overall, Option 2B, Option 3A and Option 4A are equally preferred from a Technical Risk perspective.**						
4. Societal	4.1 Fishing	Significant short term disruption from the removal operations. However, the pipelines are fully removed leaving the site clear for future fishing operations. Score: 2			Medium short term disruption during remedial trenching operations. However, fully remediated pipelines will leave site clear for future fishing operations. Score: 3		Minor short term disruption during remedial trenching operations. However, fully remediated pipelines will leave site clear for future fishing operations. Score: 3	Minimal short term disruption during remedial trenching operations. Mid-line exposures remain, potentially obstructing access for fishing industry to the site. Score: 1
		S	S	MS	N	S	S	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 1C is assessed as being Stronger than Option 2B and Option 3A as while all 3 options present a clear seabed, the lines are fully removed in Option 1C. Option 1C is assessed as being Much Stronger than Option 4A as the lines will remain with spans and exposures in Option 4A. Option 2B is assessed as being Neutral to Option 3A as both options present a clear seabed for fishing operations. Option 2B is assessed as being Stronger than Option 4A as it presents a clear seabed while spans and exposures will remain with Option 4A. Option 3A is assessed as being Stronger than Option 4A as it presents a clear seabed while spans and exposures will remain with Option 4A. **Overall, Option 1C is the preferred option from a Societal impact on Fishing perspective.**						

		O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
4. Societal	4.2 Other Users	Material Returned (tonnes): Steel: 1,983 Concrete: 5,596 Polymer: 102 Medium amount of recyclable material returned. Significant amount of potentially non-recyclable material (concrete) that may need to go to landfill. Score: 2	Material Returned (tonnes): Steel: 368 Concrete: 5,596 Polymer: 23 Small amount of recyclable material returned. Significant amount of potentially non-recyclable material (concrete) that may need to go to landfill. Score: 2	Material Returned (tonnes): Steel: 7 Concrete: 5,596 Polymer: 1 Small amount of recyclable material (steel) returned. Significant amount of potentially non-recyclable material (concrete) that may need to go to landfill. Score: 1	Material Returned (tonnes): Steel: 6 Concrete: 5,596 Polymer: 1 Small amount of recyclable material (steel) returned. Significant amount of potentially non-recyclable material (concrete) that may need to go to landfill. Score: 1
		N N N	N N	N	
	Summary	The assessment of the Societal impact on Other Users sub-criterion is as follows: All options are assessed as being neutral to each other as, while there is a larger tonnage of useful material returned in Option 1C (recyclable steel) the societal benefit from this is offset by the much larger quantity of returned material (concrete from mattresses), the majority of which is likely to take up limited landfill capacity due to it being contaminated by salt water. The societal benefits and impacts were considered largely balanced for all other options. **Overall, all options are equally preferred from a Societal impact on Other Users perspective.**			
5. Economic	5.1 Short-term Costs	£99.0 million	£32.4 million	£10.4 million	£6.5 million
		MW VMW VMW	MW MW	W	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 1C is assessed as being Much Weaker than Option 2B as the costs are around 3 times higher (£67 million more) for Option 1C. Option 1C is assessed as being Very Much Weaker than Option 3A as the costs are around 9 times higher (£89 million more) for Option 1C. Option 1C is assessed as being Very Much Weaker than Option 4A as the costs are around 15 times higher (£93 million more) for Option 1C. Option 2B is assessed as being Much Weaker than Option 3A as the costs are around 3 times higher (£22 million more) for Option 2B. Option 2B is assessed as being Much Weaker than Option 4A as the costs are around 5 times higher (£26 million more) for Option 2B. Option 3A is assessed as being Weaker than Option 4A as the costs 60% higher (£4 million more) for Option 3A. **Overall, Option 4A is the preferred option from a Short-term Cost perspective.**			
5. Economic	5.2 Long-term Costs	No legacy costs with this full removal option.	Survey : £0.5 million Future Remediation: £5.7 million	Survey : £0.5 million Future Remediation: £1.8 million	Survey : £0.5 million Future Remediation: £1.6 million
		S S S	W W	N	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: Option 1C is assessed as being Stronger than all other options due to there being no long-term costs versus moderate long-term costs for survey, monitoring and future remediation in the other options. Option 2B is assessed as being Weaker than both Option 3A and Option 4A due to the higher future remediation costs in Option 2B. Option 3A is assessed as being Neutral to Option 4A as while there are differences in the long-term costs, these were considered insufficient to express a preference. **Overall, Option 1C is the preferred option from a Long-term Cost perspective.**			

E.2 Group 3 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	VMW	VMW	4.5%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	MW	MW	13.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	VMS	MS	N	N	40.9%
O4A - Leave - Minimal - Remove Ends Only	VMS	MS	N	N	40.9%

1.2 Other Users

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	12.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	W	W	20.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	33.6%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	33.6%

1.3 High Consequence Events

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	12.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	W	W	20.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	33.6%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	33.6%

1.4 Legacy Risk

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	MS	38.1%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

E.3 Group 3 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	MW	MW	12.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	W	W	20.8%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MS	S	N	N	33.6%
O4A - Leave - Minimal - Remove Ends Only	MS	S	N	N	33.6%

2.2 Atmospheric Emissions & Fuel Consumption

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	W	W	18.2%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

2.3 Other Consumptions	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	N	N	N	25.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

2.5 Legacy Marine Impacts	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MS	MS	MS	49.8%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MW	N	N	S	18.4%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MW	N	N	S	18.4%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	13.5%

2.5 Legacy Marine Impacts	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MS	MS	MS	49.8%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MW	N	N	S	18.4%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MW	N	N	S	18.4%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	13.5%

E.4 Group 3 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	W	W	W	18.2%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

E.5 Group 3 Pairwise Comparison Matrices – Societal

4.1 Fishing

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	MS	38.1%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

4.2 Other Users

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	N	N	N	25.0%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

E.6 Group 3 Pairwise Comparison Matrices – Economic

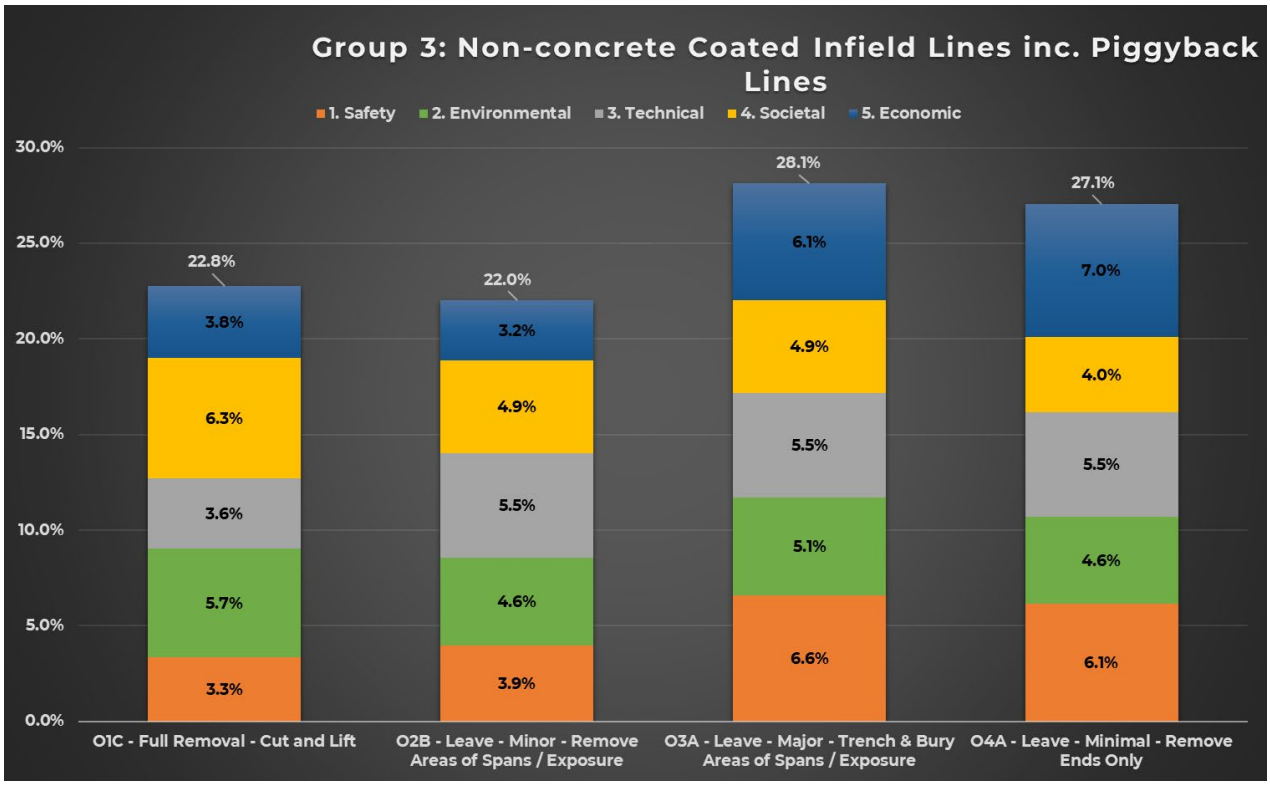
5.1 Short-term Costs

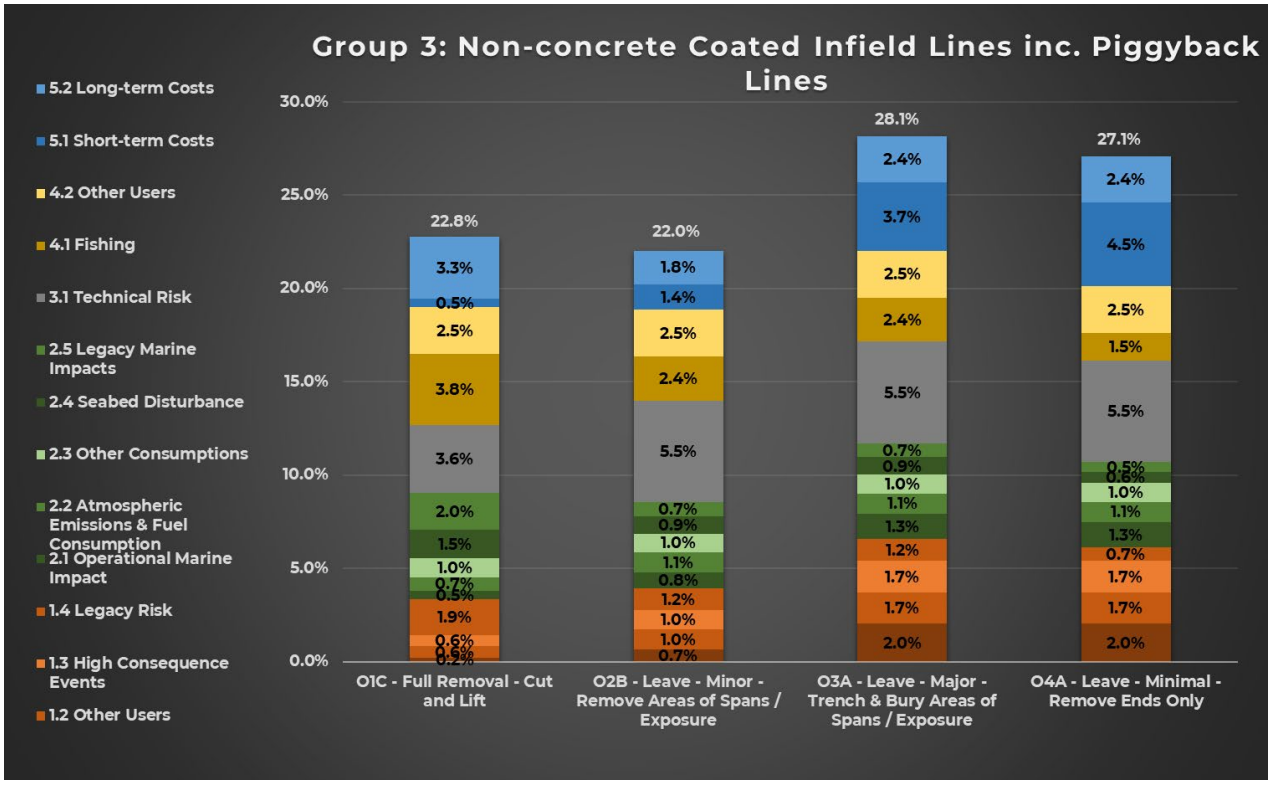
	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	MW	VMW	VMW	4.5%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	MS	N	MW	MW	13.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	VMS	MS	N	W	36.8%
O4A - Leave - Minimal - Remove Ends Only	VMS	MS	S	N	45.1%

5.2 Long-term Costs

	O1C - Full Removal - Cut and Lift	O2B - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1C - Full Removal - Cut and Lift	N	S	S	S	33.1%
O2B - Leave - Minor - Remove Areas of Spans / Exposure	W	N	W	W	18.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	S	N	N	24.4%
O4A - Leave - Minimal - Remove Ends Only	W	S	N	N	24.4%

E.7 Group 3 Results Charts





APPENDIX F GROUP 4 – DETAILED EVALUATION RESULTS

F.1 Group 4 Attributes Table

		O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
		- Disconnection of umbilical ends - De-burial umbilical with MFE as required - Initiate umbilical - Recover by reverse reeling	- Disconnection of umbilical ends - Expose umbilical around areas of spans / exposures / pipeline ends - Remove spans / exposures / umbilical ends by cut and lift utilising MSV/CSV	- Disconnection of umbilical ends - Remove umbilical ends by cut and lift utilising MSV/CSV - Trench and backfill areas of spans / exposure to minimum 0.6 m ToP	- Disconnection of umbilical ends - Remove umbilical ends by cut and lift utilising MSV/CSV
1. Safety	1.1 Operations Personnel	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 65 / 133,890 / 8.91E-03 Divers: 25 / 65 / 21,600 / 3.09E-02 Umbilical Recovery Vessel: 75 / 11 / 20,340 / 5.80E-04 Total offshore hours: 175,830 hrs Total offshore PLL: 4.03E-02 Resource Type: Hours / PLL Engineering & Management: 14,342 / 5.74E-05 Project Management: 3,315 / 1.33E-05 Onshore Operations : 9,438 / 1.16E-03 Total onshore hours: 27,095 hrs Total onshore PLL: 1.23E-03 Total operational hours: 202,925 hrs Total operational PLL: 4.16E-02	Vessel Type: PoB / Days / Hours / PLL CSV: 130 / 8 / 22,621 / 1.09E-03 DSV: 100 / 19 / 40,540 / 2.02E-03 Divers: 25 / 19 / 6,360 / 9.09E-03 Total offshore hours: 69,521 hrs Total offshore PLL: 1.22E-02 Resource Type: Hours / PLL Engineering & Management: 10,887 / 4.35E-05 Project Management: 2,516 / 1.01E-05 Onshore Operations : 8,914 / 1.10E-03 Total onshore hours: 22,317 hrs Total onshore PLL: 1.15E-03 Total operational hours: 91,838 hrs Total operational PLL: 1.33E-02	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 17 / 37,260 / 2.25E-03 Divers: 25 / 17 / 4,200 / 6.00E-03 Trencher: 75 / 22 / 39,150 / 1.51E-03 Total offshore hours: 80,610 hrs Total offshore PLL: 9.76E-03 Resource Type: Hours / PLL Engineering & Management: 9,186 / 3.67E-05 Project Management: 2,123 / 8.49E-06 Onshore Operations : 8,762 / 1.08E-03 Total onshore hours: 20,071 hrs Total onshore PLL: 1.12E-03 Total operational hours: 100,682 hrs Total operational PLL: 1.09E-02	Vessel Type: PoB / Days / Hours / PLL DSV: 100 / 19 / 40,500 / 1.56E-03 Divers: 25 / 19 / 4,800 / 6.86E-03 Total offshore hours: 45,300 hrs Total offshore PLL: 8.42E-03 Resource Type: Hours / PLL Engineering & Management: 5,879 / 2.35E-05 Project Management: 1,359 / 5.44E-06 Onshore Operations : 8,762 / 1.08E-03 Total onshore hours: 16,000 hrs Total onshore PLL: 1.11E-03 Total operational hours: 61,300 hrs Total operational PLL: 9.52E-03
		W	**W**	**W**	**N**	**N**	**N**
	Summary	The assessment of the Operations Personnel sub-criterion is as follows: Option 1A is assessed as being Weaker than Option 2A due to the risk exposure being around three times higher due to the increased offshore scope associated with the full removal of the lines in Option 1A. Option 1A is assessed as being Weaker than Option 3A due to the risk exposure being around four times higher due to the increased offshore scope associated with the full removal of the lines in Option 1A. Option 1A is assessed as being Weaker than Option 4A due to the risk exposure being around four times higher due to the increased offshore scope associated with the full removal of the lines in Option 1A. Option 2A is assessed as being Neutral to Option 3A and Option 4A as, while the risk exposure is greater in Option 2A than the other options, this was considered insufficient to express a preference. Option 3A is assessed as being Neutral to Option 4A as, while the risk exposure is greater in Option 3A, this was considered insufficient to express a preference. **Overall, Option 2A, Option 3A and Option 4A are equally preferred from a risk to Operations Personnel perspective.**			
1. Safety	1.2 Other Users	Vessel Days: DSV: 61 Umbilical Recovery Vessel: 7 Total vessel days: 68 days Transits: 4	Vessel Days: CSV: 4 DSV: 15 Total vessel days: 19 days Transits: 4	Vessel Days: DSV: 13 Trencher: 18 Total vessel days: 31 days Transits: 4	Vessel Days: DSV: 15 Total vessel days: 15 days Transits: 2
		W	**W**	**W**	**N**	**N**	**N**
	Summary	The assessment of the Other Users sub-criterion is as follows: Option 1A is assessed as being Weaker than all other options due to the greater number of vessel days compared to the other options presenting a small increase to the potential safety impact to other users of the sea. All other options are assessed as being Neutral to each other as, while there are differences in the vessel days and transits, these are insufficient to express a preference from a safety perspective. **Overall, Option 2A, Option 3A and Option 4A are equally preferred from a risk to Other Users perspective.**			

		O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
1. Safety	1.3 High Consequence Events	Number of offshore lifts: 341 Lift PLL: 3.75E-03	Number of offshore lifts: 78 Lift PLL: 8.58E-04	Number of offshore lifts: 74 Lift PLL: 8.14E-04	Number of offshore lifts: 74 Lift PLL: 8.14E-04
		W **W** **W**	**N** **N**	**N**	
	Summary	The assessment of the High Consequence Events sub-criterion is as follows: Option 1A is assessed as being Weaker than all other options due to the greater number of offshore lifting operations associated with recovery of the mattresses along the entire length of the lines with Option 1A. All other options are assessed as being Neutral to each other as the number of offshore lifting operations and hence the potential for a high consequence event from a dropped object is similar for these options. **Overall, Option 2A, Option 3A and Option 4A are equally preferred from a High Consequence Events perspective.**			
1. Safety	1.4 Legacy Risk	No legacy risk associated with this full removal option.	The line would remain in-situ with this option. Areas of spans or exposure will be removed with the cut ends being trenched and buried 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 24 / 16,992 / 6.54E-04 OM Survey Vessel: 15 / 26 / 9,403 / 2.68E-04 Total legacy hours: 26,395 hrs Total legacy PLL: 9.22E-04	The line would remain in-situ with this option although it would be trenched and buried along its entire length to remove areas of spans or exposure. 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 24 / 16,992 / 6.54E-04 OM Survey Vessel: 15 / 26 / 9,403 / 2.68E-04 Total legacy hours: 26,395 hrs Total legacy PLL: 9.22E-04	The line would remain in-situ with this option. The line ends would be removed with the cut ends being trenched and buried to mitigate potential snag hazard. Any areas of spans or exposure 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. Vessel Type: PoB / Days / Hours / PLL Trencher Remediation: 30 / 22 / 16,128 / 4.60E-04 OM Survey Vessel: 15 / 26 / 9,403 / 2.68E-04 Total legacy hours: 25,531 hrs Total legacy PLL: 7.28E-04
		S **S** **MS**	**N** **S**	**S**	
	Summary	The assessment of the Legacy Risk sub-criterion is as follows: Option 1A is assessed as being Stronger than both Option 2A and Option 3A as there is no legacy risk associated with the full removal option versus the lines remaining largely in-situ in Option 2A and Option 3A albeit the as-left status will present a clear seabed. There is also a small legacy risk associated with the future remediation / survey scope. Option 1A is assessed as being Much Stronger than Option 4A as there is no legacy risk associated with the full removal option versus the lines remaining in-situ with limited areas of spans and exposure remaining in Option 4A. Again, there is also a small legacy risk associated with the future remediation / survey scope. Option 2A is assessed as being Neutral to Option 3A as the legacy risk associated with the as left status of a largely clear seabed and the legacy risk from the future survey / remediation being similar in both cases. Option 2A is assessed as being Stronger than Option 4A as the legacy risk associated with the limited remaining spans and exposures in Option 4A is greater. Option 3A is assessed as being Stronger than Option 4A as the legacy risk associated with the limited remaining spans and exposures in Option 4A is greater. **Overall, Option 1A is the preferred option from a Legacy Risk perspective.**			

		O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.1 Operational Marine Impact	Vessel Noise (days on-site): DSV: 61 Umbilical Recovery Vessel: 7 Total: 68 Tooling Noise (days): Diamond Wire Cutting Noise : 1 Operation 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. Reverse reeling of lines would lead to an elevated discharge of fluids from within the lines in one location at one time. However, given the prior cleaning of the lines, 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 68 days it is the highest of the options being evaluated.	Vessel Noise (days on-site): CSV: 4 DSV: 15 Total: 19 Tooling Noise (days): Diamond Wire Cutting Noise : 2 Operation 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 lines. However, given the prior cleaning of the lines, 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 19 days it is at the lower end of the options evaluated and considered negligible.	Vessel Noise (days on-site): DSV: 13 Trencher: 18 Total: 31 Tooling Noise (days): MFE Noise: 2 Diamond Wire Cutting Noise : 0.78 Operation 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 lines. However, given the prior cleaning of the lines, 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 at the lower end of the options being evaluated and considered negligible.	Vessel Noise (days on-site): DSV: 15 Total: 15 Tooling Noise (days): Diamond Wire Cutting Noise : 0.79 Operation 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 lines. However, given the prior cleaning of the lines, 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 15 days it is the lowest of the options being evaluated and considered negligible.
		W W W	N N	N	
	Summary	The assessment of the Operational Marine Impact sub-criterion is as follows: Option 1A is assessed as being Weaker than all other options due to greater environmental impact from the vessel noise generated by the longer offshore durations and the greater discharges from the lines during reverse reeling operations in Option 1A. It is noted that, while the impact would be greater for Option 1A, it would still be considered low overall. All other options are assessed as being Neutral to each other as the environmental impacts are considered similar for these options. **Overall, Option 2A, Option 3A and Option 4A are equally preferred from an Operational Marine Impact perspective.**			
2. Environmental	2.2 Atmospheric Emissions & Fuel Consumption	Vessel Emissions (in tonnes): Fuel: 1,263 CO2: 4,004 Vessel Energy Use: 48,444 GJ	Vessel Emissions (in tonnes): Fuel: 554 CO2: 1,756 Vessel Energy Use: 23,879 GJ	Vessel Emissions (in tonnes): Fuel: 943 CO2: 2,989 Vessel Energy Use: 40,643 GJ	Vessel Emissions (in tonnes): Fuel: 598 CO2: 1,896 Vessel Energy Use: 113,612 GJ
		N N N	N N	N	
	Summary	The assessment of the Atmospheric Emissions & Consumptions sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there are small differences in the emissions and fuel consumption, these are considered insufficient to express a preference. **Overall, all options are equally preferred from an Atmospheric Emissions & Consumptions perspective.**			

		O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.3 Other Consumptions	Material Emissions (CO_2 in tonnes): Recovered Material: 3,514 Remaining Material: Total: 3,514	Material Emissions (CO_2 in tonnes): Recovered Material: 3,308 Remaining Material: 568 Total: 3,877	Material Emissions (CO_2 in tonnes): Recovered Material: 3,253 Remaining Material: 701 Total: 3,954	Material Emissions (CO_2 in tonnes): Recovered Material: 3,253 Remaining Material: 701 Total: 3,954
		N N N	N N	N	
	Summary	The assessment of the Other Consumptions sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there are small differences in the impact from material recovered or material left in-situ, these are considered insufficient to express a preference. **Overall, all options are equally preferred from an Other Consumptions perspective.**			
2. Environmental	2.4 Seabed Disturbance	Seabed Disturbance (MFE deburial along entire length of lines during full removal operations): 172,528 m^2 total / 172,528 m^2 (100%) within SACs. The area disturbed from the MFE deburial operations to allow full line removal is all located within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is small in context of the area of the SACs. with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is no permanent impact associated with this full removal option as the lines are fully removed.	Seabed Disturbance (MFE deburial during areas of spans / exposure removal operations): 1,806 m^2 total / 1,806 m^2 (100%) within SACs. The area disturbed from the MFE deburial operations required to gain access to allow areas of spans / exposures to be removed is all within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is very small in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 17.2 km of line (excludes approx. 50 m of spans and exposures which are removed) left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives.	Seabed Disturbance (Trenching of areas of spans / exposure operations): 478 m^2 total / 478 m^2 (100%) within SACs The area disturbed from the trenching operations required to bury areas of spans / exposures is all within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is negligible in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 17.3 km of line left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives. The 17.3 km of line left in-situ includes approx. 50 m of spans and exposures which will be trenched and buried.	Seabed Disturbance (minor disturbance from line end removal): 400 m^2 total / 400 m^2 (100%) within SACs. The area of limited seabed disturbance from the surface laid line end removal operations all within the Haisborough, Hammond & Winterton (HHW) SAC (impacting Sandbanks and Ross Worms (Sabellaria Spinulosa)) and the Southern North Sea (SNS) SAC (impacting Harbour Porpoise). The area impacted is negligible in context of the area of the SACs with the impacts being temporary in both the HHW SAC (as the sandbanks and ross worms habitats are expected to recover quickly in the dynamic SNS environment) and the SNS SAC (as the seabed environment for harbour porpoise feeding is expected to recover quickly in the dynamic SNS environment). There is a small permanent impact to the seabed from the 17.3 km of line left in-situ in this option as their presence impacts the behaviour of the sandbanks within the HHW SAC which is against the conservation objectives. The 17.3 km of line left in-situ includes approx. 50 m of spans and exposures which further influences the sandbank habitat.
		S S MS	N S	S	
	Summary	The assessment of the Seabed Disturbance sub-criterion is as follows: Assessment should change from S / MS / VMS, S / MS, S to S / S / MS, N / S, S Option 1A is assessed as being Stronger than Option 2A and Option 3A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ in Option 2A and Option 3A have a permanent influence on the sandbanks within the SAC. Option 1A is assessed as being Much Stronger than Option 4A as the full removal option enables the sandbanks in the Haisborough, Hammond and Winterton SAC to exhibit natural behaviour whereas the lines remaining in-situ with areas of spans and exposures also remaining in Option 4A have a more significant permanent influence on the sandbanks within the SAC. It is noted that the large area of seabed impact during the operations to remove the lines in Option 1A is less influential in the assessment due to the temporary nature of those impacts. Option 2A is assessed as being Neutral to Option 3A as the permanent seabed impact from these lines remaining in-situ is expected to be similar in both options. Option 2A is assessed as being Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours. Again, the differences in the area of seabed impact during the operations is less influential in the assessment due to the temporary nature of those impacts. Option 3A is assessed as being Stronger than Option 4A as, while both options influence the behaviour of the sandbanks in the HHW SAC, the spans and exposures remaining in Option 4A are expected to have a greater influence on those behaviours. **Overall, Option 1C is the preferred option from a Seabed Disturbance perspective.**			

Criterion	Sub-criterion	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
2. Environmental	2.5 Legacy Marine Impacts	No legacy marine impact from this full removal option.	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.	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.	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.
		MS / MS / MS	N / S	S	
	Summary	The assessment of the Legacy Marine Impacts sub-criterion is as follows: Option 1A is assessed as being Much Stronger than all other options as there is no legacy environmental impact associated with the full removal option versus the small impact from lines and contents being left in-situ in all other options. This is influenced by the polymer left in-situ with these options. Option 2A is assessed as being Neutral to Option 3A as the lines left in-situ are fully buried and the quantity of material left in-situ is similar in both cases. Option 2A is assessed as being Stronger than Option 4A as the lines left in-situ are fully buried versus a small number of spans and exposures in Option 4A where the polymer sheath of the lines will be exposed to the water column which is considered to have a greater (but still low) environmental impact. Option 3A is assessed as being Stronger than Option 4A as the lines left in-situ are fully buried versus a small number of spans and exposures in Option 4A where the polymer sheath of the lines will be exposed to the water column which is considered to have a greater (but still low) environmental impact. **Overall, Option 1A is the preferred option from a Legacy Marine Impacts perspective.**			
3. Technical	3.1 Technical Risk	Reverse reel techniques are well proven and have broad market availability. Consequence of failure minor, delay to the schedule only. Score: 3	Cut and lift techniques are well proven and have broad market availability. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minor, delay to the schedule only. Score: 3	Trenching to 0.6m depth is proven in the area. Challenges remain of operating in the highly mobile and tidal environment. Consequence of failure minimal, delay to the schedule only. Score: 3	Cut and lift techniques are well proven and have broad market availability. Consequence of failure minimal, delay to the schedule only. Score: 3
		W / W / W	N / N	N	
	Summary	The assessment of the Technical Risk sub-criterion is as follows: Option 1A is assessed as being Weaker than all other options as, while all options employ routine operations, the scale associated with the full removal option presents technical challenges on a cumulative basis. All other options are assessed as being Neutral to each other as the nature and scale of the operations present a similar, low technical risk profile. **Overall, Option 2A, Option 3A and Option 4A are equally preferred from a Technical Risk perspective.**			
4. Societal	4.1 Fishing	Minor short term disruption from the removal operations. However, the umbilicals are fully removed leaving the site clear for future fishing operations. Score: 3	Minor short term disruption from the removal operations. However, fully remediating problem areas leave the site clear for future fishing operations. Score: 3	Minor short term disruption from the removal operations. However, fully remediating problem areas leave the site clear for future fishing operations. Score: 3	Minimal short term disruption during umbilical end removal operations. Mid-line exposures remain, potentially obstructing access for fishing industry to the site. Score: 1
		S / S / MS	N / S	S	
	Summary	The assessment of the Societal impact on Fishing sub-criterion is as follows: Option 1A is assessed as being Stronger than Option 2A and Option 3A as while all 3 options present a clear seabed, the lines are fully removed in Option 1A. Option 1A is assessed as being Much Stronger than Option 4A as the lines will remain with a small number of spans and exposures in Option 4A. Option 2A is assessed as being Neutral to Option 3A as both options present a clear seabed for fishing operations. Option 2A is assessed as being Stronger than Option 4A as it presents a clear seabed while a small number of spans and exposures will remain with Option 4A. Option 3A is assessed as being Stronger than Option 4A as it presents a clear seabed while a small number of spans and exposures will remain with Option 4A. **Overall, Option 1A is the preferred option from a Societal impact on Fishing perspective.**			

		O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only
4. Societal	4.2 Other Users	Material Returned (tonnes): Steel: 195 Concrete: 4,106 Polymer: 105 Small amount of recyclable material (steel & copper) returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2	Material Returned (tonnes): Steel: 49 Concrete: 4,106 Polymer: 13 Very small amount of recyclable material (steel & copper) returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2	Material Returned (tonnes): Steel: 1 Concrete: 4,106 Polymer: 1 Very small amount of recyclable material (steel & copper) returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2	Material Returned (tonnes): Steel: 1 Concrete: 4,106 Polymer: 1 Very small amount of recyclable material (steel & copper) returned. Large amount of material (concrete) some of which may require to go to landfill Score: 2
		N **N** **N**	**N** **N**	**N**	
	Summary	The assessment of the Societal impact on Other Users sub-criterion is as follows: All options are assessed as being Neutral to each other as, while there is a larger tonnage of useful material returned in Option 1A (recyclable steel / copper) than the other options, the societal benefit from this is offset by the larger quantity of polymer returned with this option which is likely to take up limited landfill capacity. The concrete returned across all options is the same. The societal benefits and impacts were considered largely balanced for all other options. **Overall, all options are equally preferred from a Societal impact on Other Users perspective.**			
5. Economic	5.1 Short-term Costs	£16.4 million	£6.8 million	£5.3 million	£5.6 million
		W **W** **W**	**N** **N**	**N**	
	Summary	The assessment of the Short-term Costs sub-criterion is as follows: Option 1A is assessed as being Weaker than Option 2A as the costs are almost 3 times higher (£9.6 million more) for Option 1A. Option 1A is assessed as being Weaker than Option 3A as the costs are more than 3 times higher (£11.1 million more) for Option 1A. Option 1A is assessed as being Weaker than Option 4A as the costs are almost 3 times higher (£10.8 million more) for Option 1A. All other options are assessed as being Neutral to each other as, while there are differences in the costs for these options, these differences were considered insufficient to express a preference. **Overall, Option 2A, Option 3A and Option 4A are equally preferred from a Short-term Cost perspective.**			
5. Economic	5.2 Long-term Costs	No legacy costs with this full removal option.	Survey: £0.2 million Future Remediation: £3.8 million	Survey: £0.2 million Future Remediation: £0.7 million	Survey: £0.2 million Future Remediation: £0.7 million
		S **S** **S**	**W** **W**	**N**	
	Summary	The assessment of the Long-term Costs sub-criterion is as follows: Option 1A is assessed as being Stronger than all other options due to there being no long-term costs associated with the full removal option versus long-term costs of varying degrees associated with the future survey / remediation in all other options. Option 2A is assessed as being Weaker than Option 3A and Option 4A due to the greater remediation costs associated with Option 2A. Option 3A is assessed as being Neutral to Option 4A as the long-term costs associated with these options are the same. **Overall, Option 1A is the preferred option from a Long-term Cost perspective.**			

F.2 Group 4 Pairwise Comparison Matrices – Safety

1.1 Operations Personnel

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	W	W	W	18.2%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

1.2 Other Users

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	W	W	W	18.2%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

1.3 High Consequence Events

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	W	W	W	18.2%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

1.4 Legacy Risk

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	S	S	MS	38.1%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

F.3 Group 4 Pairwise Comparison Matrices – Environment

2.1 Operational Marine Impact

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	W	W	W	18.2%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

2.2 Atmospheric Emissions & Fuel Consumption

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	N	N	N	25.0%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

2.3 Other Consumptions	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	N	N	N	25.0%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

2.4 Seabed Disturbance	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	S	S	MS	38.1%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

2.5 Legacy Marine Impacts	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	MS	MS	MS	49.8%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	MW	N	N	S	18.4%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	MW	N	N	S	18.4%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	13.5%

F.4 Group 4 Pairwise Comparison Matrices – Technical

3.1 Technical Risk	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	W	W	W	18.2%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

F.5 Group 4 Pairwise Comparison Matrices – Societal

4.1 Fishing

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	S	S	MS	38.1%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	W	N	N	S	23.6%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	N	N	S	23.6%
O4A - Leave - Minimal - Remove Ends Only	MW	W	W	N	14.7%

4.2 Other Users

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	N	N	N	25.0%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	N	N	N	N	25.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	N	N	N	N	25.0%
O4A - Leave - Minimal - Remove Ends Only	N	N	N	N	25.0%

F.6 Group 4 Pairwise Comparison Matrices – Economic

5.1 Short-term Costs

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	W	W	W	18.2%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	S	N	N	N	27.3%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	S	N	N	N	27.3%
O4A - Leave - Minimal - Remove Ends Only	S	N	N	N	27.3%

5.2 Long-term Costs

	O1A - Full Removal - Reverse Reeling	O2A - Leave - Minor - Remove Areas of Spans / Exposure	O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	O4A - Leave - Minimal - Remove Ends Only	Weighting
O1A - Full Removal - Reverse Reeling	N	S	S	S	33.1%
O2A - Leave - Minor - Remove Areas of Spans / Exposure	W	N	W	W	18.0%
O3A - Leave - Major - Trench & Bury Areas of Spans / Exposure	W	S	N	N	24.4%
O4A - Leave - Minimal - Remove Ends Only	W	S	N	N	24.4%

F.7 Group 4 Results Charts